Innovation strategies of the 19th Century
The case of LM Ericsson

Innovations strategier under 1800-talet
fallet L M Ericsson
av Arnold Rombo
Innovation strategies of the 19th century - The case of LM Ericsson /

Innovations strategier under 1800-talet - fallet L M Ericsson

**Background:** Firms owe their existence to both the shareholders and stakeholders whose goals they seek to satisfy through outwitting competition and earning profits. But earning profits is only possible when firms employ appropriate corporate strategies to attain competitive advantage over competitors. For technology based firms however, innovation is the key to achieving competitive advantage and by extension meeting the firm’s stated goals.

**Aim:** The aim of this study is to identify and describe the innovation strategies applied by LM Ericsson in the last decade of 19th century

**Methods and Compilation:** Owing to the historical nature of this work, a qualitative study based on secondary data was conducted to explore the history of the company that is the subject of study with an aim of addressing the single case of innovation strategies employed by the company in the given period of study.

**Results & Conclusion:** The path dependent nature of the telephone technology and the lack of patents in Scandinavia enabled the handy, cautious and thorough Lars Magnus Ericsson to use his innate engineering skills to be able to exploit the existing innovations to reach higher levels of success with his company. Favourable domestic industry conditions of limited competition and the enriching partnership/collaboration with the company’s main and significant customer also served to ensure ready markets for the company products thus completing the success story.

**KEY WORDS:** Strategy, Innovation, Technology, Telephone, Collaboration
ABSTRACT

For any given firm in any industry, market success is a desire that all strive for, and this is achieved by outsmarting competition through brilliant strategies. To develop these strategies many firms resort to innovation, and as such innovation is the key to developing better strategies for market success.

It is with this acknowledgement that this thesis delves into the history of LM Ericsson in order to unearth the innovation strategies that lay behind the company’s success during the last decade of the 19th century. To achieve this mission, we ask ourselves such questions as to what was unique with Lars Magnus Ericsson that he relayed to the company that ensured success. We even try to find out if there were any technology related aspects that facilitated this success and finally take a look at the company’s business environment to find out if the environment played any roles which can be attributed to the company’s success.

Getting the above mentioned tasks accomplished required the application of appropriate methodological steps. Owing to the historical nature of the study and the data to be collected all indications were leaning towards a qualitative study based on secondary data with a case study as the most suitable design given that the aim of study was to explore LM Ericsson’s innovation strategies. But this study’s relevance is tied to the relationship with theory wherein relevance is proclaimed if the empirical data collected can somehow be related to the theories used in the study. With respect to the issue of relevance, an inductive approach was suitable as we sought to make some theoretical inferences out of the findings arrived at. The application of the chosen approach edged the thesis closer towards achieving the stated aim of study. An analysis was therefore done with the help of relevant theories among them open innovation, path dependence, competitive strategy as well as theory on networks.

The conclusion arrived at was that Lars Magnus Ericsson possessed a raft of unique capabilities, among them innate engineering skills, handiness, and a host of other personal attributes such as thoroughness and cautiousness. All these traits together with
the favourable domestic business environment incorporating limited number of competitors and the low level of technology at that time worked in favour of the company. In addition it is also important to note that the path dependent nature of the telephone technology as well as the lack of patents in telephone technology in the Nordic region, allowed the founder of the company to borrow foreign knowledge for use in developing products. But perhaps the most outstanding of all the success factors, personal qualities aside, was LM Ericsson’s collaboration with Henrik Cedergren’s SAT (Stockholms Allmänna Telefonaktiebolag). There is no doubt Lars Magnus Ericsson would have succeeded thanks to his innate skills which were instrumental in the production of quality products, but he would probably not have been as successful as he was. Collaboration with SAT highly promoted the success of the company. The special relationship endeared the company to the telephone market, and made the innovation equation complete for LM Ericsson. The company could thus concentrate on improving its technical skills base while SAT delivered the markets and success was inevitable. When this relationship tended towards its end by the turn of the century, LM Ericsson’s fortunes began to diminish and it had no choice but to diversify beyond the domestic market it once dominated with SAT’s help, to venture into foreign markets. This highlights the epicentre of LM Ericsson’s success pillars, thereby bringing us to the most important lesson we learn with this case as one of the major reasons behind LM Ericsson’s success.

Before proceeding to the main body of this thesis, the reader’s attention is being drawn to the fact that the company which is the subject of this study shares the same name with its founder. Therefore in a bid to differentiate between the founder and the company to ensure clarity the full names of Lars Magnus Ericsson is used in reference to the founder while LM Ericsson refers to the company.
# Table of Contents

INTRODUCTION ................................................................................................................. 1  
PROBLEM DISCUSSION ........................................................................................................ 3  
AIM OF STUDY .................................................................................................................. 7  
METHODOLOGY ................................................................................................................. 8  
PRACTICAL EXECUTION ...................................................................................................... 8  
RESEARCH PHILOSOPHY ................................................................................................... 9  
   Interpretivism ..................................................................................................................... 11  
RESEARCH STRATEGY ....................................................................................................... 13  
RESEARCH DESIGN ......................................................................................................... 14  
   Case study ........................................................................................................................ 15  
RESEARCH APPROACH .................................................................................................... 16  
   Induction .......................................................................................................................... 17  
DATA COLLECTION ........................................................................................................... 18  
   Secondary data ................................................................................................................ 18  
   Critique of data collection methods .............................................................................. 19  
THEORY ............................................................................................................................ 21  
OPEN INNOVATION ......................................................................................................... 22  
   Closed innovation .......................................................................................................... 22  
   From Closed to open innovation .................................................................................. 22  
   Open innovation ............................................................................................................. 23  
   The three core processes in open innovation .............................................................. 24  
PATH DEPENDENCE ....................................................................................................... 25
THEORY BASED ANALYSIS ........................................................................................................ 84

The role of open innovation in the acquisition of telephone technology ........................................ 84

The effects of properties’ of path dependence ........................................................................... 89

Key industry players and the role they played ........................................................................... 92

The role of networks .................................................................................................................. 97

The inherent network arrangements and the roles they played ............................................... 99

REFLECTION OVER CHOSEN THEORIES ........................................................................... 101

DISCUSSION .............................................................................................................................. 103

CONCLUSION ........................................................................................................................... 106
INTRODUCTION

Every organisation has a purpose for which it exists. Therefore an organisation without a purpose or goals to achieve will have its existence questioned or would even not exist at all. The two common dimensions often mentioned with regard to organisation purpose are the shareholder and the stakeholder perspectives as defined by both De Wit et.al, (2005) and Schilling (2008), among other authors. They are both of the position that organisations’ main purpose is to create value for both the shareholders and the stakeholders. De Wit et.al, (2005) further argues that this purpose for which any organization exists prompts the search for a plan, a course of action which entails the means of achieving this purpose. This plan is strategy. The managerial understanding of an organisations purpose according to De Wit et.al, (2005) has implications for strategy in that it influences strategic thinking, and other elements such as strategy formation and strategic change. In this way the purpose becomes a yard stick for evaluating strategic actions.

But it is not only the purpose that can guide the activities of an organisation. Other elements such as philosophies and values might also be of crucial importance. These elements that make up what De Wit et.al, (2005) call corporate mission drives the organisation along its path towards achieving the set purpose or goals by influencing strategy and strategic decisions.

Corporate mission though important is just but a component of corporate strategy. Andrews (1987) in his book on Concept of Corporate Strategy defines corporate strategy, “as a pattern of decisions in a company that determines and reveals the objectives, purposes or goals and policies and plans of achieving these goals, the range of businesses a company is engaged in as well as the human and economic organisation it intends to be and contributions it intends to make to the stakeholders and shareholders.

Corporate strategy as the overall strategy of a company serves to determine the strategic direction with a purpose of creating competitive advantage, necessary to achieve organisation goals.
Collis and Montgomery (1999) describe the role corporate strategy can play in creating competitive advantage through the selection of business areas and integrating them into the corporate whole by aligning the firm’s resources with the chosen business areas and organisation in the right way. The importance of resources in delivering competitive advantage is also captured by Andrews (1987) where he stresses the need to focus resources on core competencies to create competitive advantage. In this context corporate strategy acts as the blue print or the law or a script containing best practices that guides the employees and the management of an organisation towards achieving the set goals.

Turning our attention to innovation, which is the main theme of this thesis it is imperative to make the case for the linkage between innovation and corporate strategy and ultimately competitive advantage. The relationship between innovation and corporate strategy is mutual (Tidd et.al, 2001). The R&D unit of a firm plays a central role in the formulation of innovation strategies; an integral part of overall corporate strategy. The level of existing technology in a firm will either enable or constraint the achievements of the desired corporate goals. Likewise it is the corporate strategy that outlines the objectives that are to be achieved with the help of technology.

Innovation is not necessarily technological in all firms. Examples of non-technological successful innovations (Tidd et.al, 2001) that have improved competitiveness of the firms associated with them include the Karolinska Hospital in Stockholm, which managed to cut waiting queues by 75% and cancellations by 80%. The UK First Direct in the banking sector, enhanced its position in the market by attracting 10 000 more new customers through telephone banking backed by an IT system.

Size advantage and possession of unique assets to mention but a few are some of the means through which competitive advantage can be created but recent trends (Tidd et.al, 2001) strengthens the case for innovation as being the most common way through which modern firms create competitive advantage. Research shows that new products enhance profitability through increased market shares.

For their mature counterparts, non-price aspects of design and quality seem to matter to the consumers, just as much as low prices.
Life cycles of products such as electronics have become shorter lasting only a few months, and the customer tastes and preferences are constantly changing. Among other things legislation is also changing, with a typical example in the area of environment where concerns about environmental degradation exert pressure on the adoption of clean production processes and safe products. These market dynamics require that firms adapt to the speed of change by constantly innovating to upgrade their products and by even being quicker than competition.

**PROBLEM DISCUSSION**

The first management definition of innovation (Verloop 2004) as given by the economist Joseph Schumpeter referred to innovation as “The commercial or industrial application of something new, a new product, process or method of industrial production; a new market or source of supply; a new form of commercial, business or commercial organization.”

Kline and Rosenberg (1986) in their work entitled *an innovation overview* describe innovation as the creation and marketing of the new. The novelty implies high level of uncertainty as far as technical performance is concerned; on the other hand the response a new product elicits in the market cannot be predicted with certainty either.

Many authors describe innovation as a complex and chaotic process that involves many stakeholders. Innovation process (Martin, 1994) is not only technological in nature but also socio-economic.

This position is also held by Kline and Rosenberg who cite several examples of brilliant projects that failed due to the neglecting of aspects crucial to the success of innovation. They argue that the popularly held notion of innovation being possible with only technical considerations taken into account is a fallacy. Technical performance alone is not enough for success; economic factors too have to be taken into account.

Some of the remarkable examples of failed innovation attempts that were purely dominated by technical agendas include the Concorde project which was aimed at
shortening the transatlantic flight hours by half, but it later on turned out that not so many customers were keen on shortening the flight hours, but were comfortable with what was available in the market at that time. Besides, Concorde’s fuel costs per passenger mile were fifteen times higher than a Boeing 747 plane. Thomas Edison launched a vote counting machine intended for use in the US congress, only to be told by the congressmen that that was the last thing they needed. Tidd et. al, (2001) highlights more on the causes of the innovation failures so far mentioned in the above examples by the analogy of the mystery of the “black box” with respect to the two protagonists at the centre of innovation. The problem of complexity of the innovation process persists as economists tend to focus and define albeit with difficulties the inputs and the outputs of the black box (e.g. new technology) with little or no attention at all being paid to what is going on inside the box e.g. the complex process through which inputs are transformed into outputs.

In this way they lose insight of the institutional factors that are necessary for the success of the process. The technologists likewise are preoccupied only with the goings on in the black box, with no attention being paid to market forces that are crucial for the success of innovation. Examples of the kind of failures addressed are plenty, and the important lesson to be learnt is that successful innovation (Tidd et. al, 2001) requires the balancing of the technical requirements of a new product and its production process, as well as the market needs, and an organisation better equipped to sustain the process effectively.

Whereas it is crucial to pay attention to both the paradigms of technologists and strategists or economists, it is technology (Goodman et.al, 1994) that portends more problems than economic issues. The problem with technology is the characteristics it possesses that also impact greatly on the management of a firm. Technological concepts always elude many non-technology organisation members, and the unpredictability of technological development, in some cases always lead to a mismatch between the actual an expected performance.

The frequency with which discontinuities and continuities in the technological development process alternate always lead to uneven pace of technological development (Goodman et.al, 1994).
But besides the problems mentioned, technology brings benefits that cannot be overlooked, hence the need to take it seriously with a view to finding a trade-off between the problems and the benefits. A good strategy shields against competition and creates some certainty allowing for the adoption of effective approaches appropriate to the market needs. It is technology (Goodman et.al, 1994) that delivers that strategy. Production activities, be it the production of superior products with new product designs or improved production processes for competitive leverage, directly involves the application of technology. This shows how strategic technology is to the survival of an organisation.

Now that it is acknowledged that technology is one of the means through which successful implementation of strategy can be attained, Goodman et.al (1994) stresses the necessity of reviewing the traditional planning process to accommodate the paradigms of both the technologists and strategists. He talks of a strategy technology interface, to emphasize how important technology and strategy are both important to the normal functioning of an organisation. A weak strategy implies losing track of organisation processes eventually leading to their weaknesses. Likewise instability in organisation technological base brings uncertainty and disrupts the normal planning processes.

While reviewing literature on the main research problem in this thesis, it is important to bear in mind the fact that much of the theories applied here are much younger than the period which the thesis covers.

This glaring disparity between the age of the theories applied and the period the thesis covers leads us to the question of what the relevance is in undertaking a study of a period long time ago in history. The answer lies in one of the characteristics of technology; path dependence.

Rosenberg (1994) argues that a given stock of technological knowledge at any given time can be understood by examining the history of its origins.

By the same token he continues that the growth of technological knowledge or the likely future direction of technological growth can only be understood by assessing the sequence of events that make up the history of the technology in question. The two first
statements assert the fact that technology is path dependent. Further evidence of path
dependence is provided by Rosenberg’s 1991 survey of the R&D spending in the United
States as provided by Science and Engineering Indicators, with a verdict that most of
the money spent on R&D was devoted to development of existing products and not
basic or applied research. Development is especially necessary when dealing with high
technology products exhibiting high complexity features. It is also essential in tackling
the uncertainty aspects of technology. High-tech products have to be tested modified
and redesigned before their commercial introduction. The development of existing
products and not introducing new ones supports the reasoning that present technological
knowledge has been shaped by past activities and consequently present technological
activities are a good signal for the direction future technology is likely to head. In cases
of major innovations, e.g. in computers, the understanding of the subsequent
innovations can be facilitated by tracing them back to the original technology from
which they emanated. This path dependence aspect of technology lends credence to our
effort of studying technology /innovation strategies applied by LM Ericsson at the end
of the 19th century. The reasoning is that we can only understand present innovations by
looking back at the history out of which they evolved.

