Exploring the learning perspective of unorthodox projects: The case of skunkworks

Supervisor: Christer Norr

Raja Muhammad Usman Rafique, Gurilda Gjona,

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Abstract

This study explores the success stories of skunkworks and identifies the nature and form of skunkworks approach, the reasons and motivation for the success of this type of innovation model, the extent and resources required to establish and internalize skunkworks operations. The study aims to illuminate the role and impact of skunkworks approach in building organizational learning capabilities and leadership that create synergies and build momentum that reinforce the organization. This study is motivated by two research questions: (1) Why has skunkworks philosophy been so successful? (2) What can companies learn from successful skunkworks in order to internalize the procedures?

Previous research offers a descriptive account of the successful skunkworks and is inconclusive in connecting the empirical success stories with existing theories. In bridging the literature gap, a model of skunkworks as incubator, a medium for fostering innovation is proposed. This study advances our understanding of how companies can approach skunkworks as a tool to organize for rapid, efficient and cheap product development, to achieve higher performance and build organizational learning. We conducted in-depth case studies of successful skunkworks stories using historical analysis and employing a narrative organizational storytelling.

Six success factors and six take-away lessons are identified. The findings from the research suggest that although conditions are always changing in an unpredictable way, an organization can have skunkworks as a method for dealing with it. Principles are developed out of repeated actions. Lessons learned help us recognize the next step and adds to our knowledge and understanding. The impact of culture in institutionalizing skunkworks procedures is complex. In spite of what is often reported that skunkworks as a sign of dysfunctional management do not help in preserving the reputation of core products, the findings suggest that turning to skunkworks will leverage business opportunities and enable employee to install focused creativity into the development process without affecting the operation line. We conclude that cognitive thinking of team member’s matters and that skunkworks approach as a model to deal with uncertainty takes a stand into organizational learning.

Key Words: skunkworks, innovation, ambidextrous, learning, lean, intrapreneurship, champion
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May, 25th, 2016,

Gurilda Gjona       Raja Muhammad Usman Rafique
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Chapter 1. Introduction

In this chapter, background and significance of the topic is given with the aim to highlight its importance. In addition, problem discussion is elaborated in connection to the research purpose. Then research questions are derived and represent the intention of the study.

1.1 Background and significance

Companies achieve competitive advantage through acts of innovation. They approach innovation in its broadest sense, including both new technologies and new ways of doing things (Porter, 1985). Innovation is driven by the ability to see connections, to spot opportunities and to take advantage of them. Technology often plays a key role in enabling radical new options. Therefore, technology and innovation management of it matters (Tidd & Bessant, 2013). There exist different stories about skunkworks as a model for innovation. The true story of skunkworks originated in the defense industry at Lockheed Martin Corp. during World War II. Perceived threat initially of the Axis and then the Cold War, intrinsically motivated to mobilize forces and "Skunk Works" was established under Clarence “Kelly Johnson” in 1943 to build the U.S. Air Force’s first jet fighter, the F-80 "Shooting Star." Under Johnson’s leadership, it produced the F-104 Starfighter, U-2 spy plane, and SR-71 Blackbird, some of the most brilliant innovation breakthrough of technological marvels (Rich, 1994).

Nowadays, companies have to do more with less. According to Business Insider (2013), many are moving away from giant research centers, towards building something like a lean startup inside their companies. While others like Google have the luxury of a different model, where secretive labs work on projects that may never see the light of day. Max Nisen, from Business Insider in 2013 refers to skunkworks in a broader definition as ‘the places where some of the world's most talented thinkers and engineers are given time and freedom to create something fascinating’. Moving toward more dynamic business environments, innovation is crucial not only to gain competitive advantage but in general is a survival issue. In such context, history shows that skunkworks approach has been used to accelerate product development projects in situations of “do or die” for the organizations. Skunkworks has become one of the most well-known organizational innovations and R&D programs to emerge in recent years (Brown, 2004). Skunkworks refers to innovation efforts undertaken by a highly motivated team, often secret and organized outside organization’s main facility and bureaucracy in order to create room for new ideas to flourish. According to Gwynne (1997, p.18) “A skunkworks is a protected and culturally antithetical body for the purpose of innovation”.

Several business organizations have approached skunkworks as a breakthrough innovation concept resulting in a radically new superior product. The proven effectiveness of ‘skunkworks’ philosophy of rapid innovation, seems to have worked well for pushing innovation to other levels for corporations like Lockheed Martin Co., Apple, Ericsson, Toshiba, Ford etc. The list of the companies that have approached skunkworks in product development is even larger including giants like Walmart or Nordstrom. Their success is tracked worldwide and helped them to achieve leading positions in their industries. Skunkworks helps the companies to launch their innovative
products fast into the market and under high level of secrecy. Because anyone who developed a new product with commercial viability was able to create their own divisions, it provides incentives for people to innovate (Ghoshal & Bartlett, 1987). Tough competition, the need to survive, gaining competitive advantage, and willingness to own exclusivity of innovation to win the race and extend industry horizon, are key drivers behind company’s decisions to build skunkworks. Time to the market is more and more important. Companies are in search of innovation models that can capture creativity and accelerate the development. However, large mature organizations tend to be more rigid, less flexible and less innovative. Thus skunkworks is a way of handling chaos and uncertainty that comes with innovation.

1.2 Problem discussion

Given the context, skunkworks presents a major challenge for many of large established firms due to the indeterminateness of strategic context. Top management view of the new venturing as a guarantee that it will save them if main business goes bad, and not as a corporate objective, poses one of the challenges of institutionalizing the skunkworks operations (Burgelman, 1984). Thus, skunkworks becomes an attractive way of desperately embracing its approach by management. A successful skunk works- like program is one characterized by informal processes with close personal interaction (Brown, 2004). Today, skunk works are basically special teams of passionate entrepreneurs, who are isolated from the rest of their business, given resources and relatively free reign to innovate and develop (Brown, 2004 p.132).

Historically, failure to innovate within existing organizational environment in conjunction with competitive threats drives the management to innovate (that is administratively). Institutional pressure to establish skunkworks just because other companies are doing it is not a good sign of healthy management. The fact that many of radical innovations in the world today can be attributed to this group working approach, does not always guarantee success. The expectations are high in that something truly innovative will emerges, while in reality the result can be even discourages and in most of the cases, unsuccessful skunkworks efforts remain in the “dark” memory of the members of the organization and never revealed to the public. Partial understanding of the requirements, commitment and managerial implications will lead to failure (Brown, 2004).

From a learning perspective, building capability is not only a characteristic of outstanding organizations. Regardless of the position of the firm or the industry, the ability to build development capability is crucial in long-term competitiveness (Wheelwright & Clark, 1992 p.311). Understanding the development pattern of the organization facilitates senior managers in translating that pattern into group projects designed to build specific kind of capabilities and providing that kind of leadership that create synergies and build momentum to reinforce the organization (Wheelwright & Clark, 1992 p.337). We searched for projects that were successful because in all of these cases in retrospective they saved the companies. Thus, companies can learn from successful skunkworks and that managerial implications can be drawn and carefully revised.
1.3 Research purpose

In academia there is not much written about skunkworks. On the other hand, in some ways, in the business world skunkworks approach is not a new thing. Maybe they heard about successful stories of advanced development projects or they have worked in this way without realising. That is why there is a need to research with an emphasis into the learning perspective. There is lack of research in the field of innovation management in institutionalizing skunkworks procedures due to the emergent nature of it. However, there are evidences of the first attempt to internalize the operations under a set of rules - “the 14 Rules” - developed by the father of skunkworks, Kelly Johnson under which the skunkworks operations were orchestrated. The rules are simple to grasp by every manager, no matter of the nature of the project, they are applicable and present high level of practicality in managerial considerations. What is problematic in the research field is the fact that unsuccessful skunkworks are not revealed by companies and consequently not studied by researchers. This might lead to difficulties in studying practical applications of skunkworks. However, companies can learn a lot from already successful skunkworks in how to organize for rapid product development in a more efficient and cheaper way.

Taking a learning perspective, the purpose of thesis is to explore what companies can learn from successful skunkworks efforts in encouraging, supporting and internalizing them as a tool to achieve higher performance and build organizational learning. The authors have identified that there is a need of contributing to bridge the connection between the enormous empirically evidence of different cases of successful skunkworks and the literature. Gaining valuable insights from practitioner of skunkworks in several projects will lead to better understanding of this appreciated innovation process. Exploring why skunkworks strategy has been so successful will also lead to a better understanding of innovation management. It is clear that when the traditional innovation approach does not work anymore, certain situations call for unconventional thinking. Drawing lessons from successfully implemented skunkworks in several industries will definitely improve the given research area and also the practical managerial implications. Rooting them in the business portfolio with the support of top management is the path toward making innovation part of daily operations and processes.

1.4 Research questions

From the above problem discussion and research purpose sections, the following research questions are derived in intention to answer from a learning perspective:

Question 1: Why has skunkworks philosophy been so successful?
Question 2: What can companies learn from successful skunkworks in order to internalize the procedures?

1.5 Summary

- Chapter one provides an overview of the background and significance of this study, arguing for relevance in gaining a better understanding of the successful stories of skunkworks projects.
In the second chapter, a literature review of what is researched in the field of skunkworks is conducted, giving the different perspectives of where skunkworks can be seen. Aiming at providing a critical literature review of the concept itself, and integrating it with the help of different literature schools will be the focus of this chapter.

Chapter three includes methods implemented to answer the research questions. This chapter has been adopted to support the decisions made for the purpose of the study.

Chapter four consists of empirical data about skunkworks extracted from different data collected. Secondary data collections from books, articles and interviewees include four case studies: Ericsson AXE, Apple Macintosh, Swedish Air Force J22 fighter airplane and Complete Vehicle Testing Project at Volvo Trucks.

Chapter five includes the analysis of the data and discussion of the empirical findings.

The last chapter of the thesis includes the answers to the research questions, theoretical implications, managerial implications and future research.
Chapter 2. Literature Review

This chapter provides an overview of previous research in skunkworks respectively and related domains of research. It introduces the framework for the case studies that comprises the main focus of the research described in this thesis.

2.1 Preview of ‘the pros and cons of going skunky’

Before elaborating on literature review, authors discuss a critical point of view considering the pros and cons of ‘skunkworks’ innovation model. An overall picture of what is researched by several authors in this aspect is provided.

Traditional innovation approach generally takes the type of unfreezing to refreezing, and bridging the gap in capacities, mentality and execution. One exceptionally well known model, the exemplary model proposed by Kurt Lewin, contends that the procedure of progress includes three phases: (1) Unfreezing, (2) Change and (3) Refreezing. This model was essential in perceiving the significance of new learning, as well as "unlearning" old states of mind, propensities and conduct designs (referred in Yalom, 1995: 488-9). Today numerous inquiries the common sense of this model, proposing that a "refreeze" suggests resistance to future change and specifically that the future is questionable and uncertain.

In his article ‘Creating Innovative Climates’ Peters (1983, p. 347-348) is appealing to the fact that "innovation, as unpredictable, thrives in the chaos of skunkworks where product champions go scrounging for success" and that "we must learn to design organizations that explicitly take into account the unavoidable sloppiness of the process and use it to their advantage rather than fight it". It is intriguing also to find out that people is the answer to the source of innovation and in the same time people are the ones who create rigid structures that hinders innovation (Peters, 1983).

Hamel & Prahalad (1991) mentioned skunkworks technique in their Harvard Business Review article, ‘Corporate Imagination and Expeditionary Marketing’. Authors argue that whether the conventional wisdom thinks that big companies cannot be truly innovative, still despite the system, new ventures will arise out of the hindrance of bureaucracy. In order to protect the imaginative individuals from corporate orthodoxies, senior managers in many companies tend to isolate them in new venture divisions, skunkworks, incubators, and the like. Authors argue for individual imagination that must become corporate imagination when stating that: “Trying to leverage corporate competencies into new businesses while at the same time protecting new ventures from corporate orthodoxies is a contradiction in terms. Rather than move new business development off-line, the challenge of creating new markets must be met head-on”.

In addition, Steve Blank (2014) in his article ‘Why corporate skunkworks need to die’ advocates that disruption is continual in that “continuous disruption requires continuous
innovation”. Referring to Blank (2014), this means that mastering “the art of executing on core products while continually inventing new products and new businesses” is what companies are in need for. At certain degree, he argues for the integration of the innovation that skunkworks removed from core business into the organization when stating that: “We need to realize that skunkworks epitomize innovation by exception. But to survive companies need innovation by design. We now know how to do just that. We can get innovation and execution to work side-by-side”.

While understanding Steve Blank’s premise, Chicke Fitzgerald (2015) in her article ‘Innovation Mischief - Why Skunkworks may be your only hope’ in LinkedIn and Fortune 100 argues that Blank is missing something that sometimes you just cannot get there from here. She is a true believer that for some companies/industries, skunkworks is the only hope as stated:

“I believe that a skunkworks can be used not only to foster innovations and build new businesses, but properly run, they can create a model for organizations to infuse consistent, integrated innovation into the mother ship. Through an integrated, strategic planning process focused on execution and integration, the fully built product or fully defined service can then become a part of the more mature parent organization. The learning, both good and bad, can be shared with the core organization and of course, all along, the parent would be providing guidance and insight, as well as funding to the skunkworks. I believe that this is a viable model to launch totally new products, models, markets or even new ways of organizing or leading. What if there was an organization willing to run the skunkworks and even do it as a joint venture, with a vested interest in its success. And just maybe, that firm has a bit of technology that could make a real difference in the landscape of one or more industries” (Fitzgerald, 2015).

Allan Kelly (2005) in his blog Agile, Lean, Patterns acknowledges that there is something special about skunkworks, as he describes them in the blog ‘Skunkworks teams for innovation’ as: “the image of a bunch of brave souls going off to design and create a new product, cut off from the Corporation, free from the politics and infighting”. However, the author elaborates more on the downsides of this approach. First of all, while he accepts that through skunkworks a new product is created, yet the author still argues that this approach does a little to make the overall organization more innovative. Also, the fact that innovative people are isolated from the rest of the organization makes their expertise and experience inaccessible for the others. In this way these people do not act as role-models for the other employee whom in fact just continue with their regular work.

Secondly, what happens after the product is introduced is a matter of integration which might not be understood by the rest of the company, in the learning curve. Also the people who created these new products need to get back on the track within the organization. But the fact that they are used to another way of working, under no politics and a free environment, makes the return of these people more difficult (Kelly, 2005). As a result, for some of them, it is easier to leave the company. People that are part of the mainstream company and that did not participate in this production of ‘shiny things’ may feel jealous and even be resentful toward those ‘skunkworks privileged people’ (Kelly, 2005). What can be understood from the above discussion is that Kelly (2005) argues for integration of the innovation within the company’s values.
On the other hand, at Harvard Business Review Book ‘Managerial Excellence’ (Gupta & Stone 1996, p.116), a collection of articles from 1980 to 1994, the manager of R&D at Sony refer to the integration also of the losing team as: “We constantly have several projects going on. Before the competition is over, before there is a complete loss, we try to smell the potential outcome and begin to prepare for that result as early as possible......We begin to give important jobs to the people of the losing team. If your team doesn’t win you still will be evaluated as performing well....Doing something even if you fail is better than doing nothing”...

In addition, Adrian Brown (2007) wrote a book ‘Creativity & Innovation’, where the pros and cons of the so-called skunkworks model of innovation are considered. Considering the benefits of the "skunk works" model of innovation, firstly, by operating in a distance from the main organization, the group is more averse to feel confined by existing regulations, thus can think more freely. Secondly, an implication of this is that the group will be greatly focused on the assignment and are prone to shape a solid cohesive unit. Thirdly, the rest of the association is less likely to feel the pressure, particularly if this is occurring in a secret way  (Brown, 2007).

On the other hand, the skunkworks model involves some significant risks. Firstly, by working outside the organization, it is easy for managers to ignore decisions that might emerge and the ideas developed as ‘not part of the core businesses. Another risk is that managers take it for granted and imply that the skunkworks is the ‘innovative’ part of the organization, thus the others can simply get on with their daily routine (Brown, 2007). Thirdly, the separate places for the skunkworks projects can a negative impact as well. Sometimes working in a separate group can also create a setup as “Us vs Them” that can makes difficult for the persons working on the skunkworks project to integrate into the parent organization again after finishing on the skunkworks project (Ibid).

In 2013, Derek Andersen, the founder of Startup Grind conducted an interview with Nolan Bushnell, the father of video game industry and the founder of Atari Corporation, in order to gain insights of Bushnell’s book “Finding the Next Steve Jobs” (2013). Citing Bushnell (2013) from this interview where he stated: I love skunkworks. The nice thing about skunkworks is you can try things cheaply. Bureaucracies creep into companies because you have different rules if you have a thousand employees than if you have three. And you can – when you have 1000 employees, the paperwork to buy a pencil will often exceed the pencil, and going down to Radio Shack to buy a part rather than going through purchasing can be the difference between a week’s delay and no delay at all. Those are the sort of things you can open up in a skunkworks that really accelerate projects, get rid of the impediments and go straight through. There are also certain people that just work really well in skunkworks environment that, when in the main body, don’t do as well. Some people like to hide in plain sight; you can’t hide in a skunkworks.

Reflecting over ‘when to go skunky’ means taking into consideration pros and cons of this model of innovation. Skunkworks is more than just an advanced product development team. The team has the full authority over their dealing and negotiation at their own with the clients. Despite of the success stories of skunkworks, companies hesitate to go for disruptive skunkworks innovation because they misunderstood the scope and limitations of true skunkworks and also due to the risk factors. According to Rich (1994, p. 344) “the trend nowadays is towards more
supervision and bureaucracy, not less”, this thing hinders companies to go for skunkworks project and also kills the essence of skunkworks. There are other approaches for companies to become innovative. However, authors choose to gain a better understanding of what is typical of skunkworks in a learning perspective. Skunkworks role in the advancement of projects of a delicate nature is essentially important and involves potential to be the ultimate answer for innovative organizations simply because truly innovative organizations have creativity in their DNA.

2.2 Skunkworks - What is it?

Skunkworks has always been highly innovative projects, despite of their rate of success or failure. As Single and Spurgeon (1996, p.39) define as “Method of managing the innovation process” involving high level of creativity which inevitably led to uncertainty. Recently May (2013, p.54 ) provides a more concrete and meaningful definition of what skunkworks refer to as:

“To any effort that involves an elite special team that breaks away from the larger organization to work autonomously on an advanced or secret project, usually tasked with breakthrough innovation on a limited budget and under aggressive timelines”.

The term has even become official, and is defined in the fourth edition of the American Heritage Dictionary of the English Language as “an often secret experimental laboratory or facility for producing innovative products, as in the computer or aerospace field.” This definition gives a better picture of what working in a skunkworks project implies. Ben Rich (1994, p.344), successor of Kelly Johnson - the true champion of skunkworks department at Lockheed provides amazing insight of true skunkworks when states: “Any company whose fortune depends on developing new technologies should have a skunkworks in operation”.