Innovation as a business process always undertaken with strategic intentions has its
success pegged on the delicate act balancing technical needs as well as economic ones,
while paying attention to the organisation needs necessary to sustain innovation.

It is with this perception in mind that attempts are made to formulate research questions
which can facilitate the task of identifying and isolating the strategies which LM
Ericsson employed at the end of the 19th century. While agreeing that innovation
incorporates both technological as well as economic or market considerations, it is
logical that any firm embarking on some form of technological innovation must as
prerequisite posses some form of technology on which to rely to transform inputs into
outputs. The design and ingredients of these outputs are influenced by market signals.

The precedence of technology as highlighted above dictates that the formulation of the
research questions begins with technology being addressed first, followed by economic
or market issues.
The leading research questions that have thus been formulated to assist in compiling the information needed to fulfil the aim of this study are as follows:

- What were the unique corporate/technological capabilities possessed by LM Ericsson and what strategies did these capabilities yield towards meeting the company’s innovation needs?

- Did the company’s early life exhibit any discernible technology related attributes of path dependence and if so what roles did these play in the innovation process?

- What was the industry context like and what roles did the industry play towards the company’s success?

**AIM OF STUDY**

The aim of this thesis is to identify and describe the innovation strategies employed by LM Ericsson in the last decade of the 19th century. The thesis seeks to identify LM Ericsson’s strategies from the time of its establishment in 1876 stretching up to 1900. To help fulfil the aim, an analysis of LM Ericsson’s activities and its environment will be carried out to pinpoint the unique success capabilities.
METHODOLOGY

In this section, a discussion of how this thesis came about and how it was practically executed is first presented. What then follows is a detailed discussion touching on the methods applied towards accomplishing this work. The discussion begins with an account of the author’s philosophical leanings followed by research strategy, design, approach, data collection, and lastly as critique of data collection methods.

PRACTICAL EXECUTION

The topic of this thesis was proposed by one of the lecturers at the department of Management and Engineering. In the proposal there were suggested theories and methods which were deemed applicable. However the contents of the final thesis differ from the proposal as some alterations were made, with respect to both theory and methods.

After choosing this thesis proposal as the topic to write on, the immediate task was to develop the research purpose or aim from which the research questions were to be formulated. The development of the research purpose and questions was guided by the suggested theories and methods provided in the thesis proposal, save for the changes made. Technology based theories were replaced by theory on path dependence. As for the methods, books were easily accessible and proved adequate for use.

With the research questions and the aim/purpose of the thesis preliminarily developed, a clear picture of what the thesis would look like and the path towards completing it had been charted. It became clear then that the qualitative research strategy was more suitable. This was also identified and suggested in the proposal which suggested that data be obtained from books, archival document studies, annual reports, correspondence and minutes of board meetings.
However due to time constraints, it was only books that finally became the source of data used in this thesis. With regards to research design, a case study was deemed suitable.

The identification and adoption of the fundamental methodological dimensions of strategy and design paved way for consideration of data collection methods.

But before the data collection process could begin it was of essence to take into consideration the relevant theories applicable. The importance of theory is underscored by the fact that achieving the aim of this study required an analysis of the collected data with the help of the relevant theories. Before the process of data collection could commence, it was necessary to read, choose and put the theories down in writing. A review of the theories helped to shape the data to be collected. After the process of data collection was complete, a reflection on the research questions was done partly to review the research questions and also to ensure that there was consistency and above all to answer the question of whether the writer was on the path towards achieving the aim of the thesis. Then, the final step was the analysis of the collected data with the help of the theories chosen to arrive at a conclusion on whether the purpose of thesis had been achieved. A final conclusion was then drawn based on the analysis.

**RESEARCH PHILOSOPHY**

Before embarking on the task of writing a thesis, it is always assumed that the choice of a suitable topic to write about has been chosen, as observed by Bryman et. al, (2007). One of the essential and initial steps to take as the exercise of writing begins is the definition of the purpose of writing the said thesis, which in essence will influence the body content of the thesis and go further to dictate the methods applied to produce the final thesis. But what is the point or purpose of writing a thesis? Yes, to create knowledge or say something about the topic chosen. But even before the writing starts, attempts can be made to envisage roughly what the end result might look like. This is
made possible by reflecting over the nature of what we intend to communicate with the thesis.

It is not possible to accomplish the task of writing a thesis if the author does not reflect over the nature of the knowledge the thesis aims to provide.

Being conscious of the nature of the knowledge (Bryman et al, 2007, Saunders et.al, 2007) or what we intend to say through the thesis is crucial in informing the methodological steps, among them data collection, that are applicable in bringing forth the knowledge. As the purpose of this thesis is to venture into the history of LM Ericsson in order to provide some insights or knowledge about the innovation strategies that the company employed towards the end of the 19th century, it is thus apparent that historical narratives among other documents of historical nature form the source of what is to be said about LM Ericsson, and are worth pondering over. Consequently, this leads us to the important question of what methods to apply to retrieve the knowledge sought from the sources that are to be used.

Research philosophy thus is a crucial component as far as writing a thesis is concerned and serves as a key guide in the process of writing. In a typical scenario with a given topic of choice and a defined aim, the process of writing cannot move on without considerations about the nature of knowledge that surrounds the topic of choice. In other words the process of knowledge creation is headed nowhere if one is not conscious of the nature of the knowledge to be created. It is only through being conscious of the nature of the knowledge in question that one can develop further knowledge through applying suitable methods. Saunders et.al, (2007) define research philosophy as the development of knowledge while having assessed that knowledge’s nature or simply being conscious of it, and underscores the importance of philosophical considerations in understanding and influencing the type of approach to adopt in a given particular field of study.

Before embarking on the process of writing this thesis, philosophical considerations and steps were taken into account especially with regard to the nature of knowledge to be created and the pertaining sources and ultimately the methods to apply in order to arrive at the target knowledge sought.
But it is important to ask the question of why writers of theses have to bother with philosophical considerations, its usefulness aside.

The principles of scientific writing that are followed when writing reports like theses dictate that certain norms that have been arrived at by consensus be adhered to. Research philosophy is one such area covered by these principles. These principles are what distinguish scientific reports from other categories of reports. The argument is that there should be unanimity with regards to the conventionally agreed upon methods to be adopted to study a particular phenomenon of a given nature. This enhances acceptability.

Therefore while being conscious of the nature of knowledge in this thesis, the process of knowledge generation involved the interaction of the conventional methods and the empirics to yield interpretive findings.

The philosophical dimension that addresses the nature of knowledge with regard to acceptability as identified by authors in the field of business research among them Bryman et.al, (2007) and Saunders et.al, (2007) is referred to as epistemology, and is explored in the next subheading.

**Interpretivism**

The answer to the main question in this thesis, of bringing forth the innovation strategies applied by LM Ericsson seems remote or a little bit more cumbersome if quantification methods were to be applied. This notion is arrived at after reflecting on the nature of the end result as well as the nature of the materials to be used as sources of information.

Given the historical nature of the materials that form the basis of sources to be used in this thesis, the onus is on the author to choose the best methods that can be applied to obtain the useful information required. Moreover, the historical nature of the sources implies that we cannot access the people involved in the formulation of the strategies
we are out after. This leaves us with the option of interpreting their activities to come up with what is deemed to be the strategies LM Ericsson adopted.

Interpretivism according to Bryman et.al, (2007) and Saunders et.al, (2007) is a branch of philosophy that is concerned with the interpretation of human or social action. Bryman et.al, (2007) in contrasting interpretivism from its opposite, positivism, that involves quantification, stresses the need to observe the distinctiveness of humans from objects of natural science, and argues against the use of natural science principles in studying the social world.

Interpretivists thus are of the opinion that social world can only be studied and understood by grasping the subjective meaning of social action. Saunders et.al, (2007) argues that interpretation of social action can be facilitated by classifying social action into different roles. They use the metaphor of theatre with humans as playing a part on the stage of human life. This is analogous with theatrical settings where actors play different roles which can be interpreted differently both by the actor and the director of play. The interpretations of roles played determine how both the actor and the director of play perceive a certain given role and ultimately the action that follows.

The intention of using this metaphor is to explain the point that humans always interpret social action according to the meanings they attach to different roles played, and by this they underscore the significance of subjectivity.

One of the major intellectual traditions of interpretivism according to Bryman et.al, (2007) is the hermeneutic-phenomenological tradition. Hermeneutics as an interpretivist tradition is mainly concerned with the method and theory of interpretation of human action. Phenomenology is described by both Bryman et.al, (2007) and Saunders et.al, (2007) as the way in which individuals make sense of the world around them and how researchers studying them should exclude own preconceptions about that world.

This thesis is inclined towards the hermeneutic-phenomenological tradition, where the emphasis is on the interpretation of human activities at LM Ericsson and making sense of the activities with minimal subjective bias. The total exclusion of subjective bias is however not perfectly attainable.
RESEARCH STRATEGY

In the discussion about research philosophy it was pointed out that research philosophy is instrumental in identifying the appropriate strategies to be adopted. Normally there are two broad categories that are mostly used, and the choice made in any particular study, depends on the nature of what the study or report intends to achieve.

In the case of this thesis where the main task to be accomplished involve the analysis and interpretation of historical human activities, it is important to choose from the main two categories of qualitative and quantitative strategies, the one that can be applied to achieve the intended goal.

Bryman et.al, (2007) describes research strategy as the general orientation that a research takes, and goes on to identify the two most known and used strategies as the quantitative and qualitative approaches. Quantitative strategies are generally described as those that apply measurements and quantifications while those of qualitative nature apply interpretation.

Bryman et.al, (2007) distinguishes qualitative strategy from its main alternative, quantitative strategy by stressing the qualitative approach’s emphasis on the distinctiveness of humans as social actors and the social world which they are part of. Qualitative approaches according to Bryman et.al, (2007) are used in studying social phenomena as opposed to objects of natural sciences that are the domain of quantitative approaches. Bryman continues to argue that in qualitative studies events as well as the social world are viewed and interpreted through the eyes of the subjects, in this case, the people studied.

In agreement with Bryman’s assertions, this thesis therefore fits into the description of a qualitative study as it seeks to highlight and interpret some human activities or events that took place at LM Ericsson.
RESEARCH DESIGN

After identifying the strategy to be adopted, what follows is the issue of how to implement the strategy. At one’s disposal are a number of methods or designs from which to choose depending on how appealing and appropriate a design is in fulfilling the main objective. Design considerations normally precede data collection, and the choice of the design to adopt is guided by the research questions and objectives. With regard to this particular thesis where the emphasis is on identifying LM Ericsson’s innovation strategies, an appropriate design is one which will provide an in-depth study of the narrow domain of innovation strategies, within LM Ericsson.

A research design’s primary purpose, according to Blumberg et al, (2005) is to provide a framework for data collection and the analysis of the collected data. Saunders et al, (2007) argue that the design should be guided by research questions and objectives. Their views run concurrent with that of Bryman et al, (2007) who hold the position that a research design should produce results given the existing level of knowledge, time span of the completion of the research work and philosophical leanings and ultimately reveal the type of research that has been conducted.

A research design, therefore according to Saunders et al, (2007) should enable the answering of particular research questions and meet the set objectives.

Thus, in line with the arguments of the authors mentioned, the most suitable design that would facilitate the collection and analysis of data needed to achieve the set objectives of this thesis, was considered to the case study design. The design is discussed in the following sub-heading.
Case study

A case study as the name suggests, is the study of a single phenomenon in a given setting. As the study involves a single phenomenon or a few phenomena, it is important that it be thorough and in-depth to pass the credibility test.

In addition to the in-depth studies, more credence is leveraged by the use of multiple sources which provide similar data. This is in contrast to a study that involves many phenomena where giving too much detail would not only be difficult but also confusing.

This thesis is about the firm LM Ericsson, and the single case or phenomenon of innovation strategies. The study is not about all the aspects of LM Ericsson as a company but singles out innovation strategies as the single case of interest to be studied in depth.

A case study according to Blumberg et al, (2005) and Bryman et al, (2007) is a full contextual analysis or in-depth study of a case, fewer events or conditions and their inherent relationships. Case studies are rich in detail (Blumberg et. al, 2005), (Bryman et al, 2007) normally derived from multiple sources. The main pre-occupation of a researcher undertaking a case study (Bryman et al, 2007), is to clarify the unique features of the case.

This study thus qualifies to be regarded as a case study as it involves the collection of empirical data about LM Ericsson from different multiple choices with the intention of narrowing on the innovative issues of strategic content and significance among the rich data about LM Ericsson’s activities.
RESEARCH APPROACH

Theory as an integral part of a thesis plays a crucial role as far as methodological issues are concerned. The relationship between theory and the research work itself determines the kind of approach to adopt, with regard to this relationship.

The relationship is such that in some studies, the initial step involves a literature review whose main purpose is to come up with some hypotheses that are to be matched against collected empirical data, the aim being to either approve of or disapprove the hypotheses.

In other studies, the collection of empirical data precedes the literature review, with an aim of giving meaning to some conclusions from the collected data by relating the conclusions to theory.

According to Bryman et.al, (2007) the question of which approach to adopt in any research work depends mainly on the research work itself and its relationship with theory. The two common approaches are deduction and induction, where deduction (Saunders et.al, 2007) involves the use of literature, to identify theories and ideas which are later to be tested using collected data. A deductive approach thus generally starts with the process of reviewing theories/literature in order to develop a hypothesis or hypotheses which is then followed by data collection with an aim of theory testing through accepting or rejecting the hypothesis/s based on the findings arrived at. Induction discussed into details in the next sub-heading, on the contrary begins with analysis of empirical data, from which theoretical inferences are made.
Induction

In an effort to bring forth the innovation strategies of LM Ericsson, literature review was of some necessity. Of necessity was the need to explore the topic of innovation to get acquainted with its dimensions and specifics. However, as much as this sounds deductive in approach, it is important to remember that this thesis strives to create some knowledge about innovation out of the history of LM Ericsson. The literature review only serves the purpose of facilitating the identification of elements of innovation strategies within the rich text of history. The overriding task is to focus on the empirical data to ascertain whether there are traceable elements of innovation strategies similar to those in innovation literature.

Saunders et.al, (2007) describes the inductive approach, as involving the exploration of data to create theories from them (data), and relate these theories to literature. Bryman et.al, (2007) on the same account talks of the researcher deducing the implications of his or her findings for the theory that prompted the research and that the findings of an inductive approach add to the existing stock of theory as well as to the findings in the domain in question, through some generalizable inferences deduced from observations.

Since the intention of this thesis is to generate some knowledge about innovation strategies employed by LM Ericsson, it was therefore necessary to explore the available historical empirical data. This is characteristic of an inductive approach. The aim is not necessarily to generate new theories, but to come up with findings which can be related to literature. By relating the findings to the literature, the credence of the findings is strengthened to allow for some generalizable inferences to be made.
DATA COLLECTION

Secondary data

The data collected and used in this thesis are of written nature owing to the fact that this is a historical study. The historical nature of the data required that attempts be made to access materials that could provide much of the data required. Initially the targeted sources were to comprise annual reports, books, archival documents, and minutes of board meetings. However, it was not possible to access all the sources named above, mainly due to the inherent difficulties that were likely to accompany the efforts to obtain them. One very important and a major factor constituting the difficulty was the time issue. It would have taken a longer time to retrieve data such as LM Ericsson’s archival documents and minutes of board meetings from any of the archives that hosted them.

Therefore a solution had to be found, in a source that was not only going to be accessible but one that incorporated some data from the initially identified sources. The available option was to use secondary data in the form of books.

Secondary data constitutes data collected by others for their own purposes and use (Bryman et. al, 2007).

It can be in the form of data collected by other researchers as well as data collected by organisations for own use in the course of normal business operations. Secondary data (Saunders et.al, 2007) can be raw, with little or no processing or compiled with some form of selection and summarising. Some sources of secondary data (Bryman et.al, 2007) include books, journals, newspapers and some government publications. Others sources (Saunders et.al, 2007) include written materials such as notices, correspondence, minutes of meetings, reports to shareholders, diaries, transcripts of speeches, and administrative and public records. The fact that secondary data is collected for another purpose other than that of the researcher, implies that there are inherent risks of using inappropriate or out-dated data (Bryman et.al, 2007), (Saunders et.al, 2007).
et.al., 2007) in relation to research questions. But secondary data is nevertheless preferable (Saunders et.al, 2007) when a researcher is faced with time constraints and quickness is desirable. Secondary data is cheaper to collect in terms of time and money. It is a case of data already collected for the researcher to use compared to collecting own data as observed by both Bryman et.al, (2007) and Saunders et.al, (2007). The type of secondary data to be used in this thesis was initially to come from sources such as annual reports, minutes of board meetings, archival materials and correspondence among others, but the predominantly one type of secondary source used here proved to be relevant and adequate. The books that have yielded the secondary data for this thesis have their contents originating from archival materials, correspondence, annual reports and board meetings among other sources.

**Critique of data collection methods**

The data to be used in this thesis, as mentioned before was intended to come from multiple sources such as annual reports, books, archival documents and minutes of board meetings. This however, never turned out to be the case. Owing to the historical nature of the study, the issue of time was of prime concern.

It would have taken much time to retrieve data from volumes of archival material.

Since some of the data exist in raw form, not necessarily compiled to suit the needs of the researcher it would have taken a lot of time to process them into useful information. The cost aspect is one such factor that argued against the use of some of the initially identified sources. It would have been costly to move around visiting archives in search of information.

With all these limitations in the way a credible and executable solution was found in the books. The advantages of using existing literature in the form of books weighed in heavily. The obvious and immediate advantages lay in the accessibility and secondary nature, which implied that a lot of time would be saved as there was no need of time consuming process of compilation of own data let alone travelling distances in search of material.
A closer look at the books used as the main source of data reveal that their contents contain data obtained from annual reports and archival documents. In this case the use of multiple choices can be argued for though it did not literally take place. But this does not mean that the writer is oblivious of the inherent danger of some useful material being left out by the writers of the books, when collecting data from archival documents and annual reports. The omissions that would have probably occurred would have been as a result of the different intentions of both the writer of this thesis and the authors of the books used. The authors of the books used would have simply wanted to narrate LM Ericsson’s history and only focussed on what they thought was interesting from a historical perspective. The writer of this thesis however would be more concerned with historical elements of strategic content. This comes up as one of the major disadvantages of using secondary data.

Apart from the intention differences, this disadvantage of using secondary data played out largely throughout the process of data collection. The lay-out and presentation of the information from which the needed data was to be obtained presented some level of difficulty. The haphazard disposition of information especially with regard to key events that are part of the crucial data of this thesis and especially the conspicuous lack of order in the historical dates implied that some time had to be spent on restructuring the data.

The use of only books as the main source of data in this thesis, as opposed to the initial suggestion of using the stated multiple sources, could have had an impact on this thesis. Access to the initial multiple choices of data that were intended to be used could have resulted in the grasping of some crucial data that might have been left out by the authors of the books used. However, despite the likelihood of omissions of the sort the outcome of this thesis is not that much affected.
THEORY

In this section several theories in the field of strategy that are considered to be of relevance to this study are presented. The section begins with a presentation of theory on open innovation, followed by path dependence, competitive strategy, and theories on networks in that order. The relevance of open innovation and path dependence theories in the context of this thesis lie in their association with technology. Open innovation is about the flow of or transfer of technology among firms while path dependence addresses the nature of technological changes within a given time span. Theories on competitive strategy and networks are associated with the market side of the innovation equation as they are helpful in describing the business environmental issues mainly on the relationship between the innovating firm and other industry stakeholders or actors. The order adopted in the presentation of theories reflects the primacy of technology in innovation issues; with the first two theories linked to technology given the first priority, followed by market or industry related theories. Open innovation addresses the flow of the specific type of technology under scrutiny while path dependence is concerned with the historical development of the said theory. Competitive strategy addresses reactions taken by the innovating firm in response to the behaviour or actions of other industry players while networks is about the ensuing relationships the innovating firm adopts to enhance its competitive position. The relationship therefore is such that the theories that deal with the technology aspects of innovation are presented first followed by those that are concerned with economic or market aspects.
OPEN INNOVATION

Closed innovation

The traditional linear model of research and development also referred to as the closed innovation model (Chesbrough, 2003) holds the view that successful innovation must be controlled. According to the closed innovation perspective companies must exercise self-reliance by generating own ideas, which they further develop and build. They also have to market, service, and finance, distribute and support these ideas on their own (Chesbrough, 2003, 2003c, 2004).

The typical firm pursuing the closed innovation model as described by Chesbrough (2003, 2003c) is a firm that invests heavily in R&D to generate new ideas. The intensified research breeds ideas that yield products faster than other firms and makes the firm in question the pioneer in a given market. The firm reaps profits from successive release of new products and maintains its position through protecting its intellectual property.

The earned profits are further invested in R&D to create more novel ideas and products, and the cycle continues.

From Closed to open innovation

Chesbrough (2003; 2003c) identifies a number of reasons that have forced many firms to abandon the closed innovation model for the open innovation model.

Among them is the increased mobility of highly skilled workers whose expertise the former employers have no control over. These employees carry with them the expertise to new organisations or alternatively they start their own businesses. Additionally Chesbrough (2003c) argues that the increment in the college and post college training has witnessed the supply of manpower to the research laboratories. When departing,
these skilled workers set up their own businesses, and in a way they contribute to the open innovation process. The availability of private venture capital as a catalyst of the open innovation process is instrumental in financing firms such as the above named to commercialise the spill-overs of ideas they have taken with them from the corporate research laboratories. And lastly the shorter innovation cycles (Gassmann & Enkel, 2004), have implied that products reach the market much quicker than it did in the past.

**Open innovation**

Chesbrough (2003c; 2004) defines open innovation as a paradigm based on the assumption that firms can and should use both internal and external ideas, as well as internal and external paths as firms seek to advance their technology. However, Trott (2008) and Chesbrough et al (2006) while giving a similar definition describe open innovation as a deliberate two way flow of knowledge in the form of inflows and outflows from a firm’s point of view, with the intention of hastening internal innovation as well as expanding markets for external use of the given innovation.

Internal ideas (Chesbrough, 2003; 2004) can reach the market through external channels outside the current business driven by the firm. This can take place mainly through unrelated businesses. Internal ideas can also reach the market through new start-up businesses, external licensing as well as through departing employees (Chesbrough 2003c). External ideas originating from laboratories outside the firm can also be acquired and commercialised by the firm.

As such he argues that research should not only yield internal pathways to the market, just as internal pathways to the market should not only be restricted to the use of internal knowledge. This more open approach can bring benefits to the firm in the form of recovery of false negativities. False negativities arise in cases where projects hitherto regarded to be worthless turn out to be valuable in new markets or when pursued in combination with other forms of external knowledge.
The three core processes in open innovation

Gassmann & Enkel (2004) identify three core processes that are central to the open innovation model. These are the outside-in, inside-out and the coupled processes.

Outside-in process

The tenets of this process lie in a firm’s co-operation with its suppliers and customers among other external entities with the aim of integrating the external knowledge gained from such co-operations. Apart from integrating customers and suppliers external knowledge can also be obtained from listening posts at innovation clusters, as well as through purchase of intellectual property or licenses. Through supplier integration, several operational benefits accrue. These can take the form of earlier detection of problems, availability of prototypes and fewer changes in engineering orders.

Strategic gains in the form of shorter time to market, better utilisation of internal resources, reduced technical and financial risks and improved product features can also be realised through supplier integration.

Turning to customers, their integration can help firms deduce their needs in advance even before they become aware of them.

Inside-out process

The inside-out process involves the externalisation of knowledge and innovation aimed at reaching the markets faster compared to internal means.

It can be accomplished through licensing of intellectual property and technology transfers. The benefits apart from the accruing revenues are the increased speed due to shorter time to market, sharing of costs, and access to new knowledge. This approach to innovation also allows room for the firm to concentrate on core competencies and facilitates management of capacity problems.
**Coupled process**

The coupled process combines both the outside-in and the inside-out perspectives enabling the firm to gain external knowledge and take ideas to the market as well. It entails co-operation of strategic network nature guided by the spirit of give and take. An example of this approach can take the form of joint knowledge development through relationships with specific partners such as a consortium of competitors. The benefits accrue in the form of improvement of the competitive position and risk minimisation.

**PATH DEPENDENCE**

**Definition**

Path dependence can be referred to as the persistence of discernible historical elements within the lifespan of an organisation. These elements, which can be of organisational or technological nature, pervade organisational life in a path that stretches from the past to the present.

The past present connection may be useful in providing answers to questions as to why some things tend to be the way they are in contemporary times.

Most authors concur over the essence of history in path dependence and the inherent role that history can play in shaping the life of an organisation. Sydow & Schreyögg (2009) describe path dependence as “all kinds of imprinting effects of the past on organisation behaviour.” David (1985) argues that these historical events can be temporally remote, and can also include events that happen by chance. Arthur (1989) also acknowledges the chance element in the historical events, but adds that the events themselves are insignificant when generally considered.

He argues that historical events can by chance give market advantage to a technology or a product. The recognition of the powerful influence of historical events in
organisations and technological domains is not in dispute even though different authors point at the insignificant nature of these events. This position is captured by Ruttan (1997) who stresses that the gravity of path dependence lies in the importance of specific sequence of micro-level historical events.

Properties of Path Dependence

Non-predictability

Path dependent processes are those whose outcomes cannot be determined in advance (Sydow et.al, 2009).

The presence of increasing returns arising from chance events, render the market knowledge, and the awareness of the potential technological possibilities insufficient in predicting the outcome in the market (Arthur, 1989).

Non-ergodicity

Path dependent processes have multiple outcomes but history selects among the possible alternatives (Sydow et.al, 2009).

Past events are a common feature of path dependent processes and therefore history cannot be shaken off, wished away or ignored (Arthur, 1989), (David, 1994).

Inflexibility

There is a tendency of actors being unable to shift to another option (Sydow et.al, 2009). In path dependent processes, emerging outcomes become gradually more “locked-in” (Arthur, 1989). Inflexibility can also arise from irreversibility of investments (David, 1985), (David, 1994).
Inefficiency

Inefficiency arises when path dependence leads to the adoption of inferior solutions (Sydow et.al, 2009) through lock in. Arthur (1989) while singling out increasing returns as the main driver of path dependence argues that pursuit of increasing returns may lead to the adoption of a technology that is inferior. David (1985) illustrates inefficiency through his account of the economics of QWERTY, where it was a known fact that there were better alternatives to the QWERTY keyboard, but it nonetheless carried the day. The case given by David is that of the Dvorak Simplified Keyboard which lost to the inferior QWERTY keyboard.

Drivers of Path Dependence

Increasing Returns

Increasing returns is perhaps the most prominent and overriding drivers of path dependence when compared to the other drivers of path dependence. Increasing returns in essence incorporates all the other drivers. This notion is captured by Arthur (1989), one of the leading authors in this field.

Arthur highlights the properties of increasing returns, that are similar to those of (Sydow et.al, 2009), whose article has been used as reference when listing path dependence properties in this thesis.

Where increasing returns are realisable, investments are likely to be irreversible; i.e. shifting to another option looks remote. Increasing returns can also be achieved in cases where there are interrelatedness say of technologies, and even in those cases where complementarities exist. To emphasize on the last driver of path dependence which is learning, Arthur (1989) argues that the more modern complex technologies register
increasing returns to adoption, *the more they are adopted and the more experience is gained with them, and the more they are improved.*

Improved technologies have the potential of yielding increasing returns. Ruttan (1997) attributes technological lock-in in a later stage in path dependence to network technologies whose existence is owed to increasing returns. David (1985) mentions one of the reasons that led to the lock-in to the QWERTY keyboard as economies of scale arising from intersystem competition. The larger production system that created synergy effect due to system compatibility consisted of manufacturers, buyers, operators and organisations that undertook the job of training people in the typing skills.

**Irreversibility of investments**

Investments are likely to become irreversible in circumstances where a firm is experiencing increasing returns, and where the cost of switching to another investment is enormous. The cost factor does not only involve investing new capital but also looming unpredictability of results associated with the new investment, especially if it is in a domain that has a small market share. Failure by the new investment to generate results redirects focus on the cost of the investment and the inherent loss.

The case of fear of losses associated with new investments is highlighted by David (1994) through his example of the necessity of information channels and codes in facilitating communication in organisations.

He argues that the codes once learnt, become self-re-enforced and any attempts to shift to new ones can not only imply more costs being incurred to instil the new codes, but can also result in unpredictable outcomes. David (1985) in his analysis of the QWERTY keyboard argues that QWERTY was adopted as the single predominant keyboard design due to high costs of software conversion and the resulting irreversibility of investments in specific touch-typing skills which were adapted to the QWERTY keyboard.
Interrelatedness and Complementarities

Path dependence is likely to persist in situations where elements are interrelated or where there are some forms of compatibility. As David (1994) puts it, “some solutions fit together with others more logically”. Another case of interrelatedness is highlighted by David (1985) in his analysis of the dominance of the QWERTY keyboard. He talks of a large and complex system of production comprising manufacturers, buyers, and operators and organisations offering training in typing skills, all who needed to work with a certain standard for all to gain economically. Besides compatibility in the larger production system, there was the need for system compatibility between the keyboard software and hardware.

Path dependence is also likely to be entrenched in cases where compatibility brings with it benefits such as the synergy effects (Sydow et al., 2009).

Learning

The principle of learning holds that more experience is gained with repeated performance of an operation. The experience gained has implications on efficiency (Sydow et al., 2009).

The gains include speed, reliability and error minimisation, all of which lead to decreasing costs, with the reverse effects on returns.

When firms experience increasing returns out of doing what they have experience in, they are likely to continue on the same path. A case in point is the dominance of light-water reactors in the US nuclear industry (Arthur 1989). The reactors were first constructed and used by the US Navy, and thus subsequent construction contracts were mostly awarded to the Navy. Learning and early experience in nuclear reactor construction by the US Navy led to the dominance of the light-water reactors in the US nuclear industry.
Path dependence and technology

Evidence that technology is path dependent is provided by different authors in the field of path dependence. Ruttan (1997) argues that it is undisputed that technical change is path dependent, as it (technical change) evolves from previous efforts of technological development.