Those guys’ brainstormed ‘what-if” questions about the future needs of commercial and military aircraft,” writes Ben Rich in his memories. “And if one of their ideas resulted in a contract to build an experimental prototype, Kelly would borrow the best people he could find in the main plant to get the job done. That way the overhead was kept low and the financial risks to the company stayed small.” Ben Rich, the operational brilliant boss for two decades provides also practical implications in his book “skunkworks” when drawing the right lessons that are relevant even in today’s austere business climate. “Going skunky is a very practical way to take modest risks, provided that top management is willing to surrender oversight in exchange for a truly independent operation that can make everyone look good if its technology innovations really catch on” (Rich, 1994, p.318). The wide range of definitions available provides better insight of what skunkworks is its attractiveness to companies despite the risks. In the following table, several definitions from different authors are listed, thus aiming to give a good overview of the topic in hands.
<table>
<thead>
<tr>
<th>Authors</th>
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<tbody>
<tr>
<td>Rich &amp; Janos (1994)</td>
<td>“Any company whose fortune depends on developing new technologies should have a skunkworks in operation. By its very definition as a low-overhead advanced development operation for crash production of hot items-prototypes representing cutting-edge technologies that the customer eagerly needs or wants to exploit - the skunkworks is needed more than ever”. (p.344)</td>
</tr>
<tr>
<td>American Heritage Dictionary of the English Language (4th edition)</td>
<td>“An often secret experimental laboratory or facility for producing innovative products, as in the computer or aerospace field.”</td>
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<tr>
<td>Single &amp; Spurgeon (1996)</td>
<td>“Method of managing the innovation process, characterized by extremely efficient use of time by a small group of creative engineers” (p.39)</td>
</tr>
<tr>
<td>Gwynne (1997)</td>
<td>“A skunkworks is a protected and culturally antithetical body for the purpose of Innovation”. (p.18)</td>
</tr>
<tr>
<td>Brown (2004)</td>
<td>“A true skunkworks is an isolated and highly skilled team designed to accelerate the research, but especially the development of innovative product/services. This team typically works outside the bounds of the parent’s rules and regulations and under time pressure”. (p. 134)</td>
</tr>
<tr>
<td>Richard (2009)</td>
<td>“A skunkworks is a separate, small, informal, highly autonomous, and often secretive group that focuses on breakthrough ideas for the business”. (p.296)</td>
</tr>
<tr>
<td>Bwired (2009)</td>
<td>“A term widely used to describe a team that have a high degree of autonomy, little bureaucracy and work on specific projects” (p.3)</td>
</tr>
<tr>
<td>Whatis.com (2016).</td>
<td>“A skunkworks (also known as Skunk Works) is a small group of people who work on a project in an unconventional way. The group’s purpose is to develop something quickly with minimal management constraints. Skunkworks is often used to initially roll out a product or service that thereafter will be developed according to usual business processes”.</td>
</tr>
<tr>
<td>Accepted Definition</td>
<td>A skunkworks is a group of people who in order to achieve unusual results, works in a project in a way that is outside the usual rules. A skunkworks is often a small team that assumes or is given responsibility for developing something in a short time with minimal management constraints. Typically, a skunkworks has a small number of members in order to reduce communication overhead. A skunkworks is sometimes used to spearhead a product design that thereafter will be developed according to the usual process. A skunkworks project may be secret.</td>
</tr>
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</table>
Even though different definitions of different authors about “what skunkworks is” exist, some common key points can be drawn like emphasis on innovation of small group of people, specific aim and highly skilled people. To conclude, for the purpose of this working thesis the accepted definition will be:

*A skunkworks is a group of people who in order to achieve unusual results, works in a project in a way that is outside the usual rules. A skunkworks is often a small team that assumes or is given responsibility for developing something in a short time with minimal management constraints. Typically, a skunkworks has a small number of members in order to reduce communication overhead. A skunkworks is sometimes used to spearhead a product design that thereafter will be developed according to the usual process. A skunkworks project may be secret.*

### 2.3 Skunkworks matrix

Brown’s contribution in studying skunkworks is the skunkworks matrix presented in the following figure (Brown, 2004). There are two dimensions provided in the matrix, the level of secrecy and level of management support and four spaces of skunkworks are given.

![Skunkworks matrix](Image)

*Figure 1. Skunkworks matrix, source Brown (2004, p.137)*

“*True skunkworks*” refers to a skunkworks that is both secret and mandated. Nowadays this type of skunkworks is limited and belongs to military and government projects. They are fully supported from top management and as a result more successful than other innovative programs (Brown, 2004. p.138).
“Pseudo skunkworks” refers to skunkworks that is public and mandated by top management. This type of skunkworks mostly exists in corporate projects, which are known “throughout an organization as causing some of its dysfunctions and problems” (Ibid.).

“Emergent skunkworks” usually starts from small and secret projects, without permission and support by top management. According to Brown (2004), if a project can reach some success and be proved, it can be approved by the managers and stop being under the table. After that, the project will switch to other types of skunk works. (Ibid.).

“Transitional skunkworks” is considered as public and high level of management support. The direct influence on “transitional skunkworks” usually comes from top management team, who able to decide the future of the project. For example, the project could be continued and moved to “pseudo- skunkworks”; or in case of rejection of the project, it can be moved to “emergent Skunk works” and become “more secretly and more unofficially than previously”. (Ibid.).

Taking into consideration Abetti (1997), Brown’s work in skunkworks need to be expanded. According to Abetti (1997), the “underground” skunkworks project needs to be elaborated, the case when the project starts without the approval of senior management. He is referring to Toshiba’s laptop project which started as a project out of the control of top managements. According to Brown (2004), Mischi (1999) and Abetti (1997), skunkworks projects should be supported by the top management. The underground project describe by Abetti (1997) can be included in the Brown’s model as non-supported but emerged skunkworks projects.

According to Brown’s (2004) original model and expanded model there are four types of skunkworks projects in terms of level of secrecy and support by the management, both the models are actually same but the expanded model is in reverse coordinate plate, instead of matrix. This expanded model is the result of the difference in support by the management and level of secrecy during the project and it depends upon the nature of the project to be more pseudo or the true skunkworks project with the high level of secrecy.

![Figure 2. Expanded model of Brown’s types of skunkworks. Pataci (2013)](image-url)
2.4 Skunkworks vs. traditional innovation projects

Skunkworks projects can be differentiated from the traditional innovation projects on the basis of team formation, leadership, bureaucracy, level of secrecy, risk factors involved, funding and real time adjustments in the projects. Skunkworks projects are differentiated on the basis of level of management support and the level of secrecy (Brown, 2004). According to Gwynne (1997) skunkworks can be differentiated from the traditional innovation concept on high flexibility, number of people at project, continuous human and financial resources, free from bureaucracy, regular reporting and delays in vital items. These factors make skunkworks so appealing to Fortune 200 and other large companies.

Autonomous Team Structure. The skunkworks projects are run by a small group of intensely competitive, highly skilled and talented people. The skunkworks team is an isolated team and designed to accelerate the research and especially for the development of innovative product/services. Traditional innovation projects teams’ formation is functional teams or lightweight team; on the other hand the skunkworks team is a tiger team. A skunkworks team is highly skilled handpicked team which works on the individuals design and ideas outside the routine organizational procedure (Gwynne, 1997).

Strong Leadership. The skunkworks projects requires a strong leader with a sound technical and management background at the same time (Gwynne, 1997; Rich, 1994). The leader knows how to achieve the goals in minimum time, how to manage the people and protect them from the bureaucracy and external influence, also to make sure that the requirements and resources of the project team are approved at the short notice and available for the whole period (Gwynne, 1997). Traditional innovation process have no strict rules over the leader, either it can be a manager or a technical person. The availability of resources depends upon the interest and how important that project is for the company.

Freedom from bureaucracy. The skunkworks projects are free from bureaucracy and external pressures (Rich, 1994). It is assured by the project manager that the team working in the skunkworks project has no external pressure from outside and even from the parent company. That’s why the skunkworks projects are placed at the separate place from the parent company so that the parent company’s bureaucracy will not influence the project’s performance and efficiency of the project (Rich, 1994). The traditional innovation projects progress at the same place within the company and have an influence of the bureaucracy within the company, which might affect the progress of the company.

High secrecy level. The skunkworks projects are highly secret projects. The skunkworks projects at Lockheed Martin were the Military projects and of course require high level of secrecy, but later this became part of the strategy that every skunkworks project should be secret (Rich, 1994). It is also advised to have the separate premises for the skunkworks project from the parents company (Gwynne, 1997). Traditional innovation project are at the same place within the company and it involves a number a people depending the size of the project. So the level of the secrecy is not comparable to the skunkworks project as it is more open in the company.

Real Time adjustments/Sense of urgency. In skunkworks the real time adjustments are a common procedure. There is no general reporting procedure and permission from the top management. The bureaucratic structure of the organization resist the technological innovation
within the organization, therefore smaller units outside the parent company are formed for technological innovation that are free from the bureaucracy inside the company (Rich, 1994).

*High level of risk.* The risk factors involved in the skunkworks projects is quite higher than the traditional innovation projects because the skunkworks projects are relatively accelerated project and time constraints usually exist. Skunkworks projects are goal oriented and required to be completed in a limited time (Pataci, 2013). Also the risk factor is high because sometime the ideas of the skunkworks are too innovative while traditional innovations projects have not high risk because of the time constraints. The following table gives the comparison elements of both innovation approaches. The table 2 provides a clear picture of the fact that when approaching skunkworks mode of innovation, managerial requirements should be carefully considered by top management to ensure success of the innovation effort.

*Table 2. Comparing skunkworks approach with traditional innovation approach.*

<table>
<thead>
<tr>
<th>Factors</th>
<th>Skunkworks</th>
<th>Traditional Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Format</td>
<td>Autonomous team structure/Fully dedicated</td>
<td>Functional team or lightweight team</td>
</tr>
<tr>
<td>Working Facility</td>
<td>The workplace for skunkworks projects is always located outside the parent company facility.</td>
<td>These projects are carried out within same place of the main company.</td>
</tr>
<tr>
<td>Secrecy</td>
<td>High level of secrecy</td>
<td>Depends on the nature of project.</td>
</tr>
<tr>
<td>Programme Manager</td>
<td>Complete control of the program in all aspects. Full authority to make quick decisions regarding technical, financial and operational matters.</td>
<td>Do not have the full authority to make the quick decisions regarding technical, financial and operational matters.</td>
</tr>
<tr>
<td>Management Support</td>
<td>Requires nurturing and support strategically from senior management.</td>
<td>Projects are carried out in the light of management. Every detail is known.</td>
</tr>
<tr>
<td>Reporting Procedure</td>
<td>Minimum number of reports/bureaucracy under attack</td>
<td>Tendency to report as much as possible, an issue is that the focus can be lost.</td>
</tr>
<tr>
<td>Sense of urgency</td>
<td>Usually exists: these projects are goal oriented and required to be completed in a limited time.</td>
<td>It depends on the project. In general time constraint is not a factor to be counted for completion of the project.</td>
</tr>
<tr>
<td>Risk Factor</td>
<td>Usually high due to the radical innovation ideas.</td>
<td>Tendency to take as less risk as possible</td>
</tr>
</tbody>
</table>
2.5 “Skunkworks” Philosophy

2.5.1 Collaborative Innovation Network concept COINs

Taking a different starting point from Brown (2004), Peter Gloor (2016) argues that this unorthodox way of innovating has always existed and there are evidences of it throughout human history. Peter Gloor (2016), scientist at MIT Sloan's Center for Collective Intelligence, in his latest book “HomoCollaborensis” advocates the importance of Collaborative Innovation Network concept (COINs) in a historical perspective. Gloor’s book (2016) and clarification from the interview will be reviewed to organize the rest of this section. He argues that COINs, often called skunk works, have been around for quite a while. Benjamin Franklin utilized the idea to add to some of his developments, and in his life account portrayed guidelines for building up such a system, to the point that are still pertinent today. The group Collaborative Innovation Network where a little gathering of naturally spurred individuals, gets together to enhance and make something fundamentally new. Established in 1663 by contract of King Charles II, the Royal Society was a gathering of doctors and common rationalists who needed to propel science what's more, normal rationality. Royal Society's first secretary, Henry Oldenburg, was an extraordinary connector with a pan European system of scientific respondents. One of his supporters at the Royal Society was Robert Boyle, the seventh child of the Earl of Cork and a noticeable physicist. After his education at Eton, Boyle was sent on a fantastic European visit, meeting Galileo Galilei in Florence, and building his own network European science system. After acquiring a considerable fortune from his dad, Boyle turned out to be a piece of a gathering of analysts called the "Invisible College" which were changed over in 1663 to the Royal Society of London for enhancing Natural Knowledge. Together with Oldenburg they wove a European system of researchers, where scientists like Isaac Newton and Gottfried Wilhelm Leibniz compared on creating analytics to kick off the advancement of Western sciences (Ibid).

In today's reality, this development motor with the COIN – the Collaborative Innovation Network – at its center, has been turbocharged by the Internet. A maker with a world-evolving thought, be it Elon Musk, Mark Zuckerberg, or Malala Yousafzai, can without much of a stretch contact like-minded individuals anywhere on the world to begin their COIN. Be that as it may, they all share a few (un)common attributes. Gloor (2016) claims that COINs are turning out to be progressively vital as a motor of advancement for large organizations that should keep pace with fast moving markets. Today, the web and online networking, consolidated with a voracious appetite for new products, is driving another stage in the improvement of COINs (Gloor, 2016). In his book “Innovation never stops” Peter Merrill (2015) takes a further step in identifying skunkworks as a ‘nickname’ for communities of innovation. The author continues this line by arguing that it was Lockheed in 1940s that created the term skunkworks after their innovation community. Since then skunkworks is often associated with innovative solution to bring people together and be creative. They create a network of personal interactions, where trust is essential and information become knowledge. It is this community of innovation who will enable the best knowledge transfer. In leading this kind of team, the leader and members must have a passion for the subject, for the game, for friendship and demonstrate highly focus in specific opportunity (Merrill, 2015).
According to Gloor (2016), the fundamental procedure for setting up a COIN commonly begins with a profoundly energetic, inventive individual, who has an idea he or she needs to convey to realization. This evangelist enlists a gathering of similarly invested partners – possibly three to 12 individuals – to convey the task forward. Once the starting, freakish thought has been interpreted into a model, more teammates are pulled in to the task to frame a community oriented learning organize; the hatchery for the COIN. The activity likewise prompted crucial changes in the inventory network for the parts. Another key component of these systems is that they have a turning administration. As Gloor (2016) clarifies, once settled a COIN needs diverse sorts of initiative as it advances. At first the pioneer is an evangelist who drives the gathering's work. As the task develops, it requires more deals aptitudes at the top. Additionally, pioneers propel and support the endeavors of the members, yet have moderately little control over the gathering. It's turning out to be more vital for organizations to have the capacity to recognize and encourage COINs. (Gloor, 2016). Product life cycles are getting shorter and skunkworks are an essential source of disruptive innovation and also methods for organizations to be receptive and agile to moving business sector requests. "Today, large organizations need what the armed force calls "energy to the edge", to delegate obligation (for development), and that implies empowering individuals who are self-helpers" (Gloor, 2016).

### 2.5.2 Skunkworks and the lean philosophy

The well-known book “The Machine that Changed the World” by Womack, J., Jones, D., and Roos, D., (1990) explored the downside of mass production and lean production is presented alternatively. In mass production, the task is divided into small incremental tasks, the smallest and simplified possible that anyone without expertise and concern about total quality could execute. The only people that are required to concern about expertise and quality management are the production engineer. The employees are not exposed to “the big picture” and they are not even supposed to solve the problems that occur. An implication is that employees do not have the ability to do changes and neither do they have incentives. This lead to low morale in the operation level and the problem may still be unsolved. The production engineer is more concern about specialty then the good overall productability.

Meanwhile in lean production the empowerment of the employee to identify and solve problems and even to stop the whole production line if a problem is identified, underlines the lean philosophy, the Japanese way. Concerning new product development, the Japanese approach is to form dedicated development teams with all the required technical capabilities and led by a strong leader. The leader is strong because he or she has real power to direct the resources toward the outcome to make it happen. The leader is strongly identified with the product and has wide exposure to technical development, production, and customer service. This is reflected in the book “The Machine that Changed the World” (1990, p. 113) in the following citation:

> "(Japanese Large Project Manager)...was given powers far surpassing any (US Project Manager) ever dreamed of. While (Japanese company) also uses a matrix ... (manager) was told to borrow appropriate people from each of the relevant departments and transfer them to the ... project for its life. Rather than coordinating, (manager)’s task was, clearly, to manage. He could move the project along rapidly, because all the necessary resources were under his direct control.”
…..“(Japanese companies) decided early-on that product engineering inherently encompassed both process and industrial engineering. Thus, they formed teams with strong leaders that contained all the relevant expertise.”

…..“In the best Japanese companies the position of (large project manager) carries great power and is, perhaps, the most coveted in the company.”

Daniel P. Raymer further elaborated this philosophy in his article “Lean production and the skunkworks approach to aircraft design” (2008) in relation to 14 points of Kelly Johnson. The legendary Lockheed “Skunk Works” approach to new aircraft development seems to closely follow the above-described Japanese practice for product development. Kelly Johnson developed such revolutionary aircraft as the P-80, F-104, U-2, C-130, and SR-71, using “14 Points”. Many of these 14 Points sound like the “best practices” devised in Japan and described in “The Machine that Changed the World” (Raymer, 2008, p. 4). According to Raymer (2008, p.4), skunkworks is often synonymized with the ideal new product development but is rarely followed in its entire entity. He goes further by citing Johnson (1985) who states “I have been trying to convince others to use our principles and practices for years. ...Very seldom has the formula been followed. Most companies, while desiring the benefits, will not pay the price in revised methods and procedure for setting up a skunkworks-type of operation. They will not delegate the authority to one individual, as Lockheed did in my case from the very first skunkworks. It requires management confidence and considerable courage.”

The author concludes his study by stating that “the legendary skunkworks approach includes a strong technical leader with lots of real authority, a minimum of micromanagement from above, dedicated product teams, and a strict avoidance of “design-by-committee.” All in all, this sounds very much like the Japanese methods for management of new product development as described in “The Machine that Changed the World.” Neither “The Machine...” nor Kelly Johnson’s book describes anything remotely like the nearly-leaderless teams and Integrated Project Team’s which are sometimes offered as the “new” way for product development”. (Raymer, 2008, p.5).

This discussion was necessary to gain an understanding behind skunkworks approach and lean. Steve Blank in his article “Why Lean startup changes everything” Harvard Business Review (2013) advocates for experimentation overelaborate planning, customer feedback over intuition, and iterative design over traditional “big design up front” development. Mike Rother in his bestseller “Toyota Kata” (2010) enhance our understanding in developing new patterns of thinking in human behavior which are applicable every day and tap human potential in working together toward new levels of performance. According to Rother (2010), an effective management system is the one that keeps an organization adjusting to unpredictable, dynamic conditions and satisfying customers. Human beings in general tend to look for certainty where there is none. From the point where we are to where we want to be, if we think that the way ahead is preconceived, then we are in the implementation mode where the progress of people capabilities is impeded rather than simulated in how to learning and deal with uncertainty, as pointed in the figure 3 below.
In such context, skunkworks takes a stand in the organizational learning. From this point of view, in new product development, skunkworks is the approach to deal with uncertainty, where the path cannot be accurately predicted. As Rother (2010, p.9) points out “the true certainty and confidence do not lie in preconceived implementation steps or solutions, which may or may not work as intended, but in understanding the logic and method for how to proceed through unclear territory”. When the needs come urgently, the state is chaotic and nonlinear, the existing systematic procedures and routines are not good enough, and then skunkworks procedures are needed to get through that territory. Adapting lateral thinking breaks away from traditional problem solving. As a term, lateral thinking is coined by Edward de Bono in 1967. It refers to problem solving through approaching it sideways, in ways which are indirect and not obvious by the step by step traditional vertical logic. As Shane Snow discuss in his book “Smartcuts: The Breakthrough Power of Lateral Thinking” (2014), all breakthrough innovations have one thing in common, that they occur when people employee lateral thinking and break the assumptions that were just convenience, and this pattern is repeated over and over again.

2.6 Risk management in skunkworks projects

According to Pataci (2013) inherently, the skunkworks projects have risks and uncertainties depending upon the type of the project. It's the duty of the true leader of skunkworks project to convert these risks to opportunity and to convert it into the successful skunkworks project. The main aim of the skunkworks project is to complete the project in the limited time and budget then the ordinary projects. According to Stam et al. (2007) the risk assessment can be organized by the experts from outside but in skunkworks project the involvement of the personal outside from the project might not be possible due to the secrecy of the projects. According to PMI (2000) there are four types of risks; Technical, management, organizational and external risks in a project.

Pataci (2013) adopts a balanced SWOT model approach to skunkworks risk management. She presents that external risk and managerial risks are considered as threats while technical and organizational risks are taken as weaknesses. Then she expands her arguments in taking into account also the positive factors and argues that management and external positive factors can be considered as opportunities and technical and organizational positive effect can be considered as strengths. In such context then, Pataci (2013) combines Smith and Merritt (2002), Stam et al. (2007) models and SWOT model together and evaluates the importance of a tailored approach.
She presents her sequence approach to minimize the risk in skunkworks projects which consists in
the following:

1. Creating a SWOT and keeping it updated.
2. Identify and Analyze the risks involved the project.
3. Prioritize and map these risks.
4. Resolve the risks.
5. Monitor the risks, update the SWOT and risk list.

While agreeing about the importance of keeping a healthy balanced approach as Pataci
(2013) suggests, in this thesis the authors find it essentially to point out that the skunkworks
projects cannot simply follow a sequence routine of risk management. Gloor (2016, p.39) in his
latest book “HomoCollaborensis” claims that “by taking great personal risk, by setting an
example, and by being a member of the swarm, the swarm gets energized and is willing to join
the leaders on their world-changing endeavor”. In the interview conducted with Peter Gloor, he
reinforced his argument in this point in stating that skunkworks is inherently risky and requires
call for risk-taking leaders with entrepreneurial spirit. Citing his argument from the interview:
“Well I am not sure you can really manage risk because if you look at Grexit, if you look at
European Central Bank, if you look at... if you look all these tried to exclude all the risks. It's like
Fukushima Nuclear plant when everybody is there and it's impossible that nuclear plant can
explode and then something happens. I mean all of these happen, so you should try to exclude all
of those the things but entrepreneur are not risk managers, entrepreneur are risk takers. So an
obsession is managing risk. so that's the reason why Nokia didn't work anymore, in the beginning
they hired Olila who was a risk taker, the next one was a lawyer, and lawyer do only one thing
they manage risks and sue other people, which Nokia did. But that is not how you create mobile
phones”.

The skunkworks projects require the real time adjustments during the projects. One cannot
simply map or monitor the risks before starting the skunkworks project. The risks are resolved by
the real time decisions through the joint efforts of the leader and the team members. The
skunkworks leader minimizes the risks from the beginning by choosing the right people, with
excellent technical skills and in the same time capable of thinking in an unconventional way.
Everyone involved in skunk works is fully responsible for the outcome of the project, thus is
everyone’s job to contribute in risk assessment on daily basis. They are fully competent in
respective fields and able to adapt generalist views when is necessary, thus acting like leaders and
members simultaneously.

Actually the risk assessment is done through intuitive thinking on daily basis between
engineers and as a team since communication is the strongest pattern of this team. In one
occasion, Ben Rich designed the drawing of inlet and handed that over to the Kelly Johansson
who figured it out in his mind and handed back the design to Rich to refigure it because it's 20
percent bigger than the required design and later Rich realize Kelly said correct, the design was 18
percent bigger. It might be due to intuition or may be just experience but he was impressed (Rich
1994; p.108). Since engineers at skunkworks keep the paperwork in minimum, documenting only
important stages, then updating the SWOT seems like a routine that they do not like and simply
do not do. Due to the high entrepreneurial spirit among the team members, it is common to assume risk and resolve it as soon as possible and not waiting for others to do it. Thus in this thesis, the authors adopt a process view of the risk management where these steps can occur in different ways, in parallel or even simultaneously rather than a logical sequence view.

2.7 Team structure and formation

Development projects themselves are the vehicle by which new approach and new thinking are adopted and take on institutional reality. Without the advanced development work the firms only choice would be to be a follower (Wheelwright & Clark 1992, p.38). ‘Every organizational unit must break old habits, even good ones’ (Wheelwright & Clark 1992, p.56). Most organizations fail to realize the strategic potential in new technology or markets and next-generation projects because there are too many projects and because they pay too little attention to the strategic mission of the development effort and too much attention to short-term pressures.

It is also true that planning, shaping and initiating longer-term, more strategic projects requires a very different kind of managerial activity. Managing advanced development projects or breaking into new markets is much more comprehensive, ambiguous and uncertain than reacting to short-term problems. There is need to create an aggregate project plan in order to ensure that collective set of projects will accomplish the development goals and objectives and build the organizational capabilities needed for ongoing development success (Wheelwright & Clark 1992, p.48).

![Figure 4. Source Wheelwright and Clark (1992)](image_url)

There are four dominant structures around which project activities can be organized (Wheelwright & Clark 1992, p. 91).

**Functional Team Structure** - These teams are primarily found in large, mature firms grouped by discipline and have a sub functional manager as well as a senior functional manager. The major advantage is that the company benefits from prior experience and they hold the organization's depth of knowledge, while the major disadvantage is that each development project differs in its objectives and performance requirements. When used for product development, the primary
responsibility for the project is passed sequentially from function to function, also known as "throwing it over the wall." When used for technical problem solving, or competency building, these teams can be quite effective (Wheelwright & Clark 1992, p. 91).

**Lightweight Team Structure** - These teams are represented by a liaison person from each functional area, usually managed by a middle or junior level person who has little influence, status, and/or power. Team leaders usually spend only 25% of their time on a single project. These teams have the same strengths and weaknesses of the functional team structure, but have improved communication and coordination with regard to expectations. However, the lightweight team leader can sometimes feel ignored. For incremental product improvements, lightweight teams are great training grounds (Ibid.).

**Heavyweight Team Structure** - The manager of a heavyweight team has direct access to top management, and is responsible for the work of everybody involved in the project. The manager is a ‘heavyweight’ because he/she is a senior manager; hence they have the clout, experience, influence, and dedication of core members. Often core members are also co-located in the same physical location as heavyweight manager. Since the team members are not assigned permanently, then the heavyweight project leader can evaluate individual’s performance but the functions of career path development rest within their functional managers. Heavyweight teams are especially good at developing next-generation components or products (Ibid.).

**Autonomous Team Structure** - Also called "tiger teams," where team members from different functions are assigned formally on permanent basis to the project and co-located in the same area as the project leader. The team takes full responsibility for a project's failure or success. They are protected from organizational noise and bureaucracy and usually begin their project with a clean sheet of paper, creating their own policies and procedures. They have no established boundaries and usually provide unique solutions as a result. However, their autonomy often causes major problems. This type of team is volatile, depending on its success or failure. Their main strength is focus, concentration in doing everything it takes to succeed. They are especially successful in creating new business areas by creating new components or products. It is a requirement that
senior managers should establish clear guidelines in advance, thus not generating problems during the project when exercising their influence. This is a hard period for senior managers who should delegate more responsibility and control to the team and project leader than in any other type of project teams (Ibid.).

2.7.1 What is typical of skunkworks?

Skunkworks focus on radical or breakthrough projects. The essence of this approach is team formation. A dedicated tiger team is created and located outside of the main company, given full responsibility and resources to its leader and members to develop new products. During the development effort, there are no major stages of the project specified. The stages are specified by the team in the course of development rather than following up standardized set of procedures. In this manner the team decides all the significant milestones and oversees itself against those. However, there are guidelines on procedure to follow (standards for testing) and a budget to meet.

“Quick and dirty solutions”. A group of mavericks and a retired engineer Kelly Johnson at Lockheed Martin made the impossible possible. When building the U-2 spy plane, experts of aeronautics evaluated that it will never fly. But Lockheed Martin is not unique. This activity at GE is called ‘bootlegging’ and at 3M is labelled ‘scrounging’. In such context, according to Peters (1983, p. 351), it seems legit to argue that 3M, Hewlett-Packard, Digital Equipments are nothing more than collections of skunkworks because “Whenever a practical innovation has occurred, a skunkwork, usually with a nucleus of six to 25 people has been at the heart of it”. In the book “The Soul of a New Machine” of Tracy Kidder, Tom West, the project leader at Data General claims that the company’s crucial breakthrough in micro coding have taken place in less than a week. (referred in Peters, 1983)

“Charged-up Teams”. According to Peters (1983), all the mechanisms of the development framework support the concept of autonomous structure in order to emphasize team identity. This team environment is ideal for breakthrough project or experimental development where the aim is specifically to break new ground, not bounded by the existing systems and products. The impetus behind charged-up teams is ownership and commitment and a surprisingly small group is optimal. Companies like 3M, Hewlett-Packard, Digital Equipments follow “growing big by staying small” in order to make it manageable and less bureaucratic. As Peters (1983, p. 353) argues “The charged up team that contains 10 to 50 people is not in the “10 percent productivity improvement game”. Its results are often even larger than those achieved by larger groups “.

“Service and Quality counts”. Technology push is important. But customers generate ideas too. Skunkworks seems to combine both. Management by Walking Around is the term to coin this process. This is more than just listening to the users, is integrating customers into the design and testing process. To stay in touch with users is important for every industry. Listening to their frustrations and needs is an essential part of the learning process. Yet in certain circumstances it remains a capable model for guaranteeing speedy configuration (Ibid.).

As Peters (1983: p. 355) argues: “If it weren't for people, 10,000 person research groups would be the most efficient, if it weren't for people, huge amounts of money invested in technical forecasting would allow companies to anticipate competition and technological surprises. As a
way to do the job, skunkworks is faster, cheaper and higher quality. Getting 90 percent compatibility and letting the marketplace do the rest is optimal rather than aiming at that 10 percent than might cost you 60 percent of the market”.

Basic framework elements are presented in the table 4 with the skunkworks features explained and the respected issues involved.

*Table 3. Development framework (Wheelwright and Clark, 1992; Rich, 1994)*

<table>
<thead>
<tr>
<th>Element</th>
<th>Skunkworks features</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Development Project</td>
<td>Tiger Team fully dedicated and control over resources and processes, fully accountable for the project’s outcome success/failure.</td>
<td>Achieving focus on breakthrough projects without losing creativity and market opportunity. Strong team orientation</td>
</tr>
<tr>
<td>Major stages</td>
<td>Nonstandard/Team specifies major milestones and review procedures for those.</td>
<td>Technical excellence in early phases without losing focus on customer, speed of development and creativity.</td>
</tr>
<tr>
<td>Project Organisation/Staffing</td>
<td>Relatively small-size team, dedicated and co-located separately from main organization. People have broad assignments Team develops own procedures without constraints. Highly focused effort.</td>
<td>Necessary paperwork when it is critically important and eliminated all the rest of it. High level of personal interaction and effective communication among members of different function, cultivating sense of ownership.</td>
</tr>
<tr>
<td>Project Leadership/Management</td>
<td>Project leader is in charge-CEO of the effort, does own hiring, training, evaluation, manages all aspects, often creates an entire business unit.</td>
<td>There is no substitute for astute managerial skills. A successful skunkworks will demand a strong leader and highly motivated employees.</td>
</tr>
<tr>
<td>Prototype/Testing</td>
<td>Cross-functional, but early phases dominated by technical concerns, emphasis on technical performance on critical dimensions, Engineers work directly with customers and do own prototypes</td>
<td>True believers of the tremendous value of prototyping. The beauty of a prototype is that it can be evaluated and its use clarified before costly investments for large numbers are made.</td>
</tr>
<tr>
<td>Senior Management Revision</td>
<td>Limited formal review between project leader and top manager who sets aggregate resource limits, Team is largely on its own. Broad discretion on phases, practices, methods and approaches.</td>
<td>Senior managers willing to surrender oversight in exchange for a truly independent operation that can make everyone look good if technology innovations really catch on.</td>
</tr>
</tbody>
</table>
2.7.2 The typical skunkworks Leader

Staffing an innovative organization as a crucial process has been discussed extensively by Roberts and Fusfeld (1981). Authors underline five work roles that must be carried out by one or more individuals. Referring to Roberts & Fusfeld (1981, p.313) the roles are described as below:

**Idea Generating**: Analyzing or synthesizing information about markets, technologies, approaches, or procedures, from which is generated an idea for a new or improved product or service, a new technical approach or procedure, or a solution to a challenging technical problem." The analysis or synthesis may be implicit or explicit; the information may be formal or informal. Roberts & Fusfeld (1981, p.313).

**Entrepreneuring or Championing**: Recognizing, proposing, pushing, and demonstrating a new technical idea, approach, or procedure for formal management approval (Ibid.).

**Project Leading**: Planning and coordinating the diverse sets of activities and people involved in moving a demonstrated idea into practice (Ibid.).

**Gatekeeping**: Collecting and channeling information about important changes in the internal and external environments. Information gatekeeping can be focused on developments in the market, in manufacturing, or in the world of technology (Ibid.).

**Sponsoring or Coaching**: Guiding and developing less experienced personnel in their critical roles; behind-the-scenes support, protection, advocacy, and bootlegging of funds (Ibid.).

Bennis (1997, p.20) identifies the leader of a great group as “almost always a pragmatic dreamer. They are people who get things done, but they are people with immortal longings. Often, they are scientifically minded people with poetry in their souls….people with an original vision…. A dream is the engine that drives the group….a promise on the visionary’s part that the goal is attainable.”

In skunkworks, the team leader usually plays all the roles as explained in table 4. Leadership is one of the key elements of skunkworks (Gwynne, 1997; Rich, 1994). A strong leader, who will have the capacity to see the entire picture without concentrating a lot on details, and be a definitive choice producer with the capacity to assign both power and obligation (Gwynne, 1997 & Rich, 1994). In addition, the leader must be charming, and have a capacity effectively advise and give individuals vision, objectives and destinations. Both the leader and the team must think in long-run terms and have the capacity to look ahead (Single and Spurgeon, 1996). Besides, the leader should likewise have the capacity to make a unique domain of trust and “informal processes with close personal interaction” (Brown, 2004). The leader must pick right people as the way that the further result is completely relies on upon the group execution.

In such context, it is important to locate the right individuals with the right experience, network, competence and give them complete flexibility from organization. Team members...
should likewise be profoundly qualified what's more, experienced (Spurgeon 1996 & Brown 2004). It is additionally imperative to have right individuals with right aptitudes, learning and individual qualities (Single & Spurgeon, 1996). Gwynne (1997) likewise said that an exploration from American Express discovered 85% of the unsuccessful skunk works ventures had the same issue with including incorrectly individuals in the venture. Besides, communication between various individuals and leader likewise assumes essential part in effective skunkworks (Single & Spurgeon, 1996). Integrating their point of views in one table, the aim is to give a full picture of the roles covered by skunkworks team leader in a constantly dynamic environment and interactions.

Table 4. The typical skunkworks manager (Wheelwright & Clark, 1992; Roberts & Fusfeld, 1981)

<table>
<thead>
<tr>
<th>Roles</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Market Interpreter (Idea Generator)</td>
<td>Gathers firsthand information from customers, distributor visits, industry shows; has own marketing budget, market study team, direct contact and discussion with customers. Generates new ideas and test their feasibility</td>
</tr>
<tr>
<td>Multilingual Translator (Entrepreneuring/Championing)</td>
<td>Fluency in language of customers, engineers, marketers, stylist, translator between customer experience/requirements and engineering specifications. Gets resources. Sells new ideas to other in the organizations. Aggressive in “championing his/her cause”</td>
</tr>
<tr>
<td>Direct Engineering Manager (Project Leading)</td>
<td>Orchestra conductor, evangelist of conceptual integrity and coordinator of component development; direct eye-to-eye discussions with working-level engineers; shows up in drafting rooms, looks over engineer’s shoulders. Provides the team leadership and motivation. Provides necessary coordination among team members.</td>
</tr>
<tr>
<td>Program Manager “in motion” (Gatekeeping)</td>
<td>Out of the office, not too many meetings, not too much paperwork, face-to-face communication, and conflict resolution manager. Passes information on the others, find it easy to talk to colleagues. Keeps informed of related developments that occur outside the organization. Provides informal coordination among personnel</td>
</tr>
<tr>
<td>Concept infuser (Sponsoring/Coaching) Concept Custodian</td>
<td>Concept guardian confronts conflicts, not only reacts but implement own philosophy, ultimate decision maker, coordination of details and creation of harmony. Provides encouragement, guidance and acts as a sounding board for the project leader and others. Helps develop people’s talents. Provides legitimacy and organizational confidence in the project.</td>
</tr>
</tbody>
</table>
2.8 Intrapreneurship

Intrapreneurship is defined as ‘entrepreneurship inside organizations’, which helps large and mature organizations in their revitalization and growth (Pinchot, 1985; Pinchot & Pellman, 1999). Pinchot (1985, p.22) suggests ten Commandments for intrapreneurs (refer to appendix 2). However defining entrepreneurship as well as intrapreneurship is problematic and also well reflected in the European research conference (Fayolle, 2002). A common core is presented (referred at Brown, 2004, p.5) in intention to define entrepreneurship as:

“Entrepreneurship is a process of exploiting opportunities that exist in the environment or that are created through innovation in an attempt to create value. It often includes the creation and management of new business ventures by an individual or a team”.

According to the English heritage dictionary, an intrapreneur is defined as “a person within a large corporation who takes direct responsibility for turning an idea into a profitable finished product through assertive risk taking and innovation”. There is a need to emphasize that the concept of entrepreneurship is not only limited to small business development (Cummings, 1998; Pinchot, 1985). Vanhaverbeke and Kirschbaum (2002) concluded, based upon the study by Roberts and Berry (1985), that business as usual would only lead to incremental innovations, but that radical technological innovations in a strongly R&D driven business require strategic corporate entrepreneurship in order to succeed (Brown & Ulijn, 2004).

Large firms need entrepreneurship and/or intrapreneurship in order to be able to sustain innovation management. The concept of the skunk works might be seen as another way to stimulate intrapreneurship/entrepreneurship and out-of-the-box thinking in an existing firm (Brown, 2004). Intrapreneur involves innovations and new business ventures. Intrapreneur differs with entrepreneur by means of different environment of risk-taking, achievement orientation and proactiveness. If in the described characteristics, a single person is responsible outside an organization than its entrepreneurship, but if the above defined manner is within a company or workplace then it's called intrapreneurship. As Burgelman described it is important to identify the personal behaviors, as they are willing to take risks by enthusiastically promoting the development and implementation of an innovation through a resource acquisition process (Burgelman, 1983; Roure, 2001).

Intrapreneurs share the drive and zeal of entrepreneurs, but they don’t want to leave their organization, preferring to work within an established framework and with resources provided by the organization. (Kevin C. Desouza, 2011). Intrapreneurship is a challenging task for large established organization. The growth of the company with the time period leads towards decline in risk taking. Small-size companies are more risk taking than the large organizations. With the passage of time the organizations value and structure become more rigid and it’s not easy to take risk, moreover the focus of the organization become narrow and they stick to their core competence, mission and operation. New ideas are often looked by the company management as threats to the status quo rather than opportunities. Instead of accepting new ideas, the organization moves towards grows intolerant of risk, tending to promote only incremental innovation that align with the existing structures (Kevin C. Desouza, 2011). Wickham (2006) questioned to what extent
the intrapreneur may challenge the organizational boundaries, or is allowed to do so. Further he emphasizes that a balance should be kept between freedom of intrapreneur to act and the strategic path of the organization.

2.8.1 Internal corporate venturing process

Research on intrapreneurship, internal corporate venturing provides solid theoretical fundamentals on how innovative firms proactively seek for opportunities (Burgelman, 1984). However, in this never-ending journey of seeking for innovations, the actual processes of corporate entrepreneurship and strategic change, still remain less well understood due to the complex nature and lack of universal accepted definition (Gautam & Verma, 1997). Burgelman (1984: p. 154) conceptualizes the definition of corporate entrepreneurship as a process of “extending the firm’s domain of competence and corresponding opportunity set through internally generated new resource combinations”. Thus adopting the Schumpeterian perspective, corporate entrepreneurship can be seen as a process of efforts to “new resource combinations” aiming to extend competitive advantage of a firm through either through organizational renewal (Sathe, 1989) in terms of internal new venturing and strategic stress or either through creating completely new industries. Before Burgelman, other authors have elaborated the strategic management problems in intrapreneurship, which are most likely to be visible in the case of radical innovation efforts (Zaltman, Duncan & Holbek, 1973).

In addition, Ansoff and Brandenburg (1971) proposed that corporates need to create separate units within the corporate structure to facilitate new venture development. Burgelman bases his approach on these strategic problems and elaborates further. During development they become an integrated operating part of the corporation either as new freestanding divisions or as new departments in existing divisions. (Burgelman, 1983). Among his findings, firstly Burgelman (1983 c, p.241) strongly suggests that “the motor of corporate entrepreneurship resides in the autonomous strategic initiatives of individuals at the operational levels in the organization. They risk their reputations and, in some cases, their careers, because they are attracted by the perceived opportunity to become the general manager of an important new business in the corporation. This stream of autonomous strategic initiatives may be one of the most important resources for maintaining the corporate capability for renewal through internal development. It constitutes one major source of variation out of which the corporation can select new products and markets for incorporation into a new strategy”.