Corroboration from Rosenberg (1994) is found in the argument that a given stock of technological knowledge at any given time is best understood by examining the history of that knowledge. His examination of the Science and engineering indicators index in the USA also reveals a pattern of continuous change. Most funds allocated to R&D, went into development of existing brands other than research; this presents a strong case for path dependence.

Technical Change

The two major theories of technical change are the “demand-pull” (Dosi, 1982), (Ruttan, 1997) and the “technological push” approaches. The demand pull theory emphasizes the importance of market forces as the drivers of technical change.

The conditions depicting this approach are that there is recognition of needs to be satisfied by technological efforts (Dosi, 1982). But these needs cannot emerge before the basic inventions to which they are related. Consumers’ demand patterns reveal consumer preferences, which become more conspicuous as levels of income rise. Producers take cue and embark on the innovative process to satisfy the emerging preferences (Dosi, 1982).

The technology push theory lays emphasis on R&D, with scientific inputs playing a leading role in the innovative process. The innovative process involves complex R&D activities for long term planning as opposed to the demand-pull alternative where action is based on market signals.
Technology

What is technology?

Dosi (1982) describes technology as a set of pieces of knowledge with both practical and theoretical dimensions. Practical knowledge is that which is related to existing problems and devices.

Theoretical knowledge on the other hand, (Dosi, 1982) is that knowledge that has the potential of practical application, although not necessarily already applied. Technology can exist in the form of know-how, methods, procedures, experiences of success and failure as well as physical devices and equipment.

Technological Paradigm

As we are dealing with path dependence, which in literal terms refers to movement along a given path, it is therefore plausible to talk about continuous change when path dependence comes to mind.

Based on the path dependence continuous change linkage Dosi (1982) argues that continuous changes are in most cases related to progress along a technological trajectory defined by a technological paradigm.

A technological paradigm according to Dosi (1982) is a “model” and “pattern” of solution of selected technological problems based on selected principles derived from natural sciences and on selected material technologies.

Dosi (1982) asserts that success of a technological paradigm depends on the choice of which directions of technical change to pursue and those to neglect. The emergence of a technological paradigm and its preference over others is an indication of progress along a direction of technological development and an allusion to the common view that scientific breakthroughs are limited in relation to the total number of problems and puzzles potentially allowed by scientific theory.
Dosi (1982) argues that a number of factors play a crucial role as far as the success and emergence of a paradigm is concerned. These are economic forces, institutional and social factors. Institutional pressures can arise from the interests of organisations involved in R&D, their areas of expertise as well as their technological history and lastly their very nature, whether public agencies or military.

Issues of whether practical application of a technology is conceivable as well as the availability of markets and potential profits are of economic concern, and carry more weight than institutional and social factors. Owing to their prominence (Dosi, 1982), economic factors increasingly define the actual path chosen among the several possible paths. Once the path is chosen, it exhibits a momentum of its own and helps to define the direction to which the problem solving activity moves i.e. the natural trajectory of technical progress.

**Technological Trajectory**

Dosi (1982) describes a technological trajectory as *the direction of advance within a technological paradigm* and also as *a pattern of normal problem solving activity determined by technological paradigm*.

However, in a more detailed description he describes it as a *cluster of possible technological directions whose outer boundaries are defined by the nature of a technological paradigm itself*. 
Properties of a Technological Trajectory

Certain properties of technological trajectories which support the opinion that technology is path dependent are discussed by Dosi (1982) as provided in the text that follows below;

- There are trajectories with more general attributes and those with more specific attributes, just as there are more powerful or less powerful trajectories.

- There are complementarities among trajectories. These can exist in the form of complementarities between different forms of knowledge, skills, and experience. Further development or lack of development in one technology can promote or frustrate development in other technologies.

- Progress along a trajectory is likely to retain cumulative features. The probability of future advances is related to the position a firm or country already occupies.

- Powerful trajectories are irreversible; such that it is difficult to switch to an alternative trajectory. Switching to an alternative trajectory can come with punitive consequences, as the new trajectory is likely to have a technological frontier (the highest level reached upon a technological path with regard to the relevant technological and economic dimensions) that trails that of the trajectory currently in use.
The theory on competitive strategy presented below has been exclusively taken from Michael Porter’s (2004) book on Competitive strategy.

The formulation of a competitive strategy is all about relating a firm to its environment where the term environment in this context implies the industry or the industries in which the firm operates. Competition in any given industry is in turn subject to the prevailing economic structure of the industry.

Porter (2004) argues that competition which determines profitability within a given industry depends upon five basic forces, and that a competitive strategy is defensive in nature. It either defends one’s position or influences the behaviour others to one’s favour. Strategy he continues is developed through an analysis of the source of competitive pressures in each of the five forces. The analysis exposes the strengths and the weaknesses of a firm and help define its current position and ultimately help in identifying areas which can be targeted for action to yield pay offs. Out of this effort the scanning for future opportunities and threats is also made possible.

Competition drives profits to the levels of those earned by firms in a perfectly competitive market, where firms can be said to be breaking even. Any profit above break-even is likely to lead to increased pace of activities. Incumbent firms within the industry with abnormal profits are likely to increase their investments. The abnormal profits will attract new entrants to the industry. But the magnitude of these activities is much dependent upon the five forces which have a firm influence on profits.

Some combination of the five forces can jointly affect competition and by extension profitability but the strategy formulation is heavily influenced by the strongest force or forces.

Porter exemplifies this with a scenario where a firm with a strong market position facing no threat of new entrants is likely to experience diminishing returns due to the presence of superior substitutes offering lower prices. Alternatively a firm facing no
threats from new entrants and substitutes is likely to see its returns diminish due to intense rivalry arising from firms currently existing within the industry.

**Threat of entry**

New entrants always bring with them new capacity and substantial resources. These can lead to a fall in prices and put incumbents in awkward positions especially if they cannot produce at a cost lower or equivalent to competition. Some incumbent firms while trying to fight back might see their costs sharply increasing in the face of falling prices, with the ultimate price as being put out of business. But the threat of entry depends upon how high or low the barriers are as well as how mild or severe the reactions of the incumbent firms are. Given below are some of the sources of barriers to entry of new firms into an industry.

- *Economies of scale*

These arise from falling unit costs over time in areas like production, R&D, purchasing, marketing, and distribution systems etc.

A large scale entry elicits strong reaction from incumbents while small scale entry is too costly for new entrants in terms of set up costs.

- *Product differentiation*

Strong brands and customer loyalty built over a long time through advertising and customer service create barriers to potential entrants. Undoing the loyalties would demand massive spending on the part of the potential entrant.

- *Capital requirements*

New entrants face huge capital requirements for advertising to compete against incumbent firms. Funds are also required to engage in R&D as well as for meeting start-up costs and to finance production. All these requirements of funds might prove to be too much for a potential entrant.
• **Switching costs**

Retraining, switching from one supplier to another, cost of new equipment to enter the new field together with the need for technical help in the new field are some of the issues that might lead to escalating costs for the new entrant. For the new entrant to entice buyers to switch to it, it must keep the switching costs low and offer superior performance.

• **Access to distribution channels**

There is a serious need for the new entrants to secure distribution channels as the existing ones are already serving the incumbent firms. Measures such as offering price breaks and advertising allowances, as well as product promotions are some of the ways through which new entrants can secure distribution channels.

• **Cost disadvantages independent of scale**

Incumbent firms create barriers through protecting their technological know-how with patents. They also lock out potential entrants from favourable access to raw materials. The favourable locations occupied by incumbents also give them advantage over new entrants who would probably have to pay more if they are to get a favourable location. This is because the advantages that accrue by virtue of occupying these locations cause their prices to appreciate. In some cases the activities of incumbent firms are subsidised. The subsidies coupled with accumulated experience due to many years of operation within industry make incumbent firms formidable opponents for new entrants.

• **Government policy**

Government policies like regulation on licensing requirements, and limiting accessibility of raw materials can create barriers to entry. Sectors most prone to government regulation include liquor, railroads and freight forwarding. Air and water pollution standards established by the government can also have an influence on the productivity of a firm. Firms with pollution levels above the average limit set by the government are likely to be subjected to payment of fines that erode their earnings.

**Pressure from substitutes**
Firms in any given industry in a sense compete with producers of substitute products, and this erodes some of the profits the incumbent firms would have earned. This competition is mainly price-performance based. If substitutes which by definition are products performing the same function as any given product in an industry, can offer a good bargain in terms of price relative to performance, then industry incumbents are worse off. One remarkable thing however is that substitutes limit the earnings of incumbent firms even during periods of economic boom when these firms are expected to reap maximally.

In order to compete effectively in industries with substitutes, it is important to identify the substitutes, but this has proven not to be an easy task.

In some cases collective action by incumbent firms such as pricing better than substitute product producers can save an industry from the onslaught of substitutes and improve its performance and position.

It is important that extreme care be exercised while dealing with substitutes that are subject to fashion. This is because moving with the fashion improves these substitutes’ price-performance in relation to industry products. The same case applies to substitutes produced by industries that earn high profits. The substitutes that are subject to fashion and those produced by high profit earners easily snatch markets from industry players. Porter uses an example of the security guard industry, and electronic alarm systems as a substitute. He observes that the security guard industry easily loses out to the electronic alarm systems when cost considerations are taken into account. He suggests that the best way for the security guard firm/industry to compete is integrate the electronic alarm systems advantages into their product offering in the form of guards performing their duties with the help of the electronic alarm system.
Intensity of Rivalry

The intensity of rivalry within an industry is always triggered by the opportunity to improve a firm’s position. And since firms within the industry each compete with one another to improve profitability, every action by one firm does not go unnoticed. Some of the activities characterising internal industry rivalry include price competition, increased customer service and advertising battles among others. But intense rivalry can stifle industry growth as competition is intensified within the existing markets with individual firm expansion initiatives limited to within the industry. They also lead to high fixed or storage costs due to the rush to fill excess capacity, hence lowering of prices. This leads to high costs in proportion to value added. Intense rivalry likewise does not exhibit any differentiation traits as competition is based on price or services.

Bargaining Power of Buyers

Buyers compete by forcing down prices, playing competitors against each other, craving higher quality products or services as well as demanding more services; all these at the expense of industry profitability. The question of how powerful or less powerful buyer groups are depends on the market characteristics and the prevailing conditions in that market in which they are actors. Buyer power also depends on the size of purchases they make in relation to their businesses. Buyer power can originate from the following conditions:

- Concentrated buying/purchase of large volumes relative to seller sales

Large volume buyers expect results in the form good profit margins from the sale of what they have purchased, and therefore purchases are crucial to their businesses. This
makes them to seek lower prices when making purchases, so as to be able to earn profits. Buyers exert more power in fixed costs industry, where they know that low cost production possibilities are real and can allow them to argue for making purchases at lower prices.

- Purchases from industry forming significant fraction of buyer’s costs/purchases

Buyers always seek to spend necessary resources to buy selectively and at favourable prices, but they care less about price if what they buy is insignificant in relation to their costs or total purchases.

- Purchases of standard and undifferentiated products

Assured of finding alternative suppliers, buyers will play firms against each other in order to get a better deal.

- Few switching costs

If the switching costs are low for a buyer, then he or she can get a better deal from the current supplier by threatening to switch to other suppliers.

- Earning of low Profits

Firms earning low profits do not have enough to spend on purchases, hence low purchasing costs. But when earning high profits these firms will be price insensitive, as they have a little extra to expend on purchases.

- Threat of backward integration

Buyers can threaten suppliers with possibilities of self-manufacturing of the components they buy from the suppliers. Dangling such possibilities can win concessions for buyers. Partial manufacturing also serves to illuminate the costs involved in production and the buyer can use this as a bargaining tool.

- Buyer has full information

Buyers have power if they are fully informed about market prices and demand and supplier costs.
Bargaining power of suppliers

Suppliers can exert their power through threats of quality reduction and price increments. Other sources of supplier power are as follows:

- *Domination of supplier group by a few companies as well as their(suppliers) concentration in relation to industry they sell to*

Suppliers selling to fragmented buyers exert more pressure and influence in terms of quantity, prices and trading terms.

- *Absence of substitutes*

Competition from substitutes limits suppliers’ power even if suppliers are large and powerful.

- *Non-importance of industry as customer to supplier group*

In case of suppliers selling their products to multiple industries and sales to one industry does not account for a significant fraction of the total sales, suppliers are likely to exercise power. But if their fortunes are dependent upon the industry, the retention of the industry would be worthwhile through favourable pricing.

- *Supplier product differentiation/build-up of switching costs*

In the case of suppliers offering differentiated products and buyers are facing rising switching costs, the power balance is tilted towards the supplier and the buyers’ power of playing suppliers against one another is limited if not impossible.
- **Supplier’s product important input to the buyer’s business**

If the supplier is aware of the importance of the product it sells to the buyer’s business, it will exploit that vulnerability on the buyer’s part, most likely by raising prices.

- **Threat of forward integration**

Scarcity of labour as a commodity to be supplied can lead to its price increasing, due to lack of replaceable alternatives. Those in possession of rare skills can always bargain for more pay, and labour is more powerful if those offering it are well organised.

**NETWORKS**

De Wit et.al, (2005) argue that no organisation can exist without interacting with entities outside the organisation as they conduct their normal operations.

Before considering any interactions in detail, one simple reason in support of De Wit et.al’s argument is that organisations must carry out one of the most important activities, and that is to sell services or products. Most of the interactions an organisation engages in involve organisation stakeholders (De Wit et.al, 2005) such as suppliers, customers and governmental authorities among others. They further assert that while there might not be any strategic intentions in these interactions, many managers concur that influencing these interactions to the benefit of a firm is of strategic importance. If these interactions are well nurtured, a firm’s competitive position can be enhanced to improve profitability as observed by Porter (2004) in his analysis of five competitive forces framework.
**Network actors**

A network owes its existence to its members who we refer to here as network actors. De Wit et.al, (2005) identify two types of network actors as industry actors and contextual actors. Industry actors correspond to Porter’s five forces model involving five actors that determine industry profitability. These are suppliers, buyers, manufacturers of substitute goods, existing competitors, as well as potential industry entrants. These actors according to De Wit et.al, (2005) perform value adding activities or consume the outputs from these activities.

Contextual actors on the other hand are those whose actions both intentionally and unintentionally create conditions that govern industry operations. They include economic actors such as tax authorities, banks, and employer federations among others. Socio-cultural actors such as community groups, media and religious organisations are also part of contextual actors. Also falling under contextual actors are Technological actors such as universities and research institutes as well as patent offices and standardisation bodies. And lastly contextual actors also include political or regulatory actors in the form of governments, political parties, lobbyists, and international institutions.

In an effort to make the concept of network actors more comprehensible, a detailed description of who the various network actors are is necessary. However for relevance and practical purposes, only industry actors are addressed.
Industry actors

Supplier relations/upstream vertical

Every firm has a supplier of some sort, depending on what the supplier delivers to the firm.