Such high-innovative efforts call for unorthodox management, thus creating managerial dilemmas and their existence is seriously threaten especially in the impetus stage. The transition from entrepreneurial projects to institutionalized ones is highly depended on organizational champions (Burgelman, 1983c; Quinn 1985). The role of the champions is widely acknowledged and other authors elaborate for multiple-roles of champions in the development projects (Quinn, 1985). Venkatamaran et al (1992) expand this concept and emphasize the importance of dynamic championing evolution by identifying “four kinds of championing roles as critical if new venture ideas are to survive the organization imperatives: championing ideas, championing opportunistic behavior, championing resources and championing incorporation.
Burgelman (1983c) implements a process view of internal new venture and he argues that when it comes to radical innovation, the strategic management process is blurred and they choose to go for experimentation and selection, rather than strategic planning. In his reasoning, an internal new venture is projected in the impetus stage as an embryonic initiative. He moves forward in his arguments, in arguing that the reaching point for impetus process is the transfer of the project to the operational part of the corporate, which is facilitating by championing activities rather than through formal screening process since every project is unique (Ibid.).

Identification of strategic forcing and strategic building activities and their interplay, shape the path toward formalization inside the corporate environment. In the strategic forcing phase is natural that the product champion becomes the venture manager and focuses all his effort in the commercialization of the new product, which determines the success of this phase. In order to gain the strategic corporate context, achieving successful strategic forcing is a requirement. Ironically, Burgelman points out that this success might lead to the new development project being viewed as problem, and the result is that intrapreneurship is treated as casualty and not of strategic importance. It is a must that successful strategic forcing should be combined with strategic building in the process of requiring continuous support by management. This stage is carried out by the venture manager and can happen in parallel with the first stage. It calls for business intelligence and mastering the articulation of a strategy to keep the top management attracted and enthusiastic. Thus the institutionalization process is inherently more complex and in order for this process to take place then new venturing must become integrated into the corporation's concept of strategy (Ibid.).

Burgelman (1983c, p.238) refers to the strategic context determination as “the political process through which middle-level managers attempt to convince top management that the current concept of strategy needs to be changed so as to accommodate successful new ventures. The key to understanding the activation of this process is that corporate management knows when the current strategy is no longer entirely adequate but does not know how it should be changed until, through the selection of autonomous strategic initiatives from below, it is apparent which new businesses can become part of the business portfolio”. The role of middle managers is finally evaluated as bridging entrepreneurial context with the corporate context, inherently non-continuous states (Ibid.).

2.8.2 A notion of organizational champion and learning

“Every new opinion, at its starting, is precisely in a minority of one.” - Thomas Carlyle, 19th century British essayist and historian.

“Whenever anything is being accomplished, it is being done, I have learned, by a monomaniac with a mission.” — Peter Drucker (1979), Adventures of a Bystander. This definition describes an innovation champion as a missionary leader with a vision and intrinsically passionate to protect, support, nurture and fight for assuring the resources necessary to flourish and prove new ideas.

Research in organizational change have shown that the obsession of many managers with planned change management often drive out champions. Some of them leave to start their own
company or to join a more entrepreneurial organization. Change champions cannot be managed. The organizational sponsor needs to exercise the servant-leadership style and protects champions from bureaucracy, guide them in the right strategic direction. Once the champions have found their track, then setting the right team and resources will lead them to the path of higher performance. In today’s world the need for change champions, their creativity and energy is greater than ever. Quinn (1985) observed that “every highly innovative enterprise in my research sample emulated small company practices by using groups that functioned in a skunkworks style.” Waterman (1994) in his book, Adhocracy refers to skunkworks as ad hoc groups and writes that “adhocracy is any organization form that challenges the bureaucracy in order to embrace the new. It cuts through organizational charts, departments, functions, job descriptions, hierarchy, and tradition like a hot knife through butter. . . ad hoc organizational forms are the most powerful tools we have for effecting change”. In his article, “Learning the Ropes: My Life as a Product Champion,” Don Frey (1991, p.4) vice president of product development at Ford reflects about his experience at Mustang development team and states that “I learned the never-to-be-forgotten importance of how a few believers with no initial sanction, no committee, no formal market research, and no funds could change a company’s fate.” In an organizational setting, change champions represent vital learning leaders.

“It is no longer sufficient to have one person learning for the organization, a Ford or a Sloan or a Watson. It’s just not possible any longer to ‘figure it out’ from the top, and have everyone else following the orders of the ‘grand strategist.’ The organizations that will truly excel in the future will be the organizations that will truly tap people’s commitment and capacity to learn at all levels in an organization” (Senge 1990 p.4 & 2006).

2.8.3 Ambidextrous organization

Today’s environment presents major challenges for companies which have to satisfy the demands of current customers in leveraging incremental innovation and in the same time focus on survival issues such as long-term commitment in advanced development efforts to secure the technology for future generations. Large mature organizations find difficulties in competing with new and small entrepreneurial firms. Applying a decoupling strategy where the innovative unit is detached from the rest of the organization has been an early approach.

Originally, Duncan (1976) proposed the concept of working with a dual organizational structure approach in order to become an “ambidextrous organization”. As Galbraith (1982, p. 14) stated “Inventions occurs best when initial efforts are separated from operating organization and its controls- because innovating and operating are fundamentally opposing logics”. March (1991) has the merits of proposing that exploitation and exploration are two fundamentally different learning activities in that exploitation is associated with activities such as “refinement, efficiency, selection, and implementation,” while exploration refers to notions such as “search, variation, experimentation, and discovery” (p. 102). Therefore, exploitation and exploration may require fundamentally different organizational structures, strategies, and contexts. In addition, research in technological innovation contributed to the field and studies conducted by Abernathy & Clark, (1985) and Tushman and Anderson, (1986) distinguish between exploration and exploitation. Incremental innovation is referred as exploiting existing product and business concepts, while
radical innovation is being referred to fundamental long-term changes resulting of exploratory activities. In this context, Tushman and O’Reilly (1996) define ambidexterity as the “ability to simultaneously pursue both incremental and discontinuous innovation” (p. 24).

Tushman and O’Reilly (1997, p. 14) contributed to the concept of ambidextrous organization, an approach stated to be capable of managing both short-term and long-term issues. Gwynne (1997), like Tushman and O’Reilly (1997, p. 171), argue that the mainstream or parent organization is more evolution-driven and the smaller unit is more revolutionary and opportunistic by nature and “management needs to protect, legitimize, and to keep the entrepreneurial unit physically, culturally, and geographically separated from the rest of the organization”. The decoupling strategy has been perfectly implemented in the skunkworks organization at Lockheed Martin’s. This role model working method has been used extensively in different industries by several companies (IBM, Sony, Apple etc.). Brown (2004, p. 132) claims that the creation of a skunk works is a signal of management dysfunction in that mainstream organization is incapable to cope with radical innovation, and a new separate unit must derive and handle the changes. The benefits gained from this approach have always been debatable whether arguing for the speed and focus benefits (Gwynne, 1997) or pointing out issues in creating two organizational cultures.

2.9 Institutionalizing innovation versus de-institutionalizing innovation

Different perspectives in the issue of institutionalizing innovation exist. A review of the issue in hand elaborated by several authors of the three schools of innovation based on the Schumpeterian perspectives will be given.

2.9.1 The capability school: an economic perspective

From this perspective, innovation is seen as an institutionalized capability that characterizes the technological change. The concept of routine is introduced in order to crystallize the role of the institutionalized capability as the ‘genes’ of innovation (Nelson & Winter 1982, p.134). Routines are ‘most of what is regular and predictable about business behavior’ (1982, p.15). This point of view that innovation can be subject of imitating and a repeatable ‘thing’ underlines that people are a ‘thing’ too in this process (1982, p.117-124).

By this definition, there are three classes of routines relevant to innovation: (1) the operating routine, (2) the investment routine, (3) the search routine (1982, p.17). The search routine is where innovation occurs, thus is the most important routine. Among other authors, Teece emphasized the concept of ‘dynamic capability’ defined as the ‘firm’s ability to integrate, build, and reconfigure internal and external competences’ (Teece, Pisano & Shuen 1997: p.516; Teece 2007). Jelinek (1979) suggests two mechanisms that describe the essence of institutionalizing innovation. First, systems/routines capture knowledge: ‘It is through administrative systems that planning and policy are made possible, because the systems capture knowledge about the task’ (1979, p.139). Second, systems/routines generate innovation creating a shared pattern of thought regarding innovation” (1979, p.141). Thus, ‘innovation can be institutionalized’ (1979, p.157). In such context, she assumes that the purpose of institutionalizing innovation relies in the ability to produce a repeatable economic routine out of the ad hoc nature of innovation itself.
2.9.2 The corporate entrepreneurial school: a social perspective

On the other hand, this school of innovation claims to see innovation as a pattern of grassroots impetuses. Peters and Waterman’s (1982) were the first to found that ‘autonomy and entrepreneurship’ were crucial to innovation. In such context, avoiding routines and even breaking them in skunk works provided a source of enjoyment and autonomy for corporate entrepreneurs. In the strategic context, authors found that excellent innovative companies nurtured the ‘championship process’ rather than in ‘formal strategic planning’ (1982, p.204).

As discussed above, Burgelman suggested that ‘the institutionalized approach [to innovation] might be inadequate’ (1983: p.242) because ‘innovations don’t fit neatly into established categories’ (Burgelman & Sayles 1986, p.139). Among classic authors, Quinn (1985) conducted a research study on how American, Japanese, and European companies carried out innovation and among his findings he found that innovation operates in ‘skunkworks’ (1985, p.78). Although ‘innovation tends to be individually oriented’ (1985, p.83), it involves ‘a high level of group identity and loyalty’ (1985: p.78). Introducing a new product can be compared to ‘raising a healthy child – it needs a mother (champion) who loves it [and] a father (authority figure with resources) to support it’ (1985, p.78). Again the role of the champions is strongly discussed by this author too.

Recently, Hamel’s (2000b) research at IBM found out that corporate entrepreneurs carry out innovation ‘broke long-standing IBM rules and overstepped the boundaries of their own authority’ (2000b, p.11) in carrying out innovation. This school claims to see innovation not simply as an economic and quantifiable thing rather than as a process of human relationship and creativity that cannot be measurable. The corporate entrepreneurial school argues that routines ruin innovation simply because by favoring familiar routines companies fall in the trap and do not distinguish architectural innovation (Henderson & Clark 1990; Ahuja & Lampert 2001).

2.9.3 The culture school: cultural perspective on innovation

During 1990s a new school of innovation emerged and acknowledged the importance of institutionalizing innovation but it takes a different starting point. It claims that culture is important and that it takes a craftsman to envision the innovation. Institutionalizing innovation in this sense, means to go beyond the path, the process, and beyond the shortsighted of entrepreneurs for immediate success (Kets de Vries 1985). In such context, citing Arthur (2001: p.7, italics original) ‘Advanced technology… resides, in essence, in deep craft … a shared culture of beliefs, a shared culture of practices’ (2001: p.8). True technical innovation ‘cannot be created by digging information out of books or journal articles’ (2001, p.11).

Summary

In the new work environment of the 21st century, where there is an overwhelming emphasis on teamwork and the right environment for groups to thrive, the skunkworks is being revisited, however in somewhat distinctive context. Companies are changing structures in order to gain different development opportunities from the present business.
These structures are an advancement of the skunkworks from the past; they make enough space from the main business to take it into the consideration the development of separate specific project and yet keeping up in mind the main objectives of the parent company.

To sum up, skunkworks was specifically created and designated to accelerate product innovation. Skunkworks structure makes the smaller groups successful where the parent company or the large groups didn’t succeed. It helps company to build strong creative networks in a fashioned manner. Their unique mission and goals for existing is to bring the idea into development phase and further to the market.

### 2.10 Theoretical framework - skunkworks as an incubator medium model

According to Florén and Frishammar (2012), most of the failures in developing new products is attributed to front end, thus is critical for the success of the project to manage it. Authors refer to front end as “the stage during which ideas are created and further developed into product concepts and definitions, ending with a ‘go’ or ‘no go’ decision about whether to continue into formal new product development or not” (2012, p.20). This process can often be blurred, complex, may involve tacit knowledge, and source of conflicts within organization.

Under radical development efforts, as skunkworks underlines, the management of front end is critical for the future of the company, and mistakes in this phase can led to bankruptcy. Companies do not suffer from lack of ideas, but from lack of understanding the outcome of front end first and managerial implications when developing incremental or radical innovation (Florén & Frishammar, 2012). Authors describe the framework as: Idea/Concept development, as the core of the framework, consists of two interrelated activities as Idea/Concept Screening and Idea/Concept Refinement and complemented by Idea/Concept alignment and Idea/Concept legitimization. The two interrelated activities imply that during front end, employee need to iterate between both in an integrated manner and more informally. Idea/Concept alignment consists of the need to align ideas into the business portfolio internally and to the market externally, while Idea/Concept legitimization refers to the idea being perceived as relevant by stakeholders. These phases are not of distinct nature, which imply that not always a high degree of formalization will occur. (Florén & Frishammar, 2012). Authors provide a comprehensive framework of the front end of new product development as below:

![Figure 6. Framework for managing front-end innovation (Florén & Frishammar, 2012, p.22)](image-url)
Firms need to manage the particular nature of front end in radical development efforts in order to achieve a successful outcome. In a radical front-end development, the desirable outcome is new to the company and market, thus more iteration between activities are needed. The front end of radical innovation “seems to be an inherently messy process.” The initiative is more individual than organizational and the front end tends to be less formal. The screening process tends to be more flexible and calls for engagement in cross-functional collaborative learning process and legitimization can occur with the help of leadership and enthusiastic product champions (Ibid).

In numerous organizations the new product development is regularly analytic and diagnostic with formal arrangements and strategies verging on bureaucratic. But bureaucratic procedures are inconsistent with an inventive society and the way of advancement which is tumultuous, nonlinear and fortunate. In reality the development of breakthrough is nonlinear in nature, advancing in fits and begins. So instead of using a stage gate, regulated procedure through which new products ideas must pass, "overseeing" imaginative movement as an entrepreneurial procedure, the thought is to make an inward situation that cultivates development and an entrepreneurial soul. Once this is achieved, the next related step is involvement in practices of back end innovation (Ibid).

Back end of innovation refers to the execution of innovation that leads to commercialization of ideas. In such context, skunkworks is the most successful approach to the back end innovation. While practicing back end we look at the context in the sense if idea fits to the business strategy or calls for a new venture. Secondly, learning curve is important and in exploring opportunities new skills are required. Thirdly, a long-term perspective and resources needed to allocate are considered. Analyzing skunkworks Rule according to Rich (1994): the skunkworks manager must be delegated practically complete control of their program in all aspects. They should report to a division president or higher. Also the number of people having any connection with the project must be restricted in an almost vicious manner. Use a small number of good people (Rich, 1994). This rule still makes sense in having people crafting the concepts like in software development teams. The practice in this context becomes a useful tool for focused engagement. If the company has already an established skunkworks division than the hand off of the idea will be straightforward from idea generator to skunkworks manager. Idea contributor will be a member of the skunkworks team and will work under sponsorship of skunkworks manager. Otherwise, if no skunkworks exists then the sponsor should assign the idea generator as the manager of skunkworks or to start design that role in order to create room for the idea to emerge and develop? There is no model that can be applied to all product development projects. Projects as such are supposed to be dynamic and flexible and cannot be framed too much, according to a "static" model.

Forwarding to today’s context, taking care of the ideas seems of great relevance. Adopting Florén and Frishammar (2012) perspective in managing the outcome of the front end, authors claim skunkworks as a continuum in terms of front end and back end, rather than being engaged in two separated processes. Skunkworks obtains the best of both processes and is the medium necessary to achieve great results. Productivity is achieved through good people in a continuous iterative process. Idea generation which happens during inspiration and even before frond end will
serve as input for the idea development and invention phase inside the skunky incubator. Skunky incubator is the medium in fostering innovation through experimentation, close interaction, scrutinized technical excellence in the name of rapid product development, early integration of customer feedback through iterative prototyping and testing loops.

The model is a conceptual version of the views of the authors, showing the dynamic and interacting activities occurring in an interrelated setting. The incubator model is a dynamic model and perceive the idea of protection from outsiders, keeping the ‘baby skunkwork’ healthy and nurturing it in breaking new technology and sustaining innovation. As Bennis and Biederman (1997) strongly agree in that successful collaboration is the science of possible. Encouraging people to improvise, working imaginatively in unconventional ways, calls for deep generalists, people who are more open toward unorthodox approaches than narrow specialists (Rich, 1994). Skunkworks is more than just an advanced product development team. The team has the full authority over their dealing and negotiation at their own with the clients. Thus execution of innovation in the back end is more likely to succeed in the skunky way of innovating.

Figure 7. Skunkworks as an incubator medium in fostering innovation (Author's work)
Chapter 3. Methodological framework

In this chapter, the methodological framework consisting of chosen research perspective, research approach and method will be explained. The reasons behind every choice are elaborated in relation to improve reliability and validity of this research. This chapter provides the conceptual path and practical actions authors undertook in order to carry out the research.

3.1 Research perspectives

“In the social sciences, we are but rarely in a position to speak of clear-cut causes and effects. Instead we mostly have interaction between the elements of the social system”. Schumpeter (1946, p. 410)

There are two main research perspectives to be considered when conducting a research, positivism and hermeneutics. According to Bryman and Bell (2011, p. 15), positivism is “an epistemological position that advocates the application of the methods of the natural sciences to the study of social reality”. Positivism aims to draw certain conclusion upon logical reasoning of the empirical information and observation. Therefore, the knowledge should derive from logically testable observations. Regarding the hermeneutics perspective, the study of the social world “requires a different logic of research procedure, one that reflects the distinctiveness of humans against the natural order” (Bryman & Bell 2011, p. 16). According to Bryman and Bell (2011, p. 563) the main idea behind hermeneutics is that the researcher “must seek to bring out the meanings of a text from the perspective of its author”. Hermeneutics involve interpretation of data and a more holistic view than the positivist perspective, which aims to study an object in a progressive manner. Gummesson (2000) claims that there is no reason for antagonism between both perspectives and that positivism and hermeneutics should not be seen as contradictory but rather than complementary to each other. An interpretivist point of view will be conducted in this research with the aim to gather and process the data to attain a holistic view of the issue in hand.

3.2 Research approach

Research approach entails the relationship between theory and actual research. Deductive approach represents the most common view of the relationship between theory and research. The researcher develops hypotheses based on what theoretical considerations are known about a particular domain. Then these hypotheses are tested through empirical scrutiny. This implies that the social researcher must specify how data can be gathered in order to relate it to the hypotheses. Data collection is guided by theories and the hypotheses deduced from it (Bryman & Bell, 2011). In the inductive approach the researcher starts the research process through observation of reality and later the researcher infers the implications of his or her findings for theory contribution.

In order to establish the conditions in which a theory will be carried out, the researcher might find the need to collect further data. This involves an iterative strategy of weaving back and forth between data and theory (Bryman & Bell, 2011).

There is also a third research approach, the abductive approach which is carried out through this research project. Abductive approach can be seen as a combination between
deductive and inductive that refers to “the process of switching between the theoretical and empirical framework”. Specific case studies from different industries, military, telecommunication, and computer industry will be revisited in depth in order to draw valuable learning points out of each following an inductive way. Then these learning points will be tested against existing literature review and theories or other empirical data following a deductive approach. Therefore, by testing the learning points/findings on several cases, it can be developed and more generalized (Patel & Davidson, 2011).

3.3 Research design/method

According to Bryman and Bell 2011, there are two types of research strategies, Quantitative and Qualitative strategy. The research strategy means a general orientation to the conduct of business research. Quantitative research can be done by emphasizing quantification in the collection and analysis of data. In this type of research deductive approach is applied for the relationship between theory and research. On the other hand qualitative research usually focused more on words than quantification in the collection and analysis of the data. In qualitative research strategy inductive approach is used for the relationship between theory and research. In this research, the qualitative research strategy will be employed and this research is based on the previous case studies and also on the series of interviews for the qualitative data.

3.4 Case study research

This study is based on the case study research approach. In general, there exists no accepted definition of the case study method. Perhaps, Yin is the most renowned and cited author among scholars. In his view (Yin, 1994, p.13), the case study research should be interpreted as: “An empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. In relation to Yin’s (1994) view, Merriam (1988) argues about the significance of case study methodology that provides in depth understanding of the phenomenon embedded in social context.

Corresponding to Yin’s (1994) view, Merriam’s (1994) view of the case study as characterized as:

1. Heuristic in that leads to gain insights of the phenomenon
2. Particularistic in relation to particular situation or phenomenon
3. Descriptive in relation to detailed and enriched description of phenomenon
4. Inductive in relation to generation of concepts from researcher

Therefore, is of importance to mention that both authors embrace the inductive and particularistic character of case study in providing insights. Case study research is advantageous when it comes to offering the opportunity for a holistic view of the process:

“The detailed observations entailed in the case study method enable us to study many different aspects, examine them in relation to each other, view the process within its total environment …Consequently, case study research provides us with a greater opportunity than other available methods to obtain a holistic view of a specific research project” (Valdelin, 1974, p.47, cited in Gummesson, 2000)
Yin distinguishes between case studies as exploratory, descriptive and explanatory (Yin, 1994, p.4). Gummesson (2000, p.85) refers to exploratory use of the case study as “a pilot study that can be used as a basis for formulating more precise questions or testable hypotheses”. The descriptive case study attempts to describe a phenomenon and is often regarded in academia as less prestigious “as a matter of mere observation and reporting or reading other’s people reports and summarizing-at best, systematizing”. On the other hand, Sen (1980, p.353-369) in his book ‘Description as Choice’ states that “there is no description without analysis and interpretation”, clearly arguing in opposition to the above contrasted attitude toward descriptive case study.

Referring to Gummesson (2000, p.85), explanatory research is given the same status by mainstream business schools who looks with skepticism. Kjellen and Soderman refers to case study research by means of generating theory or initiating change while Gummesson (2000) argues for the importance of not seeing the use of case studies in isolation rather than in social context. Adopting Gummesson’s point of view, exploratory studies as well as descriptions can be theory generating, descriptions may be explanatory. In management research, the case study research has become increasingly widespread and the dominant research approach in studying technological development processes. Other factors that contribute to the use of case study methodology are the aim to cover contextual conditions (Yin, 1994, p.13) and its advantage in use for historical studies covering development over time (Yin, 1994, p.116).

3.5 Data collection and analysis

Data are collected from the selected cases and conducted carefully with sources from books, articles. Ericsson AXE case study is based on the book “A switch in time-AXE-creating the foundation for the information age” from John Meurling and Richard Jeans (1995), engineers at Ericsson and members of the development team. Meurling and Jeans were both engineers who worked at Ericsson for forty years, and their greatest achievement was the development of AXE. They became product champion for AXE in the commercialization phase. Macintosh-Apple case study is based on “Revolution in the Valley” by Andy Hertzfeld (2004), engineer at Macintosh team and “Apple Confidential 2.0” by Owen W. Linzmayer. The development of J22, the first plane of Swedish Air Force is based on the book “FlygHistorisk Revy J22” by Bo Widfeldt (1989). The case study of complete vehicle testing project at Volvo Trucks is based on the interview conducted with the project manager and the measurement manager.

3.5.1 Interviewing in qualitative research

In qualitative research interviewing is the most adopted method used for data collection. There are two main types of interviews in qualitative research; unstructured interview and semi structured interview. The difference between the quantitative and qualitative research is that the interview in quantitative research are more structured than the qualitative research because in qualitative research the emphasis is on greater generality in the formulation of initial research ideas and on interviewees’ own perspectives. (Bryman and Bell 2011, p. 466). The qualitative interviews are more flexible and give you more insight information about the research. The questions are open-ended questions and interviews can ask new questions that follow up interviewee’s replies. In this study qualitative interview approach is used. The interviews conducted with the industry personals are semi-structured interview with open-ended questions to
get the more insight information related to the research. The interview guide consists of open ended questions which were made before each interview and later during the interview further questions were asked from the answers of the interviewee. All the interviews were recorded to correct the natural limitations of memory and do more thorough examination of what the interviewee explained about the research topic. (Bryman & Bell, 2011, p. 481).

3.5.2 Historical analysis

The qualitative research gathered a large amount of unstructured data by interviewing and it’s not easy to analyze straightforward like quantitative research analyses. In this research historical analysis is used. Historical analysis helps us to put the issue under study in its context and set of circumstances, thus providing a pattern. In an organizational setting, history helps us to foresee changes, thus preparing to benefit from new situation. In such strategic thinking, Smith and Steadman (1981) cited in Gummesson (2000), enhance the concept of history and its ability to cope with change beyond the actual experiences of the company. As a stimulus to action rather than trying to derive some “historical truth”, the purpose of historical analysis to organizational issues can be seen as:

“To contribute to an awakening from organization slumber; to raise self-confidence at a time when company morale is low; to create new knowledge by studying earlier processes of intellectual development; to develop new, special types of competence; to break a vicious circle; to seek to understand the roots of growth” (Gummesson, 2000, p. 98-99).

3.5.3 A narrative knowing mode

Czarniawska (1999) states that the notion of narrative knowing was originally conceived by Bruner (1986) to contrast the traditional logic-scientific mode of knowing. Czarniawska (1999) argues that these two modes of knowing can coexist in organization theory as they do in organization practice. In addition, the author claims that the task is to tell practitioners a good story in which the point is its theory simply because ‘a story without a point is meaningless and not informed by theoretical insights’. Czarniawska (1999, p. 15). The narrative mode of knowing contributes to the extent of ‘sense-making’ tools and comprising meaningful sequencing of ideas, actions or events in organizational life that are bound by a ‘plot’ (Czarniawska, 1998; Czarniawska, 1999). As Bruner claims, narratives are ‘especially viable instruments for social negotiation’. In such context, organizational stories capture organizational life in a way that no gathering of facts could. “Narrative knowing mode represents an attractive option to bridge the gap between theory and practice (Czarniawska, 1999, p. 16) and is able “to produce generalizations and deep insights without claiming universal status” (Czarniawska, 1999, p. 23).

3.6 Selection of the cases and limitations

In this research, four case studies will be studied in depth from a historical perspective in order to gain insights of the phenomena and derives learning points to cope with change. Thus the limitations posing one case study in one industry are overcome. The case studies were chosen from different industries in order to increase the validity of the study. The cases form the setting of the study and the reason why these cases are seen as successful is that in retrospective, these projects saved the companies in a situation of ‘do or die’. Thus, the cases played a strategic role
in the renewal process of the represented companies. Without J22 project, SAAB would have not been so successful afterwards because the people from J22 went into SAAB after that and Sweden gradually became innovative in airlines. Since skunkworks projects are secret for the outsiders than is quite impossible to gain access and gather data while the process is going on. Therefore, the data gathered will always be of historical information. In order to overcome these limitations, an interview with Heather Kelso at Lockheed Martin Co. was attempted. Despite her willingness to collaborate, the interview was not conducted due to business imperatives as she explains to us via official e-mails. In order to investigate what is going on today in academia and business world with the concept of skunkworks, an interview via skype was conducted with Peter A. Gloor, Research Scientist at the Center for Collective Intelligence at MIT’s Sloan School of Management where he leads a project exploring Collaborative Innovation Networks (COIN). As an entrepreneur Gloor is the Founder and Chief Creative Officer of software company galaxyadvisors. In addition Peter is an Honorary Professor at University of Cologne, a lecturer at Aalto University in Helsinki, and Distinguished Visiting Professor at P. Universidad Católica de Chile.

The people who developed AXE unfortunately passed away and could not be interviewed. A visit at Charm fair Job at Chalmers Institute of Technology brought good luck. From this fair visit, contacts were established with Bengt Hedbjörk, former engineer at Ericsson Mobile Division and member of skunkworks team who developed the first user friendly mobile phones. Bengt Hedbjörk is working now as Business Area Manager – Electronics & SW at Conmore Ingenjörsbyrå AB in Mölndal. Later, another interview was conducted with Anders Wikberg. Cited from the interview and his profile in LinkedIn, he was the “Project leader in the Development of ODW 30 01, outdoor digital unit at Ericsson. First outdoor product for digital design unit, mainly consist of an encapsulated DUW 30 with power and control card. The project has been run with very strong TTM requirements from product management; we succeeded with early deliveries to secure the contract with Softbank for the first order” (refer to appendix). Anders has managed several successful projects for Ericsson, Purcell Systems and currently he is working as Manager Site Design at Coromatic AB in Stockholm. From the interview conducted with Anders, we were triggered to know more about the entering criteria in these teams in US. Thus we contacted again Peter Gloor from MIT about this issue. He answered that such groups constantly test new applicants to their community on cognitive thinking style. These can be implicit or explicit such as sticking to Wikipedia rules or open source rules.

At Volvo Group, an interview was conducted with Henrik Svensson and Jessica Erlandsson as the Project Manager for complete vehicle testing project. As Jessica explains during interview but also in her profile in LinkedIn, she was the “team leader for a network of persons developing a new way of testing mechatronics in complete vehicles from a driver perspective. The team included drivers, mechanics, test engineers and measurement engineers and the diversity created fantastic dynamics which made us reach over our targets in a short time. The team was awarded the Volvo 3P Technical Recognition Award in March 2012 and also awarded Volvo Group Internal Quality Award in 2014”. With their request and due to secrecy reasons, this interview transcription will not be public. Its value will be used by authors in interest of the topic.
3.7 Summary

Briefly, a hermeneutic interpretivist point of view will be carried out throughout the research. Abductive approach, as the chosen research approach, will be conducted. Following an inductive thinking, four case studies from different industries will be revisited in detail with the aim to gain insights and draw learning points. Then these learning points will be tested against existing literature review and theories or other empirical data following a deductive approach. The storytelling of each case study will follow a narrative knowing mode, with the aim to capture the organizational life in a way that no gathering of fact can do. Historical analysis of these case studies is carried out as a tool that help us to understand the context of each case study, in order to foresee a pattern of change that benefits the organizational setting in change.
In this chapter, empirical data from four case studies are provided and listed as development of Ericsson AXE in telecommunication industry, Macintosh-Apple in computer industry, J22-Swedish Air Force in military industry and Complete Vehicle Testing Project at Volvo Trucks. In this phase, the aim was to tell the story chronologically as sourced from data collection and explained at methodology chapter above. The development of each project is narrated from how the project started until the commercialization phase.

4.1 AXE project - Ericsson

The story of AXE dates back in the 1960s. By the mid 60’s, a number of modest computer-controlled switching systems were build. They were costly, inconsistent and difficult to handle, modifying software, for instance, was troublesome and tedious. Advancement proceeded and before the end of the 60’s, several systems were effectively advertised. Bell Labs and AT&T of the US were at cutting edge. Ericsson had put in its first computer-controlled exchange, of a sort called AKE. In the 70’s, one idea- survival-progressively ruled the reasoning of each business organization, each government and numerous a person. On the other hand, 60s had been a decade of development in telecommunications. The impetus for change originated from the exceptionally quick development in the quantity of subscribers and the ensuing increment in the size of exchange.

In an international context, the most significant competitor was the large US Corporation ITT and Siemens of Germany as second competitor. In the Swedish telecom market Televerket was creating A210 for large urban city exchange, while Ericsson was creating AKE12, focusing on rural systems. AKE12 was fruitful and by 1966 Ericsson chose to start up a second program-AKE13 -to assemble a bigger exchange with all the more intense, multi-processor control. In 1968, the Australian Post office (as it was then) issued a global invitation to tender for a substantial transit exchange, Pitt Street, in Sydney. This was precisely the kind of use for which AKE13 was planned and the open door Ericsson was sitting tight for. But, the Australian Post office declared to had picked Metaconta of ITT (International Telephone & Telegraph) rather than AKE13. This was a huge disappointment for Ericsson. Another element that added to the development stimulus was The Mexican Telephone Company. In Mexico City, the system was developing in more quantities of subscribers per square mile and required vast exchange to handle traffic. It was in this circumstance where confinements of existing crossbar system started to show up. The group switch was not large enough and its access range was restricted. Ericsson added to a totally new group switch, called ANC11 that would be consolidated as a local switch.

Engineers at Ericsson felt that in competitive circumstances their switches were moderate and would soon be passed. It was time when ideas started to develop, ideas for another exchanging system, in view of new ideas. Ericsson was not the only one in this experience. Televerket was looking into its experience and thinking about another system as well. Then again,
development labor prerequisites were expanding and were getting to be evident that few several man years were important to attempt an undertaking. Sweden was a small country with limited number of engineers, so it was natural for Televerket and Ericsson to team up together. Amid 1968/69 Bjorn Lundvall President of LM Ericsson and Bertil Bjurel, General Director of Televerket meet to talk about collaboration. They introduced their ideas to Marcus Wallenberg, the Chairman of LM Ericsson whom conceded to a joint development company. Authoritatively in May 1970 Ellemtel was built up as a 50/50 joint venture between Ericsson and Televerket. In Ericsson, Bjorn Lundvall the architect behind Ellemtel and Fred Sundqvist, the chief negotiator will dependably be associated with their vision and ability to stake their reputations in collaboration with a government organization.

Initially, Ellemtel was not asked to start product development, rather to create a proposal-a paper portrayal of another exchanging system and the way in which Ellemtel engineers proposed to handle the outline of it. The assignment was given to the marketing department of the switching division. A small group headed by Inge Johansson was created to carry out the job. The vast majority of the personnel at marketing were engineers, obviously not specialized expert but rather individuals with a careful learning of innovation. A draft with finished and affirmed details was accessible in 1971 and Ellemtel react with their draft proposition, to which Inge’s team reacted with remarks. In this way, exchange, verbal confrontations arrived, activating feedback. Regardless of this, AXE idea advanced quickly. A progression of principals began to develop. Ellemtel was confronting two distinct specifications, one of Televerket reflecting the idea of the Swedish Telephone System and that of Ericsson reflecting an international perspective. Both of them applied an extraordinary impact on the advancement of the new system.

The first principle was that of a modular approach. This principle reflected the global approach of Ericsson specification. Developing a system in which functional parts were composed in block that could be effectively included or left out. Televerket was pushing a considerable effort on requirements for operation and administration, as characterizing managerial elements of phone exchange. The second principle of ease handling, reflected the idea that the system must be easy to design in both hardware and software, easy to manufacture and test, easy to document, easy to teach and consequently would be easy to sell. At Ericsson, the original idea of AXE was conceived as a local exchange. Rather than staying loyal to this idea, defining a product with much wider applications in tandem and transit exchanges and not only local, was of great open mindedness to the future. So the idea of the local exchange system was conceiving, made of two autonomous parts, the subscriber switch subsystem and the group switch subsystem. Designing a digital switch began to look feasible since the costs of electronic circuits was decreasing.

By that time, ITT was marketing Metaconta, Japanese were marketing D10, Philips had its contract for PRX and in US, Western Electric was supplying Bell Systems with the No1 ESS system. It is worth to say that a lot of individuals were concentrating on digital switching. In France, Alcatel presented E10 system, an advanced system intended for small applications. In Ericsson, studying of computerized switching was occurring in Stockholm additionally in Ericsson Australia who planned a digital group switch. An official decision at Ericsson was dependent upon Hans Sund, the head of X division. Hans and his kin were persuaded however he
needed to persuade not one but rather two groups with various point of views. The decision was taken around February 1972.

All assets were committed to the development of AXE under the leadership of Bengt-Gunnar Magnusson. To direct the work of the division, a guiding board of trustees PK-TS was created with individuals from two parents including Bengt-Gunnar Magnusson as well. This was termed a product committee. Likewise there were a few technology boards. At a higher level, the coordinating committee was located that settled on issues raised by product and technology committees. PK-TS specified what was required by parents however they didn't interfere to tell to Ellemtel how to design the product. Bengt-Gunnar's area of expertise was allowed to sit unbothered to develop the system. The project had gone into the development stage and a greatly time of extreme work had come. At Ellemtel pressing work must be done on the improvement of the system, design of a new construction practice, a software language, programming tools etc. Those were energizing times as step by step planning to go to the market as John Merling recalls.

Televerket, Ericsson and Ellemtel had some of the best engineers, however so had the competitors. In the first place there were individuals who said we were failing to understand the situation: the NIH (Not Invented Here) syndrome. The project was encompassed by certain amount of secrecy. It was a major critical development to run. The same sense of urgency is found in Bengt Hedbjörk description of the development of mobile phones: “We started from scratch completely and we were 23-24 people that were supposed to do the whole phone including the software, mechanics and everything. Most of them were straight from school as well as I was. I just went from Technical Institute of Lund to Ericsson. They had NMT specifications and we had just to make a phone. So that department was more or less skunkworks. We didn't have any good specifications of what we were doing. So we made the specifications while making the development. The only goal was to make a phone....we said we can do it differently. Why don't we do like this? ....A lot of freedom and far away from Ericsson in Stockholm, in Kista. I don't think they liked us. They thought we were costing money and were not producing anything”.

There were numerous unusual individuals at Ellemtel and a great part of the time was spent in growing additional curricular exercises in games and recreations. Bengt-Gunnar was a winner and everybody realized that he would do anything to win. Goran Hemdahl was one of them. A significant number of his ideas would come to him as he paced the passages of the Ellemtel office. Everyone knew this, and Goran was allowed to sit unbothered to pace. Goran did a considerable contribution of the imperative foundation for AXE. He conceived revolutionary software architecture, introduced the concept of modular software and was behind the high-level programming language. Goran was additionally known for his unconventional teaching techniques, including cartoon figures, sensational happenings with overhead slides and a water gun. In 1974/75 he added established jazz to his collection when working with John Merling on system specifications for advertising.

For a long time, the entryways around the AXE project were virtually closed. At Ericsson, just a couple of people were in contact with the work going ahead at Ellemtel. To the world, Ericsson was selling systems in the mid 70’s, the AKE system and the AR family. Ericsson began to formulate a marketing strategy with two main thrusts. First to inform all major customers of the
work on AXE but to position AXE predominantly as a future product designed to team up with ARE and AKE and provide a complete product range. Meanwhile, an early order for one AXE installation in each of major markets as soon as possible, a sort of field trial and evaluation exchange was approached. This approach was called the canine concept of marketing control to mark the territory. AXE grew up in the fierce glare of the public tender spotlight.

Until the end of 1973, AXE was kept secret. Ericsson was doing its best amid 1974 and 1975 to put into practice canine idea. Ericsson was careful in presentations of AXE and exposing it. Still they conducted few real demonstrations of AXE. Veiko Tahti, the director of Turku Telephone Company in Helsinki was the first one to place an order and ever installed the first digital AXE exchange in the world. Veiko was a tough customer and very knowledgeable, that is why Ericsson approached him first and persuade him to install AXE. Soon, this methodology was followed in Mexico and Australia. On the whole, 1974 saw 20 presentations of AXE as a product that may be accessible soon. It is of relevance to specify that there were times of oil crisis and Ericsson was confronting troublesome decisions to begin cutting its workforce-starting in its Swedish manufacturing plants. Nevertheless, some advancement was made. AXE was starting to discussed and to wind up known around the PTTs and the competitors. Ericsson had chosen 1976 as the year to launch AXE and go public, because 1976 was also the company’s centenary year.

In December 1977, the Saudi contract, for the extension of the Saudi Arabia telephone exchange as the largest telecommunication project ever awarded, gave the chance to take AXE to another level of development-industrialization. This stage postures challenges for creation of AXE in volume. Till that time, production was done in moderately little scale which left space for act of spontaneity. Ericsson was on the move from assembling electromechanical systems to electronic ones. This implied a serious challenge in switch production techniques. A committee called INDAX (INDustrialization of AX) was set up under the administration of Stig Larsson to review, plan and execute full stream creation of electronic exchanging. INDAX itself was comprised of approximately 60 ventures. When they were actualized, they brought about a genuinely smooth and proficient production process. Transferring AXE from system design group at Ellemtel to production, engineering and marketing at Ericsson was a challenging task and as such was carefully planned. Ericsson undertook the design of some new subsystems and look after market adaptations of AXE. Beside the important technical documentation, operational and administrative, there were documentation of training of Ericsson employee and customers. Documentation and people formed the core of the in-house engineering force. A group of Ericsson engineers working on AXE at Ellemtel gradually transferred back to engineering departments at Ericsson, bringing their experience with them.