Suppliers can provide raw materials, machinery and its components or business services. Providers of virtually all factors of production including land, labour, capital, information, technology and entrepreneurship are also considered under suppliers (De Wit et.al 2005).

Suppliers can produce inputs themselves, render services or act on behalf of others e.g. agents and distributors. Alternatively firms can have some other suppliers upstream in the industry hence the use of the term upstream.

Buyer relations/downstream vertical

Buyer relations of a firm include the consumers of a firm’s output in terms of products or services and even agents that trade in the given firm’s output. Just like with supply relations a firm can have relations downstream the industry, besides the usual buyers.

Industry insider relations/direct horizontal

Firms can and do relate with industry incumbent firms. This relationship is horizontal as the firms are at the same level in terms of the similar products and services they offer, to the market.

Industry outsider relations/indirect horizontal
Relations with external firms or outside industry firms can be necessary at times. Examples that necessitate such relations can have something to do with the nature of the product such as complementary products (software/hardware). Others that can enter into such relations are manufacturers of substitute products. The nature of the relationship is horizontal as a result of the closeness of the products to each other. Assisting or frustrating entry efforts of firms with entry potential to an industry as well as relations with firms in other unrelated industries with diversification intentions are also treated as industry outsider relations.

**Objectives of networking**

Any interaction between two or more firms is usually motivated by the inherent gains that the interaction is expected to yield.

While it is widely believed that firms join networks for the mutual benefits that are likely to accrue, there is risk that some might join for selfish individual reasons. Nonetheless, there is an overriding optimism that networks are built to benefit all the actors in a way or the other.

**Knowledge development**

When firms with different knowledge backgrounds and skills exchange knowledge, there is a possibility that the exchange can lead to the emergence of a new product idea or a process (Håkansson, 1987).

On the same account the exchange can breed innovative solutions, (Håkansson1987), (De Wit et.al, 2005) to improve product quality, create multi-competence and add to the stock of existing knowledge. Such an exchange according to De Wit et.al, (2005) promotes organisational learning. Interactions of this kind, allow firms with certain technologies that they are currently not fully exploiting to pass it on to others who can fully exploit them (De Wit et.al 2005). This is usually done through licensing. These firms gain financially through licensing their technologies but they can also get other
knowledge resources in exchange. The act of one firm letting other network members use the knowledge they have developed can also be useful in buyer seller relationships, (Håkansson, 1987) where buyer knowledge can be passed on to the seller so as to improve product quality and hence customer satisfaction.

**Resource mobilisation**

A firm might possess a brilliant idea in the form of an invention, but due to limited resources it might not be able to turn it into an innovation.

When there are signals that the invention can be commercially exploited, it will draw the attention of the network actors which stand to benefit from it.

But it is not only the attention of network insiders that will be drawn, even network outsiders whose systems and products can make use of the invention will be ready to invest funds to develop the invention to suit their needs. The invention will undergo modification and redesigning to make it applicable to various users. All these resources directed towards the development of the idea or invention, in most cases cannot be in the possession of the single firm that came up with the idea, and in this way, the innovation is carried to another level by the resources availed by the network actors. Schilling (2008) on the same note argues that not only does networking bring benefits of resource and skill acquisition, it does so in a much faster and cheaper way compared to if a firm would decide to develop own in-house skills and necessary resources.

**Resource coordination**

It is not possible for a single firm to excel in all activities it considers to be value adding (De Wit et.al, 2005) and on the same note no single firm can generate enough resources to commit to knowledge creation initiatives on its own (Håkansson, 1987). This is because resources are scarce and thus a firm would be better off committing resources to initiatives that yield maximum returns. While the problem of resource scarcity persists the stock of knowledge is growing as time goes by, and firms need to acquire new knowledge if they are to remain competitive. Having noted that no firm can
isolate itself from others without experiencing difficulties, the solution lies in the specialisation of firms in different technological areas. The meagre resources available can then be used to finance the specialised initiatives, to create highly specialised units that can later coordinate to provide network members with the technological knowledge they so desire. De Wit et.al, (2005) however argues that firms can in addition to the pooling of knowledge resources; integrate their value chains with other network members with an aim of improving efficiency.

They identify an activity integration type he calls linking, which is particular with buyer seller relationships. Linking is inspired by the need to specialise in a limited number of value adding activities and requires inputs and people to buy the outputs.

The other type of activity integration identified by De Wit et.al (2005) is referred to as lumping, and this is where firms integrate their activities to achieve economies of scale.

**Position alignment**

The networking objectives previously addressed, apart from resource coordination, have predominantly addressed network benefits from the point of view of a single firm. The objective of position alignment has its main aim as collectively strengthening the bargaining power and position of network members (De Wit et.al, 2005). De Wit talks of leaning, a networking initiative that can take different dimensions such as jointly facing suppliers/buyers, working together to improve industry standards thereby building reputation for network members, as well as working together to weaken other industry actors or placing barriers for new entrants.

Network members can also improve their joint bargaining power or position through a joint lobbying action directed at contextual actors, such as political leadership and other regulatory actors. Through this they can strengthen their voice towards these actors and win concessions of the sort they deem crucial to their survival. Concordant with De Wit et al. (2005) position, Schilling (2008) presents a case of a more continuous and process oriented approach. She talks of networking of a type where for example, co-operation at technological development stage follows through to the commercialisation stage. Such types of networking can involve large pharmaceutical and small biotechnology firms, in
an arrangement where large pharmaceutical firms rely on small biotechnology firms for basic research that leads to drug discoveries. The small biotechnology firms in turn depend on the large pharmaceutical firms’ resources such as manufacturing and distribution, to channel their products into the market.

In this arrangement, both pharmaceutical and biotechnology firms enhance their positions through the mutual gains inherent in this relationship.

Types of Collaborative or Network Arrangements

Strategic Alliances

Strategic alliances are necessary when firms need to access critical capabilities that they do not possess (Schilling, 2008). In such alliances firms can exploit their own capabilities through leveraging them in other firms’ development efforts. The pooling of different skills and capabilities often facilitates faster technological developments as well as market penetration as compared to when firms carry out these activities individually. Schilling argues that large firms and small firms a can build strategic alliances and mutually benefit from each other. An example already mentioned under networks benefits of position alignment is the relationship between large pharmaceutical firms and small biotechnology firms, where the pharmaceutical firms make use of the knowledge on new drugs and the biotechnology firms get their drugs manufactured and distributed by the pharmaceutical firms. Strategic alliances allow for more flexibility (Schilling, 2008) as firms only dedicate a limited stake in a venture leaving them room to increase commitment where necessary or shifting to another opportunity.

Schilling also adds that strategic alliances can also act as an early window to emerging future opportunities, and allow for adjustment of type and scale of capabilities that are accessible, and lastly such types of alliances enable firms to learn from each other in order to be able to develop competencies either individually or collectively.
Joint ventures

Schilling, (2008) describes a joint venture as a type of strategic alliance that entails a significant structure and commitment.

To set up a joint venture she adds, requires a significant equity contribution from each partner and often a joint venture results into the creation of a totally new entity.

The capital committed in establishing a joint venture according to Schilling (2008), must be specified in carefully drafted contracts of agreements. The disposal of the profits likely to accrue from the operations of the venture is equally subject to a contract.

Licensing

Licensing is a contract based arrangement (Schilling, 2008) where an organisation or individual (the licensee) is granted the permission to use proprietary technology such as the trademark or copyrights of another organisation or individual (the licensor). Licensing enables the licensee to acquire technology or resources not in his/her/its possession at a much cheaper price compared to if the licensee developed the technology or resources on its own. Besides, the technology acquired is already technically and commercially proven (Schilling, 2008). Conversely licensing allows the licensor to penetrate a wider range of unrelated markets and make more money. The exploitation of the licensed knowledge outside its domain is not possible if the firm acts alone. But the benefits of licensing, warns Schilling (2008), should not be overstated as licensing can adversely affect technology owners. She argues that there is a possibility of the licensee building competence with the help of the acquired technology, thereby consequently eroding the value of that technology. Firms can also license their technology to their competitors to prevent them from developing own technology. In
this way they would rather earn royalties from licences than engage in fierce technology based competition (Schilling, 2008).

**Outsourcing**

Innovative firms at times do not always possess competencies, facilities and scale to perform all its value-adding activities effectively, and this argues Schilling (2008) calls for the outsourcing of the activities that cannot be catered for internally. Schilling (2008) identifies contract manufacturing as one of the solutions to inadequate capacity problems. Contract manufacturing allows a firm to meet the scale of market demand without long term capital investments and increase in labour force. In this way, she says, the firm that is outsourcing activities or parts enjoys flexibility and can thus have time to focus on competitive advantage enhancing endeavours, while contract manufacturers work to deliver the good/service or the activity that cannot be internally produced. Firms gain even more if they can devote more time to enhance their competitive positions, while outsourcing products/services or activities at a comparatively cheaper rate than if they were to do everything on their own. Other benefits identified by Schilling (2008) are economies of scale and ability to respond to business environmental changes. However, just as is the case with licensing, outsourcing can pose a risk to the firm relying on it as a source of supply. Schilling (2008) points out one major risk involved as over reliance on outsourcing at the expense of in-house competence development. The other risk she mentions is the high transaction costs, inherent in contracts. Product design, costs and quantity requirements have to be well and precisely specified in contracts.

**Collective Research Organisations**

In some industries co-operative research and development organisations are set up as a joint initiative of both industry and government (Schilling, 2008). Private firms can however, also take the initiative of setting up joint research centres.
Schilling (2008) exemplifies this with the case of Japanese firms among them Fujitsu, Hitachi, Matsushita Electric Industrial, Mitsubishi Electric, NEC and Toshiba, all who setup a collective research company called Aspla to develop designs for more advanced computer chips.
EMPIRICAL DATA

In this section the collected empirical data in this report is presented. It begins with a short autobiography of Lars Magnus Ericsson up to the time he founded the company. This is then followed is a description of the general industry conditions and lastly, data on the company is presented at a firm level. The text about the autobiography of Lars Magnus Ericsson has been exclusively taken from Peter Karlson and Johan Erseus’ book of Swedish genius, while the text on industry conditions and other data relating to LM Ericsson have been taken from Artur Attman and Jan Kuuse’s book on LM Ericsson 100 years, volume 1 (The pioneering years. Struggle for Concessions. Crisis). Additional text touching on the LM Ericsson’s telephones and the early history of the development of the telephone touching on the three fundamental functions based on electromagnetism come from Christian Jacobaeus book on LM Ericsson 100 years, volume 3 (Evolution of the Technology).

A short autobiography of Lars Magnus Ericsson

Lars Magnus Ericsson was born on the 5th of May 1846 in the Värmskog parish of Värmland in Wegerbol village between Arvika and Karlstad.

As a child his talents had already began to show. He could take a pencil and draw fine sketches of houses, machines and household utensils. If given a tin can he could make a music box for his sisters and brothers. And give him an engraving tool and he could make small precise seals; a manifestation of works of art that would soon lead him all the way to Stockholm. The Wegerbol neighbourhood in which Lars Magnus Ericsson grew up was typically agrarian. Going by his looks, he appeared strong to fit in the agrarian setting, and he was commonly referred to as the “saw-horse” because of his box-like build.
As noted before Lars Magnus Ericsson was very handy, and he had a great enthusiasm for this. He never completed more than five years of schooling, but he could read and write despite his limited education.

Some events that took place in Lars Magnus’ childhood were remarkable enough and defined who he became in adulthood. At one time he tested his skills on the central bank’s sacred currency. He and his friends had a habit of spicing up their card games with fake coins punched out of tin scraps. Young Lars Magnus Ericsson however took this a step further by imprinting the fake coins with currency emblems and giving them the automatic ring, by adding pulverised glass to the molten tin. The fake coins soon found their way out into the community, and were in circulation. This drew the attention of the district superintendent of police, who apparently knowing who the counterfeiter was, jokingly blamed youthful energy to be behind the act. Counterfeiting currency was a criminal act punishable either by whipping or prison; however nothing was done to Lars Magnus Ericsson. The superintendent treated the whole affair as a small practical joke.

Following this incident, evening village gossips became rampant and Lars Magnus Ericsson grew frustrated by the development. Apart from the annoying gossips, he became frustrated by the less progressive life in the Wegerbol village. The agrarian life was nothing for him because he knew he could do greater things elsewhere. He was stuck here in the village where working at the Staid Borgvik factory paid 25cents per hour. In this village they scoffed at his suggestions of improving the harrows and the milk carts. He was stuck in the village transporting silver ingots by horse and cart as his father did, from the mine up in the forest, only for meagre wages.

At the age of seventeen in 1863 Lars Magnus Ericsson conceived the idea of the telephone long before Alexander Graham Bell registered his patent. Sweden’s first telephone line was put in place between a red dwelling in a forest clearing and a little smithy built of branches and peat down by the marsh. In his smithy Lars Magnus Ericsson was at peace, thinking and building and did not even need to go down to the village shop. Why did he have to anyway? He could communicate with the outside world through the string he had attached to the peat roof. His mother thought it was a crazy idea and wondered why he took his time with the telephone idea instead of
making a living out of the soil as the family did. Speaking to someone through a thread sounded lunatic at least, but it worked if the thread was stretched tight and attached to two cans. Lars Magnus Ericsson had already mastered the trick. He had stretched an ox-bladder membrane, commonly used by the poor to approximate window glass like drum skin over wooden pot.

By scraping her finger nails across the slightly rough surface, his mother could signal that the potatoes boiling in the wooden stove were ready. It was a little wonder she had to admit.

Lars Magnus Ericsson had read about a German school teacher Johann Philip Reis who had built something called a “telephone”. It was like a telegraph but emitted words instead of beeps. “I should be able to make one of those”, he said to himself. “Just think mamma, I could stretch a wire to the church so that we can listen to the sermon from home”.

He retreated to his smithy to work further on this brilliant idea. Under the peat he was constructing an instrument with five components; a bladder retrieved from the most recent porky Christmas dinner, fastened to a metal plate, a pin, a wire charged with weak currents and an electromagnet. This was the first Swedish telephone using the same basic principle for all telephony.

The telephoner speaks at a membrane; the membrane vibrates, producing in turn vibration in the pin. The movement is transported via a wire charged with weak currents to another telephone where another membrane is made to vibrate by another pin. It was simple but brilliant. It was unimaginable that such an idea occurred to someone deep in the forests, far from learning institutions and industries.

Lars Magnus Ericsson would always stick out with his lack of higher education. The great potential he had convinced him that he could rise to greater achievements. He was a genius without papers when he ventured into Stockholm. His stubble was thick and his hands rough from work on the farm. Before he moved to Stockholm, he had worked at the mines, and also as railroad builder. He also engaged in apprentice smith, and worked in various workshops in Charlottenberg, Karlstad and Arvika. All his jobs were poorly
paying but during his free times, he engraved and sold seals. The small capital he saved allowed him to take the plunge and move to Stockholm.

When he ventured into Stockholm at the age of twenty, the beginning was rough. Factory owners looked down upon him with his rural heritage. “No diploma? Sorry, young man but we have got a lot of applicants.