4.2 Macintosh project-Apple

Macintosh began as a skunkwork project to develop a consumer-oriented personal computer, totally inexpensive and very user friendly, to be designed from a human perspective, very rare for that time and incomprehensible. It was the vision of one man, Jeff Raskin, the true father of Macintosh. Raskin joined Apple on January, 3, 1978 as employee no 31 in the role of manager of the publications department. Raskin shared his idea with Markkula (one of the
founders and board members) as in the spring of 1979 he was trying to recruit Raskin to join Annie project to produce a 500$ game machine and Raksin showed no interest in this project. Markkula was intrigued by Raskin’s idea and asked him to develop it and to check the feasibility of putting it to practice. He named his favorite apple McIntosh, and spelling it Macintosh, avoiding the trend of using female code names which in his opinion was sexist. Raskin envisioned with a computer that people would be so attached that they would bring it everywhere, so portability was one of the key functions. In his wish list, he included weight under 20 pounds, internal battery life up to 2 hours, a 8 bit microprocessor with 64K of RAM, one mode, a serial port, real time clock, 200K floppy disk drive and 4-5 inch screen all built in one case without cables, with an initial end-use price tag of 500 $.

Raskin needed help to develop a prototype and was looking for talented hardware designer. Bill Atkinson, one of the members of Lisa team and his former UC San Diego student, introduced him with Burrel Carver Smith, an outstanding repairman at the maintenance department. During introduction, Atkinson referred to Smith as “the man who is going to design your Macintosh” to which Raskin replied, “We will see about that”. Smith managed to build the first prototype using a Motorola 6809E microprocessor, a television monitor and the guts of an Apple II, thus impressing Raskin who made him the second member of the Mac team.

At that time Jobs was working on ‘Lisa’ a business-oriented project. In the beginning he tried to kill the Macintosh project, saying that it will never work, never sell, it is the dumbest thing in the world and criticizing it so hard even in the board meeting for almost two years. By 1980 the Macintosh team was a four person research effort (Jef Raskin, Brian Howard, Burrell Smith and Bud Tribble) the project was considered not important and several times the board wanted to terminate it but Jeff managed to take three extra months to show to Mike Scott and Mike Markkula that he was really into something. Macintosh team was located to a small office building called Good Earth building, a few blocks away from main Apple campus, in Cupertino California. After Macintosh team moved in, the office was transformed into a joyful place full of beanbag chairs and different toys, not like a typical engineering office at all. Jef was very fond of playing and he was always encouraging his team to play and be creative, express themselves by organizing games around, especially after lunch. The atmosphere was very inspiring; adding here the fact that Jef and Brian were both musicians and it was not a surprise to see instruments around, or even spontaneous concert in the office.

While Raskin’s people were striving in the Mac ‘skunkwork’ team, other events were happening in Apple. The board of directors were trying to get the Lisa project under control, while Jobs created enemies as he steered it away from its original price tag of 2000$ business computer into a much more expensive downsized Xerox Alto. In Raskin’s memories he recalls that, “Jobs was finally recognized by board of directors as a bad manager and incompetent”. Now’s Jobs personal mission was to take revenge and show to the others that he can do it that is why he set his sight on Macintosh team. Jobs pushed him in the team and as a bigger kid that he was he managed to get control of that ‘toy’.

Since Macintosh was not an important research project for the board, they allowed Jobs to enter Macintosh team, sometimes making fun of him. For Jobs this was his opportunity to prove
himself worth as a technological innovator. He started as manager of the Macintosh’s hardware side, and this did not bother Raskin since he was interested in the interface than chips inside. Soon after Jobs got involved, the team was relocated in the second floor of a building known as Texaco Towers, near to a gas station in the corner of De Anza and Stevens Creek Boulevards. This place was not even listed in the company’s telephone list and was perfect for Jobs project. Now with Jobs on the board, the Mac team went quickly from a research team to a real product development team with several dozen employees. Burrell Smith and Brian Howard took over the side of the building closest to the gas station and built a hardware lab, while Bud Tribble and Jef Raskin took over the other side setting up a lab for software development. Steve had no office there so he usually came to visit in the afternoons. Smith figured out to replace the 6809E microprocessor with a more powerful one 68000 used by Lisa, which was objected by Raskin as it would increase the cost. It was easier for Mac team to use some of the Lisa technology; however Jobs refused to make Mac compatible with the Lisa or vice versa.

Right after Jobs joined, Mac team was relocated in the second floor of Texaco Towers on the corner of De Anza and Stevens Creek Boulevards. Indeed there were no signs in the street to show the location of Mac Team and the office was not even registered in the company’s telephone list. In this period, a lot of things happened between Raskin and Jobs and the resignations of Raskin was inevitable. As Dan Kottke, one of the Mac engineers recalls “Jef Raskin and Steve Jobs both have large egos. Jef could have stayed on if he hadn’t gone against Steve. But he feels very strongly about certain things and won’t shut up” (Linzmayeur, 2004, p.94). Jobs referred to his team as pirates and his insanely famous quote “It’s better to be a pirate than to join Navy” describes the spirit of the skunkwork Mac team. Even though Jobs was striving to show to the others that he could develop a better computer than Lisa, was painful for him to realize that the real competitor was not Lisa but IBM which in August 1981 introduced its Personal Computer and the market was responding favorably. It became a real challenge for the team to face hard deadlines. Several decisions were to be made such as adding more memory. Even though Jobs was convinced that 64K memory was enough the team managed to convince him that they needed 128 K (actually, the team wanted more so they secretly designed a way to easily increased memory by swapping chips). More memory eventually lead to larger programs and Jobs team had anticipated this problem and were working on a solution. (Linzmayeur, 2004, p.95).

Finally on January 24, 1984, Apple introduced the Macintosh in a ceremonial way and Jobs would solemnly state that “There have been only two milestones products so far in our industry, The Apple II in 1977 and the IBM PC in 1981. Today, one year after Lisa, we are introducing the third industry milestone, Macintosh“. Macintosh was a sensation in the market and its sales boomed up to 72,000 pieces in 100 days. Eventually, after the initial burst of early adopters, sales dropped dramatically to 20,000 Mac per month, far away from Jobs expectations. It took Apple till 1985 to reach 500,000 pieces sold. Nevertheless, Macintosh made it. It survived the harsh and competitive internal environment inside Apple and become a world product in the external environment. Mac team member, Joanna Hoffman described Jobs managerial style as “a very emotional guy, like a Roman legion commander who really knows how to motivate small groups of people to produce”.
At the point when heading up the group that made the Macintosh, Steve Jobs enlivened his staff with the guarantee that they were making something incredible, as well as "insanely great". Jobs urged, and they raised skull and crossbones over their workplaces. He discovers approaches to say or do whatever it takes to arouse and galvanize the team. The team was convinced that they were developing something extraordinary in making the lives of millions of nontechnical users more enjoyable and easier. Macintosh has the spirit the values and attitudes of its creators, young people at their mid-20s, spontaneous, enthusiastic and able to approach unorthodox methods.

“We wanted Macintosh to be a technical and artistic tour-de-force that pushed the state of art in every conceivable dimension. No detail was too small to matter and good enough wasn’t good enough. If Steve could perceive it, it had to be great”, (Hertzfeld, 2005). The team worked in close, personal and constant interaction. The team lived and embodied on their vision of the future, a vision injected by Jobs in how computers should interact with humans. There was no real deadline as the design was an evolving process more and Jobs was one of those people who make things happen faster. He inspired his team members in encouraging each of them to feel personally responsible for the quality of product. He even made them to sign the interior of the Macintosh case in a “Signing party” organized for this purpose. While Apple was growing and eventually becoming more bureaucratic and formalized product development procedures were implemented, Macintosh team operated in a flexible, creative and breakthrough ground. As former CEO of Apple John Sculley (Red Herring, June 1996) stated: “Apple has been a somewhat dysfunctional world, arrogant when it was most successful and wonderfully innovative when its back was up against the wall.” Enthusiasm is contagious and a product that is fun to create is much more likely to be fun to use. The urgency, ambition, passion for excellence, artistic pride and irreverent humor of the original Macintosh team infused the product and energized a generation of developers and customers with the Macintosh spirit, which continues to inspire more than 30 years later. (Hertzfeld, 2005, p.277-279).

4.3 J22 aircraft project- Swedish Air Force

FFVS J22 was a single engine fighter aircraft developed for Swedish Air force during the World War II under the supervision of Bo Lundberg (see appendix 3). The layout was a steel skeleton and much lighter wooden panel which made the plane very light, small and fast. The main reason behind the J22 project was that it was impossible to import the modern fighter plane material or license to produce. Because England and Germany denied to sell modern aircraft or to allow any license to produce, also at start of World War II America started exporting war materials to UK and France against Germany and they suspected Sweden’s desire and possibilities to go against Germany. Sweden efforts to convince USA went in vain. Later their orders were affected by an export ban in USA issued on 2nd July 1940. At that time SAAB was working on single engine B17 and twin engine B18 bombers and they were not expected to finish before 1945-46. At that time Sweden decided to design and build a fighter craft J22 at their own. At that time SAAB was running at full capacity so a new firm and factory KFF (Kungliga Flygförvaltnings Flygverkstad) in Stockholm established.
At the start of the World War II, Swedish air force was not up to the standards. The only fighter plane in air force fleet was F8 which was delivered recently. Due to the increase in demand in that era an enormous development was going on fighter aircrafts. Swedish Air Force aimed to work on mission P9 and to replace J8 until 1943 starting from 1939. The construction site was built in SAAB and Götaverken but later have to cancelled both because forty American engineers went back and SAAB have to prioritize Type 17 and Type 18. It seemed impossible to finish these projects quickly and still they have not been able to provide the fast results. After the discussion it's been decided to buy the planes from Germany, UK and America. Sweden required a lot of planes so a commission was sent to America for discussion and bring the planes. In April 1940, Sixty J9 were delivered and later in July a ban on export of military equipment’s implemented and it affected all of the ordered equipment’s including 45 J9 aircraft. Due to the ban, the discussion took place in the aviation management, the chief Industrial commission and SAAB. No one believed that SAAB could manage to do that. The company AB Flygplanverken was responsible for the turbines failed to supply on time due to losses. Lundberg’s idea of GP-9 was carried on in Sweden for innovation of the J-10 airplane. The major problem for raising the speed issue was weight of the plane. Lundberg convinced Söderberg to give a presentation about his ideas about sustainability, calculations and a possible solution to the air force dilemma of weight and air resistance calculations. Light metal was the conventional technology of 20th century and dominated the brains of all the planes technicians. To convince them to use panels instead seemed impossible. Lundberg moved to USA and was posted as air force control commission.

In September 1940 Lundberg got a call from military that Söderberg want him to make a fighter plane, so he returned back home immediately in October 1940 and start with the realization of their revolutionary ideas of project named J22. This was not so easy project to have responsibility with full power to work and at the same time aggressively seek alternatives that would defeat it. The main thing was to keep the confidence high in those who were directly involved in the project J22. Government approves 1.375 million SEK for this project in Feb, 1941. In July 1941 the material plan for j22 was constructed and latest engine DB 605 was selected and approved for J22. Söderberg listened to the idea about the construction of the fighter plane with a mix of steel and wood with a surprise. The two main advantages of the panel construction over shell structure are; very little air resistance despite the star engine with its large diameter and smooth polished wood surfaces and lower structural weight allowed small wings area at the given requirements on acceptable landing speed. Söderberg was satisfied with these calculations and was fascinated with these unique manufacturing options because in a mix construction model parallel production is easy and it can be a faster mass production. But he declared directly to Lundberg’s plan of SAAB as parent company for fighter plane is unrealistic because the company was totally occupied for the production of B17 and B18. Also time tables for test flights and mass production should be rescheduled.

During that period SAAB had great difficulty in expanding its production due to the restrictions and fluctuation in spare part supply. Bo Lundeberg came up with the idea of using steel and wood in manufacturing and also the manufacturing plant should be entirely outside SAAB. The in house development includes not only construction but also the entire production remained undisclosed initially for various reasons. As SAAB had no additional product capacity of wood and steel therefore Lundberg went to Wahrgren and talk with him about the project. He
was not interested because they were not taking the subcontractors from them. Wahrgren explained in board meeting in June 1941 that SAAB is not interested to take this project because of risk of failure. After the refusal of Lundberg took this project to KFF. Wallenberg agreed on the arguments and about the project and wrote a written guarantee to not to take SAAB subcontractor without consultation to keep this project secret. Now the challenge was to keeping the calculations, performance and delivery time. Top management Gustaf Söderlund (Chairman Helge Ericsson), Ragnar Blomqvist (Thule) and William Nordström (de Leval) were very excited about the project. Bergström was appointed to look out for detailed manufacturing. The bigger problem was in finding suitable premises for the assembly and final assembly. The best place SIK (Statens Industri Kommission) could offer was General motors at Hammarbyleden.

Söderberg gave news to Lundeberg that KFF take under your leadership after construction work and manufacturing of test aircraft. There were several alternatives with or without SAAB’s involvement for the actual series production. Lundberg’s design idea combined with an unusual ability to collect extraordinarily talented employees about their project constituted prerequisites for successful results. The entire J22 project also bring a new way of thinking when it comes to precision and measurement standard in the Swedish industry. It was a tremendous excitement from April 1940 until the first test flight in September 1942. J22 worked as a single miraculous flight technical adventure. Although the panel design principle is obsolete now and carbon fiber composite panels are the future but at that time it was a huge breakthrough in air force industry. Lundberg’s invention registered as a patent in 1947 with the patent number 119216. It was a do or die situation for them and in a short time period of approximately one year under the supervision of true skunkworks leader Bo Lundberg they manage to achieve the target in a minimum cost. The new J22 costs around 80000 SEK. On the other hand the Air force value of completely destroyed aircraft at that time was 242,188 SEK. The estimated speed of 570 Km/hr and weight of less than 2000 Kg was the target for J22 project, both speed and weight targets of J22 were achieved.

4.4 Complete vehicles testing project - Volvo Trucks

Software validation in complete vehicle is a project that developed a new way of testing mechatronics in complete vehicles from a driver perspective. The project started in April 2009 and lasted until November 2011. This project was led by Jessica Erlandsson with the support of department manager Henrik Svensson. The project team included drivers, mechanics, test engineers and measurement engineers and the diversity created fantastic dynamics which made to achieve the targets in a short time.

Jessica holds a master degree in Electrical Engineering from Lund University and then joined Volvo Trucks in 2003. Before joining the complete vehicle department in 2007, she was developing a new radio system. The curiosity to know what happens when the electrical part leaves the project and the testing should be perform, in other words how the product is perceived, triggered her to new thinking. After joining then complete vehicle department, she realized that the testing method used for the electrical component was really old fashioned and not very reliable. While working on the previous project, in developing the radio system, Jessica received valuable feedback regarding the method used for testing. The new testing procedure was
developed from the driver’s manual perspective. The results were visible and a lot of value-added testing and value-added information was found. The problem was that while performing the testing and driving the truck, the same fault cannot be repeated. It was time for a new electrical system that would require a whole new set of testing the product in a different way. Jessica believed that they had to test this in a similar way as she developed with radio. Also a logging equipment was needed in order to have some sort of stamp of the truck when there was something wrong. Henrik emphasized that the logging equipment Jessica mentioned was not invented, did not exist in a normal way inside the company. So they just discover this need or they saw that there is gap in the technical ability regarding the core what happening on busses. When the problem is repeated then you can record all the busses back and forth in time.

Henrik was the manager of the measurement department in the vehicle verification team. In one occasion when they were working together on a prototype in vehicle verification, suddenly they had a truck problem, and the whole truck went gone. They lost the display and needed to go out and treat this problem again. Instead of this, if you can record all the communication than you can band it and save it and there is no need to drive out for half a day to cure if you really don’t know what’s happening. Jessica’s idea of PVT testing was to systematically go through all the functionality in the vehicle from the customer perspective. She coordinated the project and from the very beginning created a good network by connecting important parts inside organization necessary to set the stage for the project. On the other hand from the managerial perspective, a lot of investigations were going on how it should be done. According to the investigations, the recommendation from management was to put the project in vehicle verification part. Then for political reasons, objections raised. A lot of discussions and arguments went on about this for several weeks and it ended up in a situation where the responsibility was split in the attribute part and in verification part. It took quite a long time to have a final go-decision and exactly one year later the project started. The official decision to start was taken in May 2009 and Jessica was leading the project. By this time, Jessica was in Henrik’s department and it was easier with his support to start moving around. Henrik used his network and management skills to lobby for the potential of this project.

From his experience, Henrik mentioned that you need to have the power of resources inside your team, for example the measurement team and how to set up the logging equipment. According to Henrik, they had it internally and they could decide by themselves. Henrik reminds that “If that department had been in another area then I needed to convince that manager to have their persons to work in this project. That was a good bureaucracy for success here and also that Jessica had the brain and vision and we could network. The atmosphere was inclusive, new and everyone understood the vision. Also the energy and drive working on cooperation, connecting new challenges, networking internally in total as Jessica said in small scale in 2009. I remember that the electrical department, who was responsible for the verification inside the riggs, not in the complete vehicle, said that you don’t need to test, that we will fix that in riggs. So, there were political scenarios going on because they had the budget process allocated. I know that Jessica built together with her team all those codes from 2009 to 2011. They prepared the work and I know that the first weekend they started was on Friday week 49, 2010. Jessica was alone in the beginning, and then she established the network and when she did the first shot in week 49, 2011, that was the first time we ended up with a list report out here all the faults in the trucks. And then
you have logging information of each functions or electrical ---, then you don’t need to go test back to trucks”.

It was a true diverse team refers to background and experience the truck driving and log equipment, measurement system. It was a very good mix of a people with a fantastic drive. They believed in what they were doing. The problem they faced was that there was no budget left so the testing could not be performed. Then Henrik managed to help with the funding and they started doing testing and then the management realized this was really good and the team was asked to do more testing. They started to test their vehicle fleet and they were up and ready. That was the first logging system and they had also the first draft of how they should do the testing and perform it. They found out an enormous amount of faults which is quite easy because they didn't really need to work in the old way. They just had to go out to track and start with some issues. The most important thing was that they had the just-in-time logging system. In order to capture what was wrong they could use this logging system and play it to the engineers, tell them what was wrong. So, that was a true success. They can distinguish when they are running out of the logging system.

By the end of 2012, the team was compounded by 30-40 people and now they operate globally. According to Jessica, there are 6 PVT sites all over the world implementing this testing method. Jessica realized that actually they were working in the skunkworks style, and in an agile way. They had to create their own documentation using every mind in a smart way saving more than 650 million SEK to the company (estimation from Jessica and her team, supported by CEO Olof Persson). The management was always skeptic but the team proved itself and the global procedures originated called PVT testing. The team was awarded the Volvo 3P Technical Recognition Award in March 2012 and Volvo Group Internal Quality Award in 2014. 3P stands for Purchasing, Product development and Planning.

Regarding the integration of the people after the project, Jessica reminds that “People management outside the team was hard, because inside the team we had a very strong team and we had a very good atmosphere...we could disagree but we resolved it. But with others, there was a lot of jealousy and you know a lot of strange reactions that you would never expect ....but we still have problems ...and then there was reorganization a year ago and they actually splitted us all. The whole team was split up into 5 different teams again. It was all the way back to where it was in 2011”.

The political game was still strong and as soon as management realized that this could be something, they want to take over the whole set up. As Henrik reminds “They wanted to do it more in a traditional way, so they tried to put in that type of normal box. According to Jessica’s vision that was not really applicable and I understood that”. Henrik explains that there was an existing team working with the some type of testing. Then Jessica’s team was established and no one really thought that it will be something. But it grew and what’s the biggest part is that it should be integrated just two teams instead there was some yell off, and that was not working well.

Regarding secrecy, Henrik reminds that he was little bit careful of revealing because in 2010, the new management came and this was a little bit tricky. But Jessica and him continued in some way and then when the project was official, the project management started to realize that this could be
something. Citing his words from the interview: *We had the arguments needed to give the try and if it was failure ok then we can backup. The team members were put together from inside my department from different area so we created a team by ourselves...Jessica secured deep level knowledge into her team because she was not able to do by herself because she became a manager to take care of all the other things. Henrik concludes by stating that “in general you can say that if you a person with a good idea and that person should be supported by the someone who has the chance to support with the resources. With less resources longer time to fix, with much resources than short time to fix. So that is some sort of message that is to bring along in that case”.*
Chapter 5. Analysis

In this chapter, the analysis of empirical findings was conducted. The aim was to gain valuable insights from testing the findings against existing literature. In the end of the chapter, a discussion of the common learning points from all the revisited cases is presented with the aim to point out the requirements that skunkworks as an innovation model imposes to the overall organizational learning.