Come back when you have got an engineering degree”. Interestingly enough, it was his hobby of making seals that saved the day. The Öller & Company Telegraph factory was interested in seeing diplomas and certificates but all Lars Magnus Ericsson could fish out of his pockets was his evening hobby work. It was well drawn and Öller was impressed. Öller inquired from him if he could make nameplates and he replied he could.

He was given his first one week trial assignment of making company nameplates, for which he was to be paid 2kr a week. He did it excellently and was retained to work as an instrument maker.

Öller had founded a telegraph workshop in 1857, which manually manufactured materials and machines for Telegrafverket. Inspired by the need to have repairs, training and experiments close by, the government partly financed Öller’s firm.

Lars Magnus Ericsson on Öller’s advice obtained a government travel grant for further training studies and work abroad; a journey which took him to Germany and Switzerland between the years 1872 and 1875. While abroad he undertook studies in electro-technology and worked for one of the most prominent electrochemical engineering companies of Europe at that time; the Siemens & Halske of Berlin.
THE PIONEER YEARS

An overview of the evolution of telephone technology

Electromagnetism, the science on whose principles the telephone is based, was discovered as early as 1820 by a Dane named Christian Oersted. However the first application of this technology was on Morse telegraphy and it came fifteen years later in 1835.

The three functions that enable the telephone to function, all based on electromagnetism came about in a sequence of developments. The three functions are discussed below;

Transducer function

The transducer function was a major breakthrough in telephone development efforts. It enabled the conversion of sound waves into electric current and back to sound waves. The first practical results of sound transmission by means of continuous electric current were achieved by Alexander Graham Bell.

Bell’s device was simply an earphone for both transmission and reception of sound, but its transmitter function ran into problems due to weak currents.

Improvements to Bell’s device were done by among others Thomas Edison G.M Phelps, Francis Blake and Werner Von Siemens. The transmission problem was however by solved by Prof. D.E Hughes who discovered the microphone in 1878. The discovery emanated from his efforts of investigating variations of resistance in loose electrical contacts in which he proposed an arrangement with loose carbon rods that came to be called the microphone. Lars Magnus Ericsson made his first major contribution in telephony in 1879 when he came up with the helical microphone; an improvement of Francis Blake’s microphone. As the efforts to develop the microphone continued no outstanding achievements were made until 1881 when an American telephone engineer H. Hunnings made contributions that enabled commercial exploitation of the microphone. Hunnings’ carbon granule microphone was an improvement much more effective compared to the basic electromagnetic microphone.
Switching function

The switching function enabled the interconnection of speech circuits so that subscribers could speak to one another.

With this function came the telephone exchange, and just like the microphone, the telephone exchange underwent improvements as time went by. The first manual exchange was installed at New Haven in Connecticut in the US. In 1878. It was of a magneto system type which implies that it used local battery. By 1880, the multiple principle came into being. It was meant for larger exchanges and enabled all telephone operators to connect directly to all subscribers

Some of the notable improvements were also made by among others J.A Aven of Telegrafverket who came up with the call distributing system. The call distributing system enabled call distributing operators to extend calls to free service operators, who facilitated connections to desired subscribers through their multiple jack fields. Further improvements led to the development of automatic distribution where operators were replaced by switches.

By 1889 the automatic telephone exchange came into being. It was the work of an American Almon B. Strowger of Kansas City. In the mid 1890’s the central battery system for telephone exchanges came into use.

Transmission function

The last function that made the telephone system complete was the transmission function which involved the transmission of electric current between the telephone set and the exchange.

All the above three functions are basically what is needed for a telephone call to made. Telephone calls require a telephone set, a line and an exchange. Based on these, the argument is that those who worked with telegraphy knew in principle how a telephone could be constructed.
The birth and early growth of the company

On his return to Sweden in 1876, Lars Magnus Ericsson, had acquired sufficient knowledge in telegraphy and quit his job to open an engineering workshop with a former workmate at Öller’s workshop, one Carl Johan Andersson. Their firm was called LM Ericsson& Co. and was based at Drottninggatan 15.

The employees comprised the two founders and a twelve year old errand boy Carl Bildsten. The production borrowed a lot from Öller’s, with activities being of artisan nature and comprising mainly of repairs. Some of the tasks included the repairs of pointer telegraph instruments for the Railways Corporation, as well as the repair of Morse instruments for the public telegraph lines at the request of Telegrafverket. Repair works were also carried out for the Police, and the Fire Brigade. The two worked together until Carl Johan’s departure in 1886 leaving LM Ericsson as the sole owner of the company which became a limited company in 1896.

At the launch of the company the two founders commenced operations with a loan of 1,600kr and a contribution amounting to 2,300kr (Karlsson et. al, 2003) from both of them. The production equipment comprised two foot lathes (Karlsson, 2003) bought at a cost of 1,040kr and their first sales brought in approximately 5,000kr, with the Swedish Railway Corporation accounting for most of the sales revenue.

Enter the telephone

In 1877, Lars Magnus Ericsson became aware of Bell’s telephones’ imminent entry into the Swedish market through the Stockholm press. He came across a newspaper article headlined “Talking Telegraph”. One Alexander Graham Bell had invented a miraculous machine that transported words from one end of the telegraph to the other. This reminded Lars Magnus of the old pig’s bladder from Wegerbol. By early 1878, importers had already started bringing in foreign telephone models into Sweden. One of the importers Numa Peterson used to take his Bell type of telephones to Lars Magnus Ericsson for adjustments and repairs. But for Lars Magnus Ericsson who had fancied
the idea of making his own telephones, the encounter with the Bell type of telephones, was good news. Prior to this, he had gained some experience with the German Siemens & Halske large magnetic telephone. He could therefore compare the Bell and the Siemens models.

The Siemens model was based on the Bell model but it had better transmission qualities. These repairs and adjustments tasks introduced Lars Magnus Ericsson and his company to telephone technology and with the experience he began producing own telephones.

The success was however short-lived as the telephones were not connected to any telephone network in Sweden and therefore lacked market. Besides the Bell group of companies with full property rights protection, enjoyed monopoly in telephone operating services in most countries they had entered including in Sweden.

The telephone equipment they used moreover was sourced from the Company’s own plant of Western Electric Co. in Chicago. This made it harder for Lars Magnus Ericsson to sell the telephones he was making. In 1879 Lars Magnus Ericsson came up with its own independent invention; the helical microphone, an improvement on Blake’s microphone.

**Rapid Expansion (1880-1884)**

With LM Ericsson’s workshop still located at the rented premises at Biblioteksgatan 5 between the years 1880 to 1884 signs of the expansion of operations began to show, and transition from craft to industry was on going.

This was evident in the number of employees which had risen from 19 to 50 between the years 1880 and 1882 and work was divided between different departments with some degree of specialisation. The patriarchal system that prevailed at that time prohibited discussions on work execution, wages and working conditions. The foreman was highest authority on the workshop floor, and this was none other than Carl Johan Andersson who served until 1908. Each department was headed by a supervisor and
most of these positions went to Lars Magnus Ericsson’s former workmates at Öller’s workshop.

Owing to his background of limited schooling Lars Magnus Ericsson harboured some level of mistrust towards highly educated people and it took longer before educated engineers and economists were employed in the company. Training was an internal company affair and a system called the “helper” system played a central in training. The helper system involved the assignment of certain jobs to a team of workers led by a “skilled” worker, or a charge-hand as he used to be called. This skilled worker had a number of helpers, basically young men who would learn through helping the skilled worker to accomplish the assigned tasks. The helper system functioned more or less like an independent unit within the company, having been assigned a specific task quoted at a given specific price, and the skilled worker would train and pay his own ”helpers”. The machine shop and forge were the largest departments.

Other departments were the press shop, magneto generator production, microphone production, wiring of telephone sets and switchboards, assembly of receivers, and instrument making departments. LM Ericsson was expanding rapidly and the inadequacy of the instrument making department could pose problems leading to delayed deliveries and as such LM Ericsson was forced to contract out some tasks such as joinery, lacquering, nickel-plating and electroplating. This problem was however solved later with the acquisition of greater production resources.

Early training at Siemens & Halske made Lars Magnus Ericsson familiar with new production techniques, but his only set back was the shortage of funds to purchase more machines and equipment. He could only afford the foot lathes and a planning machine or two. The first drilling machine was bought in 1882 and a steam engine with 4-horse power in 1883 from J&C.G Bolinders Mekaniska Verkstad.

Stockholms Allmäna Telefonaktiebolag’s launching of telephone operations in 1883 meant that they had to place telephone orders with LM Ericsson, which as a result had to expand operations in order to meet the increasing demand. This led to the purchase of a factory site in Surbrunnsgatan now Tulegatan at a cost of 145 000kr for the purpose of putting up a new factory.
The new factory which was to commence operations a year after benefited from the purchase of an 8-horse power engine that was to contribute immensely to the expanding operations with SAT growing to become the biggest and reliable customer. Between the periods 1884 to 1889 the number of those employed increased to 100 up from 60.

In the same year LM Ericsson got in touch with a new German machine supplier, Rudolf Gebhart of Berlin from whom he could buy lathes as well as drilling and milling machine for mechanical production, but because of rigidity and accuracy problems, they could only be used in standardised and simpler operations and the rest of the work had to be done by hand. The milling machine was somehow revolutionary in that much of the developments in the production techniques revolved around it.

Mechanisation led to improved productivity with figures to the tune of 300,000kr in 1889 as compared to a meagre 10-15000 in 1870’s. Notable increment was realised between 1880-84 where employee productivity rose from 1600kr to 3,300kr, to beat the Swedish average engineering worker productivity that stood at 2500kr. LM Ericsson’s decision of beginning to bank with Stockholms Inteckning Garanti AB was a signal of expansion intentions, and earned profits were taken out in the form of reduced working hours. The working hours which stood at 65 hours in 1880 later fell by three hours in 1884 and by five hours in 1887 corresponding to a 12% decrease in a decade. Wages also rose, standing at an average of 1600kr, 66% higher than the national average and also higher than the average annual pay of the thirty largest workshops in Sweden which stood at 640kr. The wage structure was reflected on the company hierarchy where supervisors were taking home an average of 1900kr annually and “helpers” 700kr which was still better than the national average pay of engineers. The good remuneration together with the favourable number of working hours gave a good resource pool of workers for LM Ericsson.

The Swedish Telephone Industry

The foundation of the Swedish telephone industry was laid in 1879, when Telegrafverket granted permission for the construction of a telephone network in
Stockholm. The permission was granted to the managers of the Stockholm’s telegraph office amongst them H.Bratt, G. Lybeck and C.G.W Recin who led a private initiative to construct a telephone network. It was at this time that a telephone network with sets connected to a common exchange came into being, and it was then possible for interested parties to form a telephone company, a year later. But since there was no large scale production of telephones in Sweden the telephone company had to rely on the Bell Telephone Company in New York for delivery of telephones. The new company was Stockholms Bell Telefon AB (Stockholms Bell).

The 1880 launching of the telephone network in Stockholm encouraged LM Ericsson’s reorganisation of production especially with regard to telephone production. Lars Magnus Ericsson thus dedicated a lot of time in improving the helical microphone.

But the new telephone industry and its markets were dominated by the Bell group since LM Ericsson lacked the industrial production capacity to take advantage of the newly launched telephone network with its new helical fitted microphone telephone. The Stockholms Bell Telefon AB, a subsidiary of the Bell Group of companies had to invite the mother company to install and run Sweden’s first telephone exchange complete with a telephone network. The “old city” subscribers were paying a yearly fixed charge of 160 kronor while other subscribers in the rest of Stockholm were paying between 240-280 kronor depending on the distance from the exchange. The Bell group continued expansion by opening telephone traffic through its subsidiaries in Gothenburg, Malmö and Sundsvall in 1881 and Söderhamn in 1882.

The Birth of Competition

A tender for the installation and running of a telephone network in Gävle was announced by the Bell Company, as part of its continuing expansion efforts. A local businessman J.W Sundberg placed a competitive bid better than the company’s 200kr/year subscription fee.

His bid stood at a single payment of 275 kronor for finance and installation and an annual charge of 56kr. As the Gävle project was nearing its start, telecommunications
experts had approved of LM Ericsson’s sets compared to Bell’s. The GefleTelephone Association, the first one of its kind in Sweden was formed to install and run the telephone network in Gävle and the association accepted Sundberg’s bid. This meant that LM Ericsson was to supply telephone sets and switchboards towards this project.

The happenings in Gävle had significant ramifications for LM Ericsson. Market opportunities began to emerge with the growth of small private telephone companies in the Nordic region. The orders from the Nordic region spurred a turnover growth from 58,180kr to 26,7500kr between the years 1881 and 1883 respectively. On the local scene in Sweden new telephone orders were gradually being placed with LM Ericsson with Telegrafverket and SAT emerging as the two biggest customers as of 1883. Meanwhile the growth of telephone associations formed with the purpose of installing and running of telephone networks rose steadily such that by 1887, 64 out of 93 towns in Sweden had private telephone networks.

The telephone associations were determined to supply members with cheap rates, and therefore they were destined to source locally for Swedish telephone equipment with competitive prices and quality. And since their emergence was out of dissatisfaction with the Bell group’s high tariffs, they were by no means expected to buy their equipment from the Bell Company. The average charge in 90 associations was as low as 23kr, and this implied that neither the Bell Company nor Telegrafverket could compete with LM Ericsson.

Despite high installation and running costs hindering many households from installing telephones, the associations low cost concept help spread the use of telephone in Sweden.

Telegrafverket, which had been buying equipment from the Bell Company, abandoned its former supplier for LM Ericsson when it embarked on its nation-wide Rikstelefon network project. Earlier it had relied on the Bell company telephone sets for the installation of a telephone network in Stockholm between the Ministries and the central administrative boards. LM Ericsson’s entry and surge in the Swedish market from 1881 onwards gradually limited the impact the Bell Company had in Sweden.
In Norway a Swede called Carl Söderberg, who was the director of Kristiania Telefonförening in Oslo, became the first foreign customer.

He was operating in Kristiania where the Bell group had won concession and was charging high prices as was the tradition. Carl Söderberg was attracted by the good rates that LM Ericsson was offering and started a private telephone association. Besides telephone services, he also sold telephone equipment and other electrical goods all bought from LM Ericsson. Later in 1882 he ceased buying merchandise from LM Ericsson and merged his business with that of a Norwegian jeweller O Torstrup to form a company by the name “Elektrisk Bureau” Kristiania to manufacture equipment for use in both telecommunication and electric power sectors. LM Ericsson sets were used as prototypes, and thus they had a customer turned competitor.

Lars Magnus Ericsson became aware of the happenings but did not take it negatively with an argument that he also benefited from both American and German knowledge through developing his telephones using foreign prototypes.

The two biggest foreign customers as of 1882 were private telephone operating companies in Turku (Åbo) and Bergen but foreign expansion was on the increase towards the end of the decade.

LM Ericsson’s entry in the markets outside the Nordic region was done indirectly through an export agent.