5.1 AXE project - Ericsson

According to Brown (2004), AXE started as a transitional skunkworks due to the effort and urgency from both engineers at Ericsson who felt that their switches were slow and would soon be outperformed by competitors, and the sensitivity of the issue perceived by Bjorn Lundvall, the architect behind Ellemtel and Fred Sundqvist, the chief negotiator. As soon as negotiations between Ericsson and Televerket were concluded with the decision to create a joint development, Ellemtel, then AXE moved from emergent skunkworks to a true skunkworks project with full support from senior managers of both parent companies and a high level of secrecy. The risk was too high taking into consideration the period when AXE was developed.

The concepts behind AXE were revolutionary and AXE would be the first full digital modular switching system in the industry. In addition, several engineers at Ericsson were claiming that they could develop by themselves AXE and most of them already had proposals. A cloud of “Non Invented Here” was surrounding AXE and resistance to change was high. According to Gloor (2016), the leaders took great personal risk in the case of AXE. Bjorn Lundvall, President of LM Ericsson on that time and Bertil Bjurel, General Director of Televerket put their reputations in risk when presenting their proposal for the creation of Ellemtel to Marcus Wallenberg, the Chairman of LM Ericsson. However, some sort of market research was done when deciding to further go or not with AXE. Ericsson was in a really serious position Ericsson had ARE yet its competitive strength against systems using mini switches was doubtful. AKE could absolutely be enhanced however it was clear that AKE code switches were relatively moderate, and uncompetitive.

On the other hand, AXE was clearly a superior product yet that would not be underway till 1976 with development costs no less than four times those of AKE. Any choice to go for AXE would be gamble. Indeed, there were rumors that Ericsson was not in rush for AXE, rather could utilize crossbar for a long time. Televerket was in the same line. At Ericsson the improvement of AKE was led from a small group of technical wizard individuals who obviously put accentuation on technical criteria rather than association with market. In this way, inside Ericsson, this time was chosen that the prerequisites specifications for the development of AXE ought to be composed by the market. It is clear, referring to intrapreneurship literature (Pinchot 1985 & Pinchot & Pellman 1999) that AXE was a true act of intrapreneurship that helped Ericsson in revitalization and growth. As a radical technological innovation, AXE required support of strategic corporate in order to succeed (Roberts & Berry 1985; Vanhaverbeke & Kirschbaum,
and the concept of the skunk works reflected in the creation of Ellemtel was needed to stimulate out-of-the-box thinking inside Ericsson. (Brown, 2004).

Regarding institutionalization, referring to Burgelman (1983) strategic forcing and strategic building activities were orchestrated by organizational champions. Burgelman (1983) claims that the key to understanding the activation of this process is that corporate management knows when the current strategy is no longer entirely adequate but does not know how it should be changed. Applying this to Ericsson, on that time the pressure for change was high and also the restless of Ericsson’s management to change was high. Ericsson excelled in the future because it tapped people’s commitment and capacity to learn at all levels (Senge 1990).

Decoupling strategy as the “ability to simultaneously pursue both incremental and discontinuous innovation” reflected the ambidextrous nature of Ericsson. Parallel with AXE, Ericsson was developing AKE13 as incremental innovation of AKE12 in order to sustain existing market. There is a great risk of loss of impetus while the new product is being created. It is frequently best to play down the work that is going on, or to keep it mystery, so marketing people can keep on offering existing products with certainty. This is in line with Abernathy & Clark, (1985), Tushman & Anderson, (1986) Tushman and O’Reilly (1997). On the other hand, elements of Non Invented Here syndrome made it difficult for AXE to be developed inside Ericsson.

According to Brown (2004), this can be seen as an inability of management to cope with radical innovation and that is why Ellemtel was founded. Another point is that Ericsson and Televerket had achieved enormous experience separately, experience that was to end up the considerable basic resource in the development of AXE. The task was given to the marketing department of switching division. They posed a thorough knowledge of development trends within subscriber services, operation, maintenance, traffic requirements, reliability engineering and so on. In certain way, their engineering background would lead them to figure necessities that could be meet inside of cost constraints and their marketing background would lead them to make these cost limitations practical. What's more, their energy would make them do this in four months.

The adequate development team was the formation of an autonomous ‘tiger’ team. Bengt Gunnar Magnusson was the project manager of AXE. He was recognized as "Sweden’s best engineer". Combination of different approaches and functions was an important success factor. However, the most important factor was Bent Gunnar himself. “He wanted to be the best. He was demanding, particularly of himself. Even in arm wrestling, he wanted to win. He was also a source of inspiration through his will and ability to look to the future and his determination to always remain at the leading edge of technology. Everything was not invented at home, and many of the best experts in the world were recognized as such and saw their ideas realized through the talent scouts that B-G sent out. Protecting the project meant acting himself as a shield against criticism and doubt”.(Ericssonhistory.com). The art was to get all our engineers working together for a common goal, in an original and fruitful way, so that a world product would emerge-at the right time.
One of the right decisions was to create Ellemtel as a new organization in a challenging environment. The feeling of challenge is a powerful driver—far stronger than can be generated for a new project just added to a list of other on-going projects. A feeling of challenge is essential for building group responsibility and acceptance of a common, urgent and important goal. From the beginning Ellemtel was an unconventional organization. The company started as a relatively small unit, with engineers in a clear majority. Such a group can accommodate unorthodox approaches, and its management can allow, indeed encourage, unconventional individuals to work in unorthodox ways. In the case of AXE, the skunky incubator model is applied to the highest level of management. Senior managers of Ericsson and Televerket are the ones responsible for the creation of Ellemtel which represents the incubator model and accelerator. What can be inferred from the skunky incubator model is that it has the potential to serve as a tool in the strategic management referring to the decision making process of accelerating the product development.

5.2 Macintosh project - Apple

Macintosh started as an emergent skunkworks. In the beginning, it was effort of a team of four people pseudo supported by senior management (Brown, 2014). Mark Markkula (one of the founders and board members) got intrigued by Raskin’s idea to develop a non-expensive user friendly consumer-oriented personal computer. Thus he gave his approval to check the feasibility of this idea into practice. For the first two years Macintosh project was fighting to survive into the harsh internal environment and to fit the corporate strategic directions and several times senior directors wanted to terminate it, including Steve Jobs. It was considered an unimportant project with no strategic determination context. So, Macintosh was in a transitional position with two options, either to prove its feasibility and moved to pseudo skunkworks or take a step further and move to emergent again till feasibility is proven or the project is terminated.

Thus, there is need to expand the model with a type of skunkworks as pseudo-supported skunkworks or neglected skunkworks which lies in between transitional and pseudo skunkworks. This type of skunkworks was not mandated from top management and public in the beginning, but was not either underground project and totally secret. Macintosh’s position was vulnerable and fragile. It could not be added to the ongoing lists of project at Apple because of the radical principles behind. This is in line with Zaltman et.al (1973) in that the strategic management problems in intrapreneurship are more visible in the case of radical innovation. This is supported by Burgelman (1983) findings who clearly state intrapreneurship as the motor of renewal. In the case of Apple, after all, Macintosh was its renewal force and somehow everyone in the Macintosh team was the product champion (Quinn 1985; Venkatamaran et al 1992). It was not until Steve Jobs joined Macintosh team that the project was officially mandated from senior management.

In the case of Apple, after all, Macintosh was its renewal force and somehow everyone in the Macintosh team was the product champion (Quinn 1985; Venkatamaran et al 1992). It was not until Steve Jobs joined Macintosh team that the project was officially mandated from senior management. Steve Jobs was an engineer and this made him a specialist in that time. However, Jobs became the facilitator and the true product champion for Macintosh. This is in contrast with Stam et al (2007) argument that the facilitator should be a generalist. In a certain way, Job’s was a
generalist too because his leadership style of charisma, ambition for glory and tremendous desire to show to the world that Macintosh will change the future of personal computers, shaped the destiny of the project.

Considering the context and the place where Macintosh was born, Pataci (2013) sequence risk management approach seems irrelevant to apply. Silicon Valley is the heart of entrepreneurship and by definition this means that risk taking is part of daily life of an entrepreneur. This is in line with Gloor (2016). During the interview conducted with Peter Gloor, professor at MIT and entrepreneur, he emphasized that trying to exclude all the risks is like Fukushima Nuclear plant where everybody said it's impossible that the nuclear plant could explode and then it happened. Arguably, even in the beginning most of the people at Apple said that is impossible and even ridiculous to develop a computer for masses, and it happened. Indeed Jobs was considered a bad manager and Macintosh was his opportunity to show to the others that they were wrong.

No market research could be conducted because that market did not exist on that time. In the same line of logic, no risk assessment could be conducted precisely because the project was inherently risky. Recruiting rebels and swashbucklers—talented but audacious individuals who could move fast and get things done, was the main contribution of Jobs as a leader in the success of Macintosh. (May, 2013). In this way, having the right mix of ‘pirates’ who would do anything for the mission to be accomplished, and cultivating into them the sense of urgency, mission, individual responsibility, is how the risk could be lower and prioritized. In fact, this is in line with Wickham 2006 who claims that managing intrapreneurship is about breaking the rules of the organizations created by the entrepreneur Steve Jobs. Jobs was a ‘monomaniac with a mission’ (Drucker, 1979), a missionary leader with a vision and intrinsically passionate to protect, support,
nurture and fight for assuring the resources necessary to flourish and prove new ideas. Jobs accelerated the development effort and involved several dozen of people located outside the corporate main offices.

According to Andy Hertzfeld, the Mac software wizard “The most important thing Steve Jobs did was erect a giant shit-deflecting umbrella that protected the project from the evil suits across the street” (Linzmayer, 2004, p.93). Once more, this emphasizes the never-to-be-forgotten importance of the radical innovation efforts to be conducted away from organizational noise and criticism. This is in line with ambidextrous theory (Duncan 1976, March 1991, Tushman and O’Reilly, 1997) which claim that “management needs to protect, legitimize, and to keep the entrepreneurial unit physically, culturally, and geographically separated from the rest of the organization”. As Jobs would declare later, in his famous quote “it's better to be a pirate than to join Navy”(Linzmayer, 2004, p.93) that he created skunkworks because the corporate was becoming too bureaucratic. Arguably, Navy could be Apple itself or IBM or both.

From the capability school of innovation perspective, the search routine, which means innovation, can be seen as a dynamic capability (Teece et al 1997, Teece 2007). However, Macintosh demonstrates more features of the Corporate Entrepreneurial School. Steve Jobs and his pirates loved to avoid routines and to break them into skunkworks. Jobs was in the same time “the mother” who loved Mac and “the father” who provided resources. Excellent innovative companies like Apple nurtured the ‘championship process’ rather than in ‘formal strategic planning’ (Peters & Waterman 1982; Burgelman 1985c and Burgelman & Sayles 1986). This can be seen when Steve Jobs organized the “Signing party” where every member of Macintosh signed, as artists do, the interior of the Macintosh case.

Macintosh team possessed ‘a high level of group identity and loyalty’ (Quinn 1985) networking with each other in informal and personal relations as in a family, thus enabling the best knowledge transfer (Merrill, 2015). They were nurtured by Jobs and they were true believer that they were into something ‘insanely great’. While most of the projects are market-driven with the aim to outperform competitors, Macintosh was artistic value driven, neglectful to competition with the aim to be brilliant and insanely great. Macintosh team was by all means a tiger team. The team and its leader Jobs, are a perfect example of the demonstration of the autonomous team features as Wheelwright and Clark (1992) described in the theoretical framework. The team took full responsibility for the project's failure or success. They were protected from organizational noise and bureaucracy and had no established boundaries, neither real deadlines, and usually provide unique solutions as a result. However, their autonomy often caused debates inside Apple in that Macintosh team was privileged. Actually everyone involved in the development of Macintosh was depending on its success or failure.

The creation phase is evaluated with the help of Floren and Frishammar (2012) framework of the front end of innovation. Activities of Idea/Concept Screening and Idea/Concept Refinement happened in parallel inside Macintosh team and were orchestrated by team members. Idea/Concept alignment consists of the need to align ideas into the business portfolio internally and to the market externally. Macintosh was a product new to the market and new to Apple too and it was not fitting into the business strategy until management created space for it. Regarding
the alignment to the market externally, this link was missed. As explained before, Macintosh was not at all market driven, but artistic-value driven. The aim was not simply to outperform the competitor, but to go beyond that and create something extraordinary great. Idea/Concept legitimization activities were carried out by Steve Jobs who was the leader and enthusiastic product champion. As Floren and Frishammar (2012) argue, these phases are not of distinct nature, thus making it harder to see where one activity stops and the other one starts. The activities are so interrelated and connected to an informal and integrated way of working in a team.

The commercialization phase could have been managed better. Steve Jobs had an appetite for a revolutionary product and an urgency to show his creature to the world. This made him very optimistic about expectations in sales, which later turned out unrealistic. Marketing department was looking for successful ways to launch Macintosh. The financial costs for the advertisement that was never broadcasted were tremendously high. Yet, Apple tried to educate sales people but still it took several years to reach the targeted sales. Apple was putting emphasize on the rebellious heart of Mac, and people who buy one are rebels comparing to the boring corporate types of IBM. The commercials never emphasized any feature of Mac, like being easy to use and interact which is more appealing to customers. Apple failed to educate its customers and took it for granted that they would appreciate and evaluate it as Macintosh members did. Even after resolving commercialization risks inside corporation and launching Macintosh, Apple was in struggle to monitor the market and its reactions and to solve the problems that resulted thereafter. The risk/reward assessment in the case of Macintosh was mainly driven from the reward component. Macintosh team earned eternal glory in achieving the third milestone in the computer history as Jobs referred to it.

5.3 J22 aircraft project - Swedish Air Force

J22 aircraft project started in conditions when Swedish Air Force had no other choices to build at their own. The major supplier of aircraft’s UK and Germany denied to sell modern aircraft or to allow any license to produce, also at start of World war II America started exporting war materials to UK and France against Germany and they suspected Sweden’s desire and possibilities to go against Germany. Sweden efforts to convince USA went in vain. Later their orders were affected by an export ban in USA issued on 2nd July 1940. J22 project was an emergent skunkworks at the start as according to Brown (2004) emergent skunkworks are those which are not supported by top management until the project reach to some success. J22 was a secret project but at the start it was not supported by the major defense manufacturer at that time SAAB. When Lundberg went to Wahrgren and talked with him about the project they didn’t showed interest and later Wahrgren explained in board meeting in June 1941 that “SAAB is not interested to take this project because of risk of failure”. According to Pataci (2013) inherently, the skunkworks projects have risks and uncertainties depending upon the type of the project. It's the duty of the true leader of skunkworks project to convert these risks to opportunity and to convert it into the successful skunkworks project. In J22, Lundberg proved himself as a true leader and manage the project in an incredible way to achieve target in a minimum time. Also according to the interview conducted with Peter Gloor, his point of view was also that skunkworks is inherently risky and requires call for risk-taking leaders with entrepreneurial spirit.
According to Kelly Johnson’s rules of skunkworks described by Rich (1994), true skunkworks has a small number of dedicated people. J22 started as a group of 13 dedicated, committed and highly professional engineers and later few engineers were added when the workload increased and also for production. J22 was a highly secret project and it’s completed in a very short time as according to Kelly’s motto “Be quick, be quiet, be on time”. During the start of J22 project SAAB was working on B17 and B18 projects and they have no space for the J22 project, so the office of J22 was selected in a place near Bromma airport at KFF in a four room apartment away from the production site which is also in line with the 14 rules of Kelly Johansson.

For a breakthrough and radical innovation one must think out of the box and for this situation principles will be the prevention. Associations can infer the strict standards and not permitted to break them, but rather then need to languish over moderate advancement or the expanded time of the completion. Now and again even top administration thinks about the rule breaking inside of the association however they hold up until the success or progress towards success of the project. According to Pinchot’s ten commandments for intrapreneurs (Pinchot, 1985,p.22) “Remember it is easier to ask for forgiveness than for permission”. This commandment was applied at the J22 project when came from a Swedish copy of the Pratt & Whitney R-1830 Twin Wasp, manufactured without a license at the time, though license fees were paid later (symbolic 1$).

According to Burgelman (1984), innovative firms proactively seek for opportunities. In J22 project internal corporate venturing was done in connection with AGA for developing the new welding techniques for the front beam of the aircraft. At the start it was uncertain how to solve the issue but later this was done with a collaboration of SEE AB with AGA. According to Wheelwright and Clark (1992), J22 team structure was a tiger team in which Bo Lundberg, Gustaf Söderlund (Chairman Helge Ericsson), Ragnar Blomqvist (Thule) and William Nordström (de Leval ) were very enthusiastic about the project. This team was responsible for the project’s failure or success with no involvement of bureaucracy and own policies and procedure. Every morning there was a meeting about the project progress and during the day CKK secretary along with assistant and sections heads went to every design board to check the progress. The progress was going on fast pace to meet the requirement for low weight, low resistance and high pace fighter plane. According to Kelly Johnson’s rule that one should not think about hundred percent perfect project, improvements can be made later in the project with the time. The main aim should be to complete the project on time in limited resources. In J22 project during the first test flight, air intake changed the back thrust and then few changes were made. Later after 13 days the first flight successful flight was taken. J22 was a radical and breakthrough project in the history of Swedish aircraft industry.

According to the corporate entrepreneurial school (Quinn, 1985), innovation involves high level of group identity and loyalty. Introducing a new product can be compared to ‘raising a healthy child – it needs a mother (champion) who loves it a father (authority figure with resources) to support it’. In J22 case, Söderberg was figuring out all the resources and to protect the project from outside (bureaucracy). Infact he was the one who wanted Lundberg for this project and military called him and convince to work on this project. Later Lundberg (project
champion) was the one who raised this project as a mother. The incubator model is applied to the J22 project and creation phase is evaluated with the help of Floren and Frishammar (2012) framework of the front end of innovation. The idea/concept development, invention and improvements in J22 project were done in a skunky incubator. Continuous improvements back and forth after the first test flight were done under the supervision of Lundeberg to achieve the required results of speed and weight of the plane. Adopting Florén and Frishammar (2012) perspective in managing the outcome of the front end, J22 project was continuum project in terms of back end and front end. At the start J22 project emerged as a need of Air Force and the project started in a do or die situation. Referring to commercialization an inference that can be made is that the back end of innovation was carefully evaluated before and with clear purposes of usage.

5.4 Complete vehicles testing project - Volvo Trucks

The complete vehicle testing project was a real act of intrapreneurship which helped Volvo in the revitalization process (Pinchot, 1985; Pinchot & Pellman, 1999). Jessica demonstrates the treats of an intrapreneur as a person who took direct responsibility for turning an idea into a profitable finished product through assertive risk taking and innovation. She preferred not to leave the organization, thus working within an established framework and with resources provided by the organization (Kevin C. Desouza, 2011). The task was challenging for Volvo’s management too. New ideas are often looked by the company management as threats to the status quo rather than opportunities. With her idea, Jessica challenged the organizational boundaries but always fought for keeping the balance between her freedom to act and the strategic path of the organization (Wickham, 2006). Jessica was the innovation champion of the project in line with Drucker’s definition (1979) as a missionary leader with a vision and intrinsically passionate to protect, support, nurture and fight for assuring the resources necessary to flourish and prove new ideas. Henrik was the organizational sponsor who believed in Jessica’s idea, supported, nurtured and provided resources for the project to take the stage. As Henrik reminds “They wanted to do it more in a traditional way, so they tried to put in that type of normal box. According to Jessica’s vision that was not really applicable and I understood that”. The concept of the skunkworks might be seen as another way to stimulate intrapreneurship/entrepreneurship and out-of-the-box thinking in an existing firm (Brown, 2004). And in this skunkworks style development project, both Henrik and Jessica were organizational champions, Henrik championed resources and Jessica championed ideas (Venkatamaran et al,1992).

Every project is unique and in the case of the complete vehicle testing project, the transfer of the project to the operational part of the corporate was facilitated by championing activities rather than through formal screening process (Burgelman, 1983). Decoupling strategy as the “ability to simultaneously pursue both incremental and discontinuous innovation” reflected the ambidextrous nature of Volvo (Tushman and O’Reilly,1996). Still is unclear whether the exploitation and exploration units where detached or not as may require fundamentally different organizational structures, strategies, and contexts (Abernathy & Clark, 1985; Tushman & Anderson, 1986). From the capability school perspective, Volvo showed ability to integrate, build, and reconfigure internal and external competences’ (Teece, Pisano & Shuen 1997: p.516; Teece 2007). On the other hand, this project is an act of intrapreneurship operated in skunkworks, involving a high level of group identity and loyalty (Quinn 1985: p.78). Introducing a new product
can be compared to raising a healthy child—it needs a mother (champion/Jessica) who loves it [and] a father (authority figure with resources/Henrik) to support it (1985: p.78).