This agent’s name was Charles Bell, a Scot who was interested in spreading the telephone use in Europe mainly in his native Britain and Russia. In Britain he did business with the National Telephone Company while in Russia the going was not easy due to the strong presence of the Bell Company that had in essence locked out LM Ericsson from the big urban centres of Moscow, St. Petersburg, Warsaw, Riga and Odessa. The remaining small towns however provided market for LM Ericsson and Charles Bell continued supplying them with telephones until towards the end of the decade when the relationship between LM Ericsson and Charles Bell collapsed over Bell’s demand for commission payments for the work he had done.
**Cedergren’s Stockholms Allmänna Telefonaktiebolag (SAT)**

Back in Stockholm a Swedish engineer by the name Henrik Tore Cedergren took a more decisive stance to register his dissatisfaction. He had envisaged the importance of telephone in society and wanted to spread its use. He knew that this would only be possible if the installation and provision of telephone services was affordable to citizens.

In his endeavours he coined a slogan “A telephone in every household in Stockholm” and this resulted in the formation in 1883 of a telephone operating company by the name Stockholms Allmäna Telefonaktiebolag (SAT). And SAT had to rely on LM Ericsson as the provider of telephone equipment.

The formation of SAT and its collaboration with LM Ericsson as the supplier of telephone equipment marked the beginning of the battle for the Nordic telephone market. Cedergren formed SAT out of the dissatisfaction with the Bell group’s high subscriber charges, and for him to take on the Bell group, he needed another supplier of telephone equipment, and this was none other than LM Ericsson.

Though lacking experience in telephone operations, he nevertheless took the courage of challenging Stockholm’s Bell; a subsidiary of the Bell group of companies that had been operating telephone services in Stockholm.

He knew he could compete successfully against the Bell Company, since he could rely on LM Ericsson for the supply of affordable telephone sets and the exchange equipment. The initial stages of Ericsson Cedergren collaboration were marked by problems owing to their character differences. Ericsson was a highly industrious and cautious character who manufactured his products with care, relying much on his thorough and long practical training which gave him leverage in precision mechanisms of the telephone industry, but he was not social. Cedergren on the contrary was sociable with a network of contacts and active social life. He was enthusiastic and full of ideas; entrepreneurial and financially far-sighted and beamed with confidence probably due to his Stockholm heritage.
But since Cedergren’s actions were aimed at taking away the market share that the Bell Company enjoyed, he needed to be ready for a tough protracted competition. He thus needed a strong backing and as a result entered into a mutual supply agreement with LM Ericsson with many doubting whether Cedergren would match the level of expertise and financial leverage possessed by the Americans. Cedergren’s SAT attracted diverse and broad groups of subscribers within the population than the main competitors Telegrafverket and Stockholm’s Bell. SAT’s subscription charges were about half of that charged by Stockholm’s Bell. More of Bell’s customers gradually began to switch to SAT.

In order to keep costs lower and compete successfully SAT intensified its collaboration with LM Ericsson especially in the area of product development. The intention of the collaboration was to benefit both parties in the long run. One of the notable successes derived from the intensified collaboration occurred in the field of telephone exchange with the manufacture of small automatic switching devices for two or five lines for subscribers with low call frequency. This device made it possible for the same exchange line to serve several other subscribers. The net effect of this was a further reduction of subscription fees, and this meant that many more people in Stockholm could subscribe for telephone services.

The number of subscribers increased rapidly with the reduction of the subscriber fees, and this exerted pressure on the exchange system.

A high capacity exchange system was therefore highly needed, but interestingly, the solution to this problem had been invented some years back in 1879 but had not been put into use. C.E Scribner the chief engineer at Chicago factory of Western Electric Company, part of the Bell group, had invented the multiple system with patents only in Britain and the USA. The multiple system enabled a greater number of calls to be made by one and the same exchange. Earlier switchboards had limited capacity of 50 lines with a capacity of exchange of about 1000 lines but with the multiple system up to 10,000 lines could be served.

In the absence of the multiple system the only available option was to extend a large number of central exchanges in large towns especially when the number of subscribers
increased. This would result in inconveniences and slower services and hamper the development of telephone networks.

But thanks to the multiple system solution that was provided before the market called for it, and the fact that patents were only restricted to Britain and the USA, LM Ericsson and SAT during the year 1884 employed the invention to construct a multiple switchboard based on the technical description of the American multiple system that they obtained from a foreign publication. In 1885 Cedergren and Lars Magnus Ericsson made a trip to the USA to study the telephone industry. They discovered that Americans were ahead in exchange equipment technology. They had developed the multiple system further and costs had been reduced considerably. They took with them some of the improvements to be incorporated in SAT’s new exchange that was under construction.

Initially the switchboards made by LM Ericsson and SAT were intended for use in test units but they proved to be successful and were used by SAT in its exchange in “old city”. This was probably the first multiple switchboard in Europe. The success of the new switchboard technology led SAT to install a large telephone exchange at Malmskillnadsgatan in Stockholm in 1887, and the equipment was supplied by LM Ericsson.

The telephone exchange had a capacity of 7000 lines with 4800 connected subscribers and was the world’s largest at that particular time.

With regards to the telephone sets, the American techniques were not impressive. Here, again the collaboration between LM Ericsson and SAT proved fruitful. SAT engineer Aton Aven developed the idea of joining the receiver to the microphone out of doing routine line tests that proved to him that it was convenient to work with a single unit. Aven joined the receiver together with the microphone, with a wooden handle. Lars Magnus Ericsson was told of the idea and he used it to make a more attractive product. LM Ericsson made the microphone and the receiver parts more compact producing a slender handset. LM Ericsson’s handset became popular and was used as a prototype by several European telephone manufacturers.
The Bell group’s large production unit, Western Electric Co., however continued producing the group’s old telephone model of separate receiver and microphone. LM Ericsson’s new concept of receiver and microphone in a single unit was widely used in Europe than in America, but the Bell group later on approved the superiority of the concept and had no choice but to adopt it.

Common problems and interests in the communication sector formed the bedrock of the relationship between the two firms, and were in deed the catalysts of the collaboration between Cedergren’s SAT and LM Ericsson especially in production engineering, where the diverse qualities of idea richness, enthusiasm, caution and reflection were called for in order to achieve sustainable success. The industrial revolution that was taking place at this time led to the increasing growth of firms with growing needs of extensive and quick communication, and this implied that the collaboration between the two was to be stepped up to meet the new challenges that developed with time. The strong collaboration intensified and began encroaching on Bell group’s market share.

The Bell group’s monopoly in Sweden was under a threat and there were signs of decline. The Stockholm subsidiary continued operation but faced competition from SAT and the competition got stiffer from 1883 onwards.

The Bell Company’s operations were on the decline and by 1883 the local Bell subsidiary in Malmö was bought by Telegrafverket though it still bought its equipment from the Bell Company for a year or so. The 1883 formation of Allmäna Telefonföreningen in Gothenburg began the preparation for exit of the Göteborgs Bell Telefon AB, which finally succumbed by selling its network to Telegrafverket in 1888. A similar fate befell Bell subsidiaries in Söderhamn and Sundsvall. By 1885 LM Ericsson built and equipped a new telephone exchange.

In Norway the Bell Company got into trouble with the reverberation of the Gävle effect, when the application for a concession for telephone operations in Bergen was rejected in favour of LM Ericsson. An association by the name Bergens Telefonskompagni was formed and LM Ericsson got one of its first foreign orders for telephones. LM Ericsson’s entry into foreign markets continued thanks to the Gävle and Bergen effects which led to more associations being formed in Norway, Denmark, Finland and Russia.
The Bell group failed the pricing test in which they were beaten by the telephone associations which offered lower tariffs, but it is also important to note that the success of the private services hinged on the presence of LM Ericsson as a reliable source of equipment. But now that the small private telephone associations had caused LM Ericsson’s market to expand, it became clear that the expansion of the scale of operations was necessary to meet the rising demand. LM Ericsson reacted to this need by relocating to a much larger premise at NorrMalmsgatan now Biblioteksgatan 5.

**Suppliers**

In the late 1880’s procurement of raw materials accounted for 60% of production costs. Some purchases were done directly from manufacturers while others were from trading companies. Suppliers were both local and foreign though it was difficult to draw the line between the two. Some suppliers were foreign companies registered in Sweden, but there were also cases of Swedish companies furnishing LM Ericsson with goods imported from Germany and Britain.

Despite the identification problems domestic supplies accounted for four-fifth of the value of goods supplied to LM Ericsson. LM Ericsson bought magnet steel from England and also locally from Österby Bruk later Bernström & Co. of Stockholm. Other suppliers of magnet steel were German companies; H. Remy of Hagen in the Ruhr, the most important supplier in terms of value.

The second largest foreign supplier was the ebonite factory of Harburger Gummi Kamm Co. of Hamburg. The two German companies accounted for 15% of material purchases by LM Ericsson and three-quarters of supplied foreign goods.

Joinery was the most sourced of all the supplies due to the inadequacy of the instrument making department as stated earlier. Wooden parts of telephone sets such as casing and stands accounted for 30% of the goods supplied by value, but this later changed with the in-house production in the 1890’s. Another important raw material, brass was sourced
from Skultuna Mässingsbruk in Västmanland. Other suppliers of brass included Åkerberg & Hellström, and Ursell B both of Stockholm.

The rapid industrialisation that began in the 1870’s industrial revolution meant that commercial and industrial companies’ communication needs became greater and LM Ericsson was forced to cope with the pace, by acquiring a network of sub-contractors among them Max Sieverts wire and cable factory in Sundbyberg. Max Sieverts through his premises of Max Sieverts maskinaffär of 1884 was supplying LM Ericsson with insulated copper wire imported from Vogel, Germany. The development of telecommunication products in LM Ericsson centred on the telephone set and the equipment for the telephone exchanges and not the line connecting the set with the exchange, and the exchanges with each other. This meant that LM Ericsson could not engage in telephone operation services and thus did not need to apply for any concessions. Before 1920 the companies engaging in telephone operations were SAT and Telegrafverket with Sieverts cable works as the main supplier of cables.

The Bell group and Siemens engaged in the production of electric wire and cables as well as telephone sets and exchange equipment and this is because Bell was engaged in telephone operation as well as communications and electric power. Cable production at LM Ericsson only began after the merger with SAT.

The expansion trend of the 1890’s led to the increase in value of purchases from 0.2 million kr at the beginning of the decade to 1.7 million kr, at the end of the decade. Orders came from some 30 Swedish and 15 foreign suppliers mainly in the form of raw materials, semi manufactures and machine tools. Raw materials of which brass and copper wire were the most important, accounted for 48% of production costs. Other raw materials comprised ebonite, magnet steel, wood panels and screw iron. Wages accounted for 33% of the total production costs and other expenditure consumed 19% of the total production costs.

The demand that had been locally met by Swedish suppliers had grown bigger and additional supplies in the form of raw materials and semi manufactures came from Germany.
Two thirds of materials were purchased from Swedish suppliers with copper wire coming exclusively from Sieverts factory in Sundbyberg. Brass was locally sourced, with Skultuna Mässingsbruk supplying the bulk of the 40% that was locally sourced. Domestic supplies of brass rose to 70% by the turn of the century and Nordiska Metall AB was in addition to Skultuna Bruk supplying LM Ericsson with brass. Ebonite came from Harburger Gummi Kamm&Co. of Germany which accounted for 25% and one third of foreign materials supplied to LM Ericsson. Magnet steel came from Österby Bruk while wood panels were largely imported from the USA through local importing firms among them E. Bloms. Iron screw was also imported from Germany.

The single biggest and most important supplier from the beginning of the decade onwards was the Sieverts factory. LM Ericsson in turn became the Sieverts factory’s biggest customer accounting for between 35 to 40% of Sieverts factory total sales.

Other suppliers were Asten & Lyen of Stolberg and FA Lange of Auerhammer of Sweden and Berlin Rixdorfer Messingwerke and Elbinger Metallwerke in East Prussia. German brass works stood for 38% of LM Ericsson foreign supplies in 1897; a figure that fell to 23% by the turn of the century.

**Intense domestic competition and the decline of market share**

**Trunk Telephone Network**

The decision by the state telegraph company, Telegrafverket to build a continuous nationwide telephone network came to signify the beginning of the decline of LM Ericsson’s fortune in the Swedish market. The action triggered a flurry of activities that would finally see the long-time main customer SAT desert LM Ericsson.

Telegrafverket’s passive attitude to telephones had waned and it decided to fully commit itself to the telephone industry. The foundation for the trunk telephone network was laid in 1889, and the first move towards achieving a nationwide telephone network was to buy the majority of the telephone networks run by the private telephone
associations. These associations it can be recalled were the layers of the foundation of LM Ericsson’s markets, and by buying them, Telegrafverket was slowly eating into LM Ericsson’s market share. The launch of the trunk telephone network required large quantities of telephone equipment and electric wire and cables and the desire to be independent of supplies from LM Ericsson meant that investments had to be made to secure own supplies. To achieve the enormous supply needs, Telegrafverket had to set up its own factory in 1891, sending a clear signal that it was ceasing to become LM Ericsson’s customer but competitor instead. It purchased electric wire and cable to the tune of about half a million kronor per year at the beginning of the decade and the value increased to almost two million kronor by the turn of the century.

Cables were imported from abroad and electric wires were locally bought in Sweden, mainly from Sieverts factory and from Telegrafverket’s own factory. By the turn of the century 25% of material purchases in terms of wire and cable came from Sieverts.

Telegrafverket’s factory also supplied it with telephone sets and switchboards and was equally responsible for repairs. The workshop expanded ten-folds with the number of workers rising from 30 during its inception to 300 by the turn of the century. LM Ericsson’s scale of production was by far six times larger than Telegrafverkets, but the latter’s workshop was organised in an efficient way. Telegrafverket employed new production and energy techniques. Electric power produced by gas engines was used for electric production in Telegrafverket’s workshop already in 1894 as opposed to LM Ericsson which started with electric production after the turn of the century in 1914. The productivity in the workshop increased, with the yearly production per worker rising from 1600kr in early 1890’s and standing at 3600kr by the turn of the century. This was however still short of LM Ericsson’s production capacity by 10%. Telegrafverket could produce as many switchboards as they needed and the same was with telephone sets. The purchase of private telephone associations as pointed earlier took away market from LM Ericsson. The connection to Telegrafverkets network stood at 28% of telephones in 1889, and was at 97% by 1902.

Meanwhile with the nationwide expansion of the trunk telephone network continuing, competition stiffened, and for the first time the SAT/ LM Ericsson alliance’s domination of the market was threatened.
SAT with a strong presence in Stockholm, had earlier won a concession in 1891 from the state owned Telegrafverket to operate within a radius of 70 kilometres from Stortorget in central Stockholm. But Telegrafverkets new and rapidly expanding trunk telephone network threatened the 70 kilometre radius agreement between it and SAT. Telegrafverkets intentions of competing with SAT had become real and SAT hit back by first reducing subscriber fees to be later followed by the introduction of free calls throughout the concession area.

Telegrafverkets newly appointed Director-General Erik Storckenfeldt reacted by lowering tariffs too in a competition match which was more of a replica of the Bell SAT & LM Ericsson competition duel.

The intense competition led to the use of new technological advances in telephony, and costs were further reduced resulting in Stockholm having the highest density of and cheapest telephones in the world. This highly competitive atmosphere gave SAT the sense of breaking free from LM Ericsson which it relied on for the supply of telephone sets and exchanges. In order to compete effectively SAT set up its own factory in 1896, with the main purpose being to cater for the supplies it needed to compete. It probably felt that it was strategic to secure supplies from its own factory. Now that both Telegrafverket and SAT were battling for the Swedish telephone market and were no longer buying from LM Ericsson, the time to take action had come. LM Ericsson came to terms with the fierce competition and the reality that the Swedish telephone market it had dominated for some time was no longer guaranteed.

By the end of the century the use of the telephone was widespread in the commercial and industrial life of towns in Sweden as well as in administration. Rich families had also begun installing telephones in their homes, and this trend implied that the small Swedish telephone market was soon to be saturated. LM Ericsson however, was well equipped with competence that could ensure it a place in the crowded market. The earlier borrowing of American telecommunications’ technology had given LM Ericsson an edge over competitors as far as quality was concerned. He was good at product development and excelled in using the acquired technology to develop superior products. The high quality telephone equipment sold better than that of competition, as they were not only of high quality but affordable too. LM Ericsson had made a name
both in Sweden and abroad for high quality and affordable products, and it was this that informed the intention to intensify overseas presence and not only relying on the domestic market given the rising level of competition.

**LM Ericsson’s transition to Limited Company**

LM Ericsson became a limited company in 1896, the fateful year when it’s most important and trusted customer SAT deserted it. This happened twenty years after its establishment. This signified that the scale of operations had expanded with presence in international markets that needed to be fortified. Nothing in terms of policy changed when LM Ericsson became a limited company, as the aim was limited liability and hence no funds were sourced for expansion.

A statutory meeting held on the 12th of May 1896 arrived at a new name; Aktiebolaget Ericsson & Co. At this meeting the board members were also elected, with Lars Magnus Ericsson becoming the chairman and president of the board. Other board members were works foreman Carl Johan Andersson and Axel Boström. Axel Boström got employed at LM Ericsson way back in 1884, as a clerical officer, thanks his beautiful handwriting that fascinated Lars Magnus Ericsson. He got more and advanced clerical work to do throughout his stay at LM Ericsson, and rose through the ranks to become office manager. He was also charged with overseeing sales as well as formulating sales policies, and through this he built a network of agents around the world and won accolades.

The share capital of the new company stood at one million kronors with all the 1000 shares belonging to Lars Magnus Ericsson as payment for the real assets in the form of machine tools at Tulegatan factory premises, as well as fittings and inventory. Debts owed by customers as well as minor debts and bank reserves were excluded from what was sold to the limited company. A cash shortage thus ensued in the first trading years of the limited company and Lars Magnus Ericsson had to provide financial support from his own pockets to bail out the company as he was against external financing. He
retained 900 shares and the remaining 100 shares was divided among the rest of the board members with Carl Johan Andersson getting 50 shares and Axel Boström getting 5 shares.

Presence in foreign markets and the continuous expansion by LM Ericsson in these markets called for the increase in the scale of operations to meet the increasing demand. One major hitch that LM Ericsson had lived with for some time was the inadequacy of space in the premises which meant that some activities had to be contracted to outsiders. These activities comprised joinery, lacquering and electroplating.

In order to consolidate and integrate the different stages of telephone manufacture, LM Ericsson acquired land adjacent to its Tulegatan 5 factory site and a new factory was built to host the activities that were previously sourced from outside the company. This initiative as well as others expansion initiatives between 1897 to the turn of the century were financed by Lars Magnus Ericsson himself as the company did not go for additional finance at the time of incorporation.

The investments in the new premises saw the workshop floor space increase seven-fold with the workforce increasing to 1000 by the turn of the century. Production volume rose to 4.2mkr up from 0.3mkr and the annual production volume per worker stood at 4000kr, 25% higher than the average of the Swedish engineering industry. The number of working hours fell by between 5 to 10%.

The capacity increase at the end of 1880’s and early 1890 led to increased division of labour and specialisation. The number of supervisors rose from 9 to 23. Signs of the company leadership softening on the restrictive policy of non-employment of qualified engineers became evident with the employment of the first two qualified engineers. More employments took place within the last three years before the turn of the century. An office department held by Axel Boström with a workforce of 5 people was created to manage export sales. At the turn of the century however with the increasing scale of operations and complexity of products, there were very few trained technicians and administration was extremely modest.
The latter part of the 19th century witnessed the development of new production systems on the basis of the milling machine and improved turning technique.

The improvement in the turning technique was in the form of the turret lathe, with the moving part of the turret which enabled the changing of the lathe’s various tools by a single hand operation. The turning technique further underwent improvements through the development of numerous types of lathes for different purposes. The grinding machines replaced the file work, and mechanical surface finishing could be done with uniformity and precision measurement necessary for modern engineering.

The milling and turning technology was of great benefit to industries engaged in mass production of standardised products like bicycles, electric motors, combustion engines, separators sewing machines and telephones.

LM Ericsson invested in the new production techniques such that by 1896 lathes, milling and drilling machines made up 70% of LM Ericsson’s machinery by value, while screw manufacturing and processing machines accounted for 13% of machinery. New sources of energy in terms of small high pressure steam engines and a 250-horse power steam engine were acquired. Electricity was used only for lighting while the main source of power for production was the steam engines. The wages were still higher than the national average, standing at 1400 kr a year. The national average pay of engineering workers stood at 1000 kr a year. The number of working hours reduced drastically such that by the turn of the century, it stood at 53 hours a week.

**Internationalisation**

Initial attempts of internationalisation by LM Ericsson came in the form of setting up an assembly workshop in St. Petersburg, Russia. This assembly workshop housed in a rented premise was furnished with parts from LM Ericsson’s factory in Stockholm. By the turn of the century LM Ericsson had acquired own workshop on Samsonievski Prospekt, and was even considering relocating to Russia.
The plans of relocating the entire business to Russia were shelved when SAT won a concession to operate telephone networks in Moscow and Warsaw.

This event was remarkable as it led to renewal of the collapsed friendship between LM Ericsson and SAT at the launch of SAT’s own Telefonfabriken. SAT’s Telefonfabriken production capacity was inadequate, and could not cater for both the Stockholm and Moscow operations in terms of telephone equipment supplies. SAT felt that this gaping demand could be met by reviving the partnership between it and LM Ericsson.

In its adventure into the international markets, LM Ericsson had to contend with the powerful Bell group of companies.

With its extensive resources and technical know-how the Bell group dominated the North American market in both manufacturing and telephone operations. The same can be said of Europe where the Bell Company had won many concessions. In Central Europe, the telephone exchanges were equipped with multiple switchboards from Bell’s Chicago plant of Western Electric & Co., with the connection rates to the multiple switchboards standing at 52% in Germany, and 70% in France. Germany however manufactured its own telephone sets. This was done by Siemens & Halske and R. Stock among others.

In Southern Europe, Spain and Italy were the dominating countries in terms of telephone penetration though they accounted for only 10% of the continents telephone. Large exchanges as those in Madrid and Milan had modern multiple switchboards from Bell’s Western Electric &Co.

Giant Russia accounted for only 3% of the continents telephones and the main players in the Russian market were LM Ericsson and Bell. LM Ericsson supplied a small exchange to a network in Kiev, and registered remarkable success in the sale of telephone sets.

The Nordic countries with 20% of the continents telephones relied on the Bell group at first but the Bell group was quickly edged out of the Nordic market thanks to LM Ericsson’s excellence in telephone equipment manufacture, and its collaboration with the private Nordic telephone companies.
At the beginning of the last decade of the 19th century, there were 25 multiple exchanges in all major Nordic towns except Kristiania of Norway.

LM Ericsson developed important markets in non-Nordic countries mainly Russia and Britain. LM Ericsson made inroads into Britain in the 1880’s with great success in the sale of telephones and telephone parts. Orders came from the National Telephone Company, and G.P.O (General Post Office). Britain accounted for 28% of LM Ericsson sales in 1897 and the figure reached 50% by the turn of the century. Britain was followed by Russia, Holland and Spain. Supplies to Britain excluded telephone exchanges, while the opposite was the case with Russia, Holland and Spain, though the exchanges supplied were of a lower capacity type.

The reason for this was that Bell had already won concessions in large cities and LM Ericsson could only supply equipment to medium and small towns. The only exceptions were the exchanges in Copenhagen with a capacity of 10,000 lines and Helsinki with a capacity of 8,400 lines.

Australia and New Zealand also became important markets for LM Ericsson with half of the total non-European sales accounted for by Australia. Most of the sales consisted of telephones and parts. Other countries LM Ericsson’s presence included South Africa and China.

**LM ERICSSON’S TELEPHONES**

In the first years of opening the workshop in Stockholm, Lars Magnus Ericsson’s activities consisted mainly of repair works of instruments and apparatus of different kinds, and simple manufacture. Amongst the work he did was to repair pointer telegraph instruments for the railways and Morse instruments for the public telegraph lines.

Later on he began to design his own improved versions of the instruments he repaired, and their good quality earned them a good reception in the market.
In 1878 Lars Magnus Ericsson received American telephones for repair and adjustments, and from these he got the necessary experience to start manufacturing his own telephones. Matters were helped by the fact that there were no hindrances in terms of patents. In the same year he began to manufacture his own telephones using the Siemens & Halske magnetic telephone as a prototype.

The first pairs of “telephones with trumpet” were released into the market on the 14th of November 1878 and by the end of the year some twenty pairs at a cost of 55kr per pair had been sold. This marked the beginning of what was to become LM Ericsson’s main production.

The foundation of one of the world’s leading telephone manufacturers and its development from handicraft to industrial enterprise had been laid. The telephones that were manufactured thereafter by Lars Magnus Ericsson had receivers of Bell type. The transmitter had a large magnet and an improved magnetic circuit and resembled that designed by Werner von Siemens of Germany. It had better sending efficiency and could be used for long distance telephoning. To make a call signal one had to blow into a trumpet mouthpiece on the transmitter. This telephone was available in two designs namely the wall model and the table model. By the end of 1880, four hundred telephones had been manufactured.

**The “helical microphone” and the first complete telephone set**

An American engineer, Francis Blake had succeeded in designing a microphone, which was more effective compared to Bell’s telephone. Lars Magnus Ericsson made his original and first contribution in the telephone industry, when he designed the *helical microphone* telephone. The helical microphone was based on Blake’s microphone and was LM Ericsson’s first complete telephone set.

It was a wall set with a receiver of Bell type, microphone and a battery. It also contained an induction coil for improving the efficiency of the microphone circuit by matching it
to the line. The set was equipped with a hook switch, and a push button and direct current bell for signalling.

**The 1882 wall telephone**

Increasing demand for telephones inspired Lars Magnus Ericsson to improve his telephones and create new designs, and by 1882 he had completed the wall set. This telephone inspired successive wall set telephones that were thereafter manufactured for almost two decades. With this telephone Lars Magnus Ericsson proved his prowess in telephone design.

The telephone had a magneto generator and polarised bell for alternating current instead of the earlier direct current bell. Its construction was in “writing desk” form to accommodate the generator in a natural way above the battery partition. All the components were placed in such a way that it formed a compact unit. It was mainly made of metal and wood, with a design meant to reflect excellent craftsmanship with a fine finish.

The telephone was favoured by administrations and was popular among subscribers too. It was marketed under different names, among them “Swedish pattern” and sold in large numbers both in Sweden and abroad. Other telephone manufacturers made copies similar to this telephone.

**The 1884 desk set**

The efforts towards the manufacture of a practical desk set bore fruits in 1884. Lars Magnus Ericsson had come up with the first version of a desk set telephone which was to become the symbol of LM Ericsson’s telephones all over the world. The technical functions of this telephone were given major considerations and the design was purely electromechanical without a protective case. The generator magnets served as base for the set and its other components.
The handset and the 1892 telephone

The handset was LM Ericsson’s major contribution to the telephone set development. The idea of combining receiver and microphone through a handle came up in Sweden in the early 1880’s. Some operators at overseas exchanges already had a similar device, but LM Ericsson’s first handsets were intended for switchboards. He however continued working on a handset that would be suitable for subscribers.

He produced one such handset in 1892 with the help of a newly designed receiver with ring magnet in an ear cap and a carbon granule microphone. With the handset in a cradle-shaped hook, the telephone had a natural structure and was convenient to use.

This became the world’s first subscriber telephone with a handset and it was a success. Handsets were thereafter introduced on wall telephones.
ANALYSIS

In this section the empirical data in this thesis is analysed with the help of the theories provided. The chapter begins with, followed by a non-theory-based analysis meant to prepare the reader for easier understanding of the analysis. This is followed by a theory-based analysis with the issue of technology acquisition addressed first with the help of open innovation and path dependence theories. Thereafter the role played by the industry is analysed, and the chapter concludes with an analysis of the role played by networks. The last section of this chapter is about a reflection over the theories used in the analysis.

NON THEORY BASED ANALYSIS

A realisation of LM Ericsson’s childhood dream about the telephone came closer to being true when he ventured into Stockholm. Conscious of his craftsmanship qualities and the enthusiasm and passion that he had for engineering Lars Magnus Ericsson came to Stockholm knowing that he was destined for bigger things despite his limited schooling.

His first employment at Öller’s gave him the first opportunity to prove his worth, and to sharpen his inborn engineering skills. This opportunity proved crucial as it presented him with the possibility of not only putting into practice his innate skills, but also the possibility of acquiring more practical engineering skills. Excellence in Lars Magnus Ericsson’s new and first employment endeared him to the people around him, and on whose recommendations he sought a government grant for further studies overseas. The journey in search of excellence that took him to Switzerland and Germany could later on prove to be crucial to his enterprising efforts when he decided to set up his own enterprise.
The 1877 launch of the telephone could be said to be timely, coming at a time when Lars Magnus Ericsson had just boosted his engineering. Besides he still had the telephone idea fresh in his mind. Immediately after starting his own engineering workshop, Lars Magnus Ericsson had the best opportunity to push the telephone agenda further. The telephone happened to be one of the commodities whose repairs were carried out in Lars Magnus Ericsson’s workshop. The repairs provided exposure to the telephone, and the fact the telephones were of Siemens type brought him closer beginning his own manufacture operations.

He had come into contact with the Siemens technology during his overseas study trip in Germany, and the repair works on such telephones in his workshop provided him with the very last bit of practical skills he needed to commence his own telephone manufacture. The helical microphone became Lars Magnus Ericsson’s first and own product in his technology acquisition endeavours.

Another timely and favourable event in Lars Magnus Ericsson’s enterprising life came with the launch of the telephone network in Stockholm. This would later on be followed by the spreading of the network throughout Sweden. The 1880’s could be said to be the time when the Swedish telephone market developed in earnest. The dominant force in the market the Bell group was expanding its operations in Sweden sustained by a strong resource base. LM Ericsson was no match as far as resources were concerned, but the launch of the network nevertheless proved strategic as it later on played out.

The existence of the network which enabled offering of telephone services helped