According to Wheelwright & Clark (1992), the team was an autonomous one, a true diverse team referring to background and experience in truck driving, logging equipments and measurement systems. They were assigned on permanent basis to the project and co-located in the same area as the project leader, Jessica. As Henrik described “The team members were put together from inside my department from different area so we created a team by ourselves...Jessica secured deep level knowledge into her team because she was not able to do by herself”. They started with a clean sheet of paper, creating their own policies and procedures because there were no existing documentations available or specifications on how to do the work. As Jessica described they were full dedicated and the team took full responsibility for the project's failure or success. The atmosphere was inclusive, new and everyone understood the vision. Also the energy and drive working on cooperation, connecting new challenges, networking internally in total as Jessica said in small small scale in 2009. Jessica took care of recruiting the team members by herself and as she explains the risk was managed from the beginning by choosing the right people, with excellent technical skills and in the same time capable of thinking in an unconventional way. Everyone involved in the team was fully responsible for the outcome of the project, thus was everyone’s job to contribute in risk assessment on daily basis.

In order to escalate the project from the front end of developing the idea to the back end of implementation, the skunky incubator model was applied to this project, in line with the theoretical framework. As Florén & Frishammar (2012) argue, firms need to manage it considering the particular nature of front end in radical development efforts in order to achieve a successful outcome. In line with their arguments that phases of front end are not of distinct nature, which imply that not always a high degree of formalization will occur, is exactly what characterized the nature of the project. In line with Jessica’s explanation, now she realizes that actually they were working in the skunkworks style in a lean way in order to go from where they were to where they wanted to be. This is in line with Rother (2010), an effective management system is the one that keeps an organization adjusting to unpredictable, dynamic conditions and satisfying customers. Human beings in general tend to look for certainty where there is none. According to Raymer (2008), skunkworks is often synonymized with the ideal new product development but is rarely followed in its entire entity. That requires management confidence and considerable courage. Without the lean thinking, the project would have been unsuccessful or just another one in the list of the company and not as successful as it was.

5.5 Discussion of the empirical findings

In a “do or die” situation, the sense of urgency and the feeling of challenge are the motivators to build a strong group communication pattern. An autonomous “tiger” team best manifests these features. In this type of development team, members are handpicked by team leader and co-located outside the main organization. They are totally dedicated to the project and they cultivate a common feeling of responsibility for the outcome of the project, either success or failure. They work in unconventional ways, they hate to be micromanaged but they love to be led.
Thus, a strong leader is required; a “monomaniac with a mission” that does what it takes to the progress of the project.

In all the cases revisited, innovation happened outside the main facilities, bureaucracy was under attack and this spurred out of box thinking. Freedom to think, act, and experiment is essential for skunkworks. Trial and error approach was used in all the cases based on fail early and fails often. The basic purpose was to consider the new ideas, build an early prototype, test their feasibility and learn from their mistakes in order to minimize the risks by failing sooner and cheaper.

No guidelines existed in all the cases. Principles emerged through discussion. The true art was to get the people work in an original way toward a goal that was open, not too much specified. What kept them working in a vibrant way was that members identified themselves with the product, the excitement of the thinking that they were developing something innovative. This calls for deep generalists who accommodate unorthodox approaches and not narrow-minded specialists. These people applied lateral thinking to approach problems from sidetrack, thus generating completely new solutions. One should not forget the influence of the culture as the mindset of the company.

Inherently, in all the cases, projects were too risky due to radical ideas involved. All the team members of the project were aware of the risk factors but project manager was the one mainly responsible to minimize the risk. Risk is an essential factor in product development but skunkworks projects have an additional element of risk due to the high uncertainty involved. Risk cannot be totally eliminated but can be managed through choosing the right people.

The basic requirement and also the common point in the cases discussed is high level of secrecy in all the projects. Breach in secrecy might cause a severe loss to the project and also the reputation of the skunkworks team, therefore all the projects remained secret until the completion.

Another common point in all cases revised is the internal competition. The toughest customer of the project was the parent company itself. Projects can benefit from the internal competition. A pattern of objection, skepticism and even conflicts sometimes emerged, especially during the beginning phases of the project. This led to discussion and competition. On the other hand, the project champions, the people who from the very beginning put their reputations into skunkworks, and sponsors were negotiating with senior management on setting the stage, allocating resources and in general lobbying for the approval of the project. However, senior management was responsible for giving the approval thus setting the ground for skunkworks.

Most of the skunkworks projects came up with the good enough solutions to go ahead from the prototype phase to the production phase. It’s not a hard and fast rule that all the skunkworks projects became successful projects but due to the adaption trial and error it’s easy to fail fast and cheap also it is easy to make adjustment in the prototypes so that the final production will be free of errors.
Last but not least, the re-integration of the employees after skunkworks project is accomplished is a subject of discussion. Integration is a process and as such it takes time. What is important is the role of organizational champions which facilitates this process between the skunkworks team and the parent company. After all, being part of a skunkworks style project was always considered a privilege. It also has some costs in the personal life of the people involved. In overall, this experience has been marked as “times of great excitement” from most of the leaders and members of all the cases revised in this study.

A factor that shapes the destiny of skunkworks is the culture. Among cases studied, authors found that culture matters in the creation of skunkworks unit. In US, companies are more hierarchical than in Sweden and the communication pattern between people inside the same company is not as rich as in Sweden. There is a work culture of open communication in the workplace in Sweden in comparison to USA. This implies that in USA is more feasible to find this pattern of skunkworks way of working because people like to work alone and also keep the work secret. But on the other side the bureaucracies faced are higher in USA than in Sweden. This is the other side of the coin.

Another finding is that one of the criteria to enter a skunkworks group is to undertake the cognitivity test. It can be implicit or explicit and it is used to match the cognitive way of thinking with the right assignment inside the group. The testing procedures in cognitivity serve as recruitment tools. Skunkworks is a way of handling chaos and uncertainty. Large organisations tend to be too well structured with solid networks very difficult to change. They have no openness for flexibility and skunkworks is a way of handling such issues outside that corporation. In the journey of learning, the aim is not to reach a destination, rather to see the world with new eyes.
Chapter 6. Conclusions

In this chapter, conclusions are derived in order to answer the research questions. Theoretical implications are pointed out in order to make clear the contribution of this study to the field. Managerial implications and future research are presented with the aim to contribute to the practicality of the study and to pinpoint areas that needs to be researched in the future.

6.1 Research questions

The study was set out to explore the concept of skunkworks and has identified the nature and form of skunkworks approach, the reasons and motivation for the success of this type of innovation model, the extent and resources required to establish and internalize skunkworks operations. The study has also sought to know the role and impact of skunkworks approach in building organizational learning capabilities and leadership that create synergies and build momentum that reinforce the organization. The general literature review is inconclusive and does not connect the enormous successful stories in the industry with existing theories. The study sought to answer two questions in order to link the gap identified.

- Why has skunkworks philosophy been so successful?
- What can companies learn from successful skunkworks in order to internalize the procedures?

6.2 Empirical findings

In order to answer the first research question Why has skunkworks philosophy been so successful? The empirical findings are synthesized and presented in the form of six success factors.

1. **Lean structure for Innovation.** Nearly all the skunkworks operations were conducted on basis of flexible, adaptable flat organization, empowering team members to take charge and make their own and fast decisions thus cultivating responsibility for the success or failure of the project. Engineering optimization was achieved based upon knowing the problem extremely well, a feature of high performance and excellence. Less micromanagement from senior managers resulted in free and open discussion in the division about how to accomplish tasks in an innovative manner and without intervention.

2. **Intrapreneurial atmosphere of innovation.** In all the cases, the creative innovation climate was the key in stimulating out-of-box thinking. Integrated risk management of the problems encountered in daily operations was accomplished by the recruitment of the right people in the right assignments and under high level of secrecy from the rest of the organization and outsiders. Bureaucracy was under attack and time-wasting was improved in favor of a more collaborative learning curve.

3. **Dedicated product team/Strong leadership.** All of the sampled cases had a tiger team at the heart of skunkworks approach. It is noteworthy to mention the sense of familiarity installed in this team which led to the most rich communication pattern, identity and
loyalty. A strong leadership style with excellent technical skills and who envision protects and nurture the team was fundamental in establishing this kind of development.

4. **Unconventional thinking.** New solutions are deep crafted in minds of deep generalists. It is interesting to note that in all the cases, skunkworks represent the best exercise of lateral thinking.

5. **Market Opportunism.** Nearly in all the cases whenever a market opportunity emerged, functional alignment was abandoned in favor of market opportunism. inherently the new market is accompanied by uncertainty. Notably, skunkworks was approached as a method of dealing with uncertainty when the path from where we are to where we want to be cannot be accurately predicted.

6. **Rapid iteration.** Nearly in all the sampled cases, designers had flexibility to make adjustments when necessary, including the cancellation of the design. Acceleration of the product development was achieved by a strategy of fast prototype and frequent testing of the product which allowed designers to make better decisions during the whole cycle of development

In order to answer the second research question *What can companies learn from successful skunkworks in order to internalize the procedures?* a deep synthesis of the practices identified in empirical findings was conducted and presented as six take-away lessons.

1. **Apply the skunkworks practice to regular projects too.** The first lesson extends the applicability context of the skunkworks approach even to regular projects in order to help to set the stage for getting things done and accelerating the innovation process.

2. **Tap the human potential in periods of chaos.** Technological change is inherently chaotic and challenging. Skunkworks has the human potential in the DNA and the immense capability to turn challenges into real business opportunity.

3. **Utilize and survive.** In a world of commodities, the challenge is how to differentiate and excel in rapid product development. The answer lies in the lean structure of skunkworks approach.

4. **Interactive learning.** Skunkworks is the closest infusion of collaborative learning, high interactiveness and motivational environment that characterizes small ventures. Empowerment of people through continuous learning led to better decision making process. The leader works hand in hand with the engineers.

5. **Prototype is the documentation.** Let the prototype to be a physical achievement and not just an idea. Conceive it with the necessary improvement and let the market to do the rest. Work on the feedback and fail soon and cheap. Document as much as needed, however as little as possible.

6. **Failures pay off.** The great achievement and work is its own reward. Intrinsic motivation to do whatever is required for success generates incentives and premises for long-term growth.

The findings of this study suggest that although conditions are always changing in an unpredictable way, an organization can have skunkworks as a method for dealing with it. Risk is managed by choosing the right people with the right experience and network. Principles are
developed out of repeated actions. Lessons learned help us recognize the next step and adds to our knowledge and understanding.

6.3 Theoretical implications

The literature for skunkworks need to be revisited in order further understands how the mechanism of relationships works to protect the skunkworks. The framework suggests the skunkworks team as a remote ship with no connection to mothership (Brown, 2004). Indeed, this connection is orchestrated by the sponsor-leader relationship. It is, however, noted from this study that such a treatments need to be changed in order to create space for skunkworks literature to gain attention in strategic innovation management. Thus, authors hope that the model of skunkworks as an incubator for fostering innovation will trigger a constructive debate in the name of innovation. We conclude that our model is applicable in a certain context when the skunkworks is already approached as a strategy for rapid new product development by management. However, further testing is needed in order to expand its applicability. The theoretical contributions of this study include:

● Bridging the connection between the enormous empirically evidence of different cases of successful skunkworks innovation and the existing literature.
● Contribution to the literature in what is typical of skunkworks approach
● Skunkworks identification as incubator model strength the strategic importance in organizational learning tools.
● Exploration and identification of six success factors and six lessons.

6.4 Managerial implications

Radical innovation calls for monomaniac champion, strong, and perseverant. Studies continuously show that most successful innovations were led by, often fanatical, champions. In some occasions, the passionate champion of change had support from senior level and organizational sponsor and in some other occasions was even ignored until his or her idea had proven itself. This organizational champion builds a strong network of change champions. The implications clearly show the key role change champions play in a change event. In a large, bureaucratic organization, champions are needed to overcome “we’ve always done it this way” syndrome, resistance to change even if it is for better. Highly effective champions are often impatient, emotional, irrational and characterized by sense of urgency to disrupt the status quo and not simply rock the boat but to capsize it. If the work environment is oppressive then possible future-champions have chances to become good little bureaucrats or making change out of the sight of managers.

What needs to be change is the traditional approach of managers to skunkworks. The process of setting up a skunkworks team style can be standardized and skunkworks need to be supplemented with innovative scalable kick off efforts. What is usually misunderstood from managers is the scope of approaching skunkworks. Especially senior managers, who have the power, have to be keen to surrender it for the benefit of innovation. Existing organizations are obsessed with preserving the reputation of core products. While this is important for the ongoing business, however in order to leverage business opportunities and be flexible, companies can
experiment with new projects. In such conditions, turning to “skunkworks” will enable employee to install focused creativity into the development process without affecting the bottom line. Practitioners will understand that skunkworks style of development team has the true capacity of leveraging heterogeneity of ideas, reducing the time wasted on bureaucracy and utilizing that time to learn about new practices in a collaborative manner. In this way, the chances for success are improved.

6.5 Future research

An implication for future research is that new technology brings new challenges and opportunities. The old bureaucratic system of managerialism cannot be applied simply because it will not solve problems. The potential for innovative solutions represents risk but what is clear is that risk cannot be totally eliminated in that innovation and risks stay hand-in-hand. Without risk this potential does not exist. Skunkworks approach as a model for dealing with uncertainty and high risks in situations where the path from where we are to where we want to be, needs further research. In addition, more research needs to be done in the cognitive style of leaders and members of this development team. This will help practitioners to understand how to place the right individuals to the right assignment within the group, thus increasing chances of radical innovation to succeed.
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**Interviews**

1. Bengt Hedbjörk. Former Engineer at Ericsson Mobile Division
2. Peter Gloor. MIT Sloan School of Management
3. Anders Wikberg. Former Project Manager at Ericsson AB
4. Henrik Svensson. Manager of Measurement Division at Volvo
5. Erlandsson Jessica. Function Testing Manager at Volvo GTT

**Others**


1. “14 Rules of Skunkworks”

1. The skunkworks manager must be delegated practically complete control of his program in all aspects. He should report to a division president or higher.

2. Strong but small project offices must be provided both by the military and industry.

3. The number of people having any connection with the project must be restricted in an almost vicious manner. Use a small number of good people (10% to 25% compared to the so-called normal systems).

4. A very simple drawing and drawing release system with great flexibility for making changes must be provided.

5. There must be a minimum number of reports required, but important work must be recorded thoroughly.

6. There must be a monthly cost review covering not only what has been spent and committed but also projected costs to the conclusion of the program.

7. The contractor must be delegated and must assume more than normal responsibility to get good vendor bids for subcontract on the project. Commercial bid procedures are very often better than military ones.

8. The inspection system as currently used by the Skunk Works, which has been approved by both the Air Force and Navy, meets the intent of existing military requirements and should be used on new projects. Push more basic inspection responsibility back to subcontractors and vendors. Don't duplicate so much inspection.

9. The contractor must be delegated the authority to test his final product in flight. He can and must test it in the initial stages. If he doesn't, he rapidly loses his competency to design other vehicles.

10. The specifications applying to the hardware must be agreed to well in advance of contracting. The skunkworks practice of having a specification section stating clearly which important military specification items will not knowingly be complied with and reasons therefore is highly recommended.

11. Funding a program must be timely so that the contractor doesn't have to keep running to the bank to support government projects.

12. There must be mutual trust between the military project organization and the contractor, the very close cooperation and liaison on a day-to-day basis. This cuts down misunderstanding and correspondence to an absolute minimum.

13. Access by outsiders to the project and its personnel must be strictly controlled by appropriate security measures.

14. Because only a few people will be used in engineering and most other areas, ways must be provided to reward good performance by pay not based on the number of personnel supervised.
15. According to the book "Skunkworks" the 15th rule is: "Starve before doing business with the damned Navy. They don't know what the hell they want and will drive you up a wall before they break either your heart or a more exposed part of your anatomy”.

2. Pinchot’s Ten Commandments for Intrapreneurs

1. Work underground as long as you can – publicity triggers the corporate immune system
2. Remember it is easier to ask for forgiveness than for permission
3. Do any job needed to make your project work, regardless of your job description
4. Follow your intuition about the people you choose, and work only with the best
5. Circumvent any orders aimed at stopping your dream
6. Find people to help you
7. Never bet on a race unless you are running it
8. Be true to your goals, but realistic about the ways to achieve them
9. Honor your sponsors
10. Come to work every day willing to be fired

3. Bo Lundberg profile

Bo Lundberg was born in 1907 in Karlskrona and grew up in Visby and later Hudiksvall. After graduating in 1926, he was selected as reserve officer cadet. He received his flight training from Ljungbyhed and continued flight training in Karlskrona in 1927. In autumn 1927 he started studies in KTH Stockholm at the department of Mechanics and Aeronautics, partially funded studies by call-up for flight duty during summer. In September 1931 Lundeberg was employed as a test pilot by ASJA in Linköping. His first creation was Viking II, an elegant reportage airplanes covered cabin with place for 3-4 people. Later Lundberg studied German aerospace for four months. He took part actively in founding of Linköping flying club. After four years at ASJA Lundberg moved to Sparmann airplane workshop in Stockholm. He was hired as director of computational and experimental department and also as design engineer and test pilot. He was involved in the designing of the project E-4 which was in the shell construction. In 1937 he left the job at Sparmann and take over as head of newly established Götavekens flight department in Stockholm. There he constructs a new bomber GP-8 and new fighter plane GP-9 and later with that submitted the tender for air force.


1. Specs and a market plan are the first step to success
2. Detailed strategic and technological plans greatly increase the odds of a no-surprises outcome
3. Only a big team can blitz a project, especially if is a complex one.
4. Contemplation stimulates creativity
5. Big projects are inherently different from small projects and must be managed differently
6. An organization must have a rigid hierarchy if would-be innovators are to get a fair hearing
7. Product compatibility is the key to economic success
8. Customers will tell you only about yesterday’s needs
9. Technology push is the cornerstone of success
10. Perfectionism pays off

5. Ericsson as experienced

Anders Wikberg worked at Radio-based unit at Ericsson with organizational development and as a project manager for small projects and up to 500 million SEK project. Referring to the development of AXE, citing him from the interview: In order to be able to have skunkworks you must be then experienced what Ericsson is, how do people work and one aspect is that you really need to know where to find you work around because even lean, not lean as a process but you lean towards the structure as such, then you try to navigate within this structure in the best way. “They (referring to Ericsson management of that time) tried to also they understood quite early when they developed the AXE that they needed some skunkworks activity so they actually try to do that, they moved the department out of the ordinary environment and then they were allowed to work outside that area thing and try to fix something but the thing is that the environment, the development environment is very complex within Ericsson and you have tremendous amount of dependencies around the telecommunication network . Referring to his experience in management, Anders says that: “the thing is when you work with skunkworks, you can have specific goals and that must be quite narrowed. I did one project, the last one at Ericsson I think. It was a radio based station parts and baseband units and my orders from the product management that this must be ready in this week and it must be delivered to Japan and then I said :You must understand that on this time frame this is not possible, then the guy said well that’s your problem not mine. I needed to start short circuit a lot of functions. I can say that I got the responsibility because I worked within Ericsson for so many years and I know all the people so basically what happened was that I got back and I worked around management by working around and there is a challenge, need your help, we gonna do this in a very short time and but this is the only what I was very specific what I need for help, so in that sense I manage to squeeze in that activity within the ordinary world. You must not forget that the US culture is a big difference. One of the success factors from Ericsson was that everyone talks to each other’s. We do walk around in Kista when in highlight days in 90’s. You know basically lot of people, have you heard in that, have you looked into that etc. etc. So the information was flowing freely and I mean freely and some people were not keen on that. So Ericsson has deviated now from free flowing information”.
During 2008-2013 Gurilda obtained the Bachelor’s and Master’s in Telecommunication Engineering from Polytechnic University of Tirana. She worked as a Technical Engineer at Albanian Broadband Communication for two years before moving to Sweden.

Raja Usman has a Bachelor’s degree in Chemical Engineering from UET Lahore and a Master’s degree in Innovative and Sustainable Chemical Engineering from Chalmers University of Technology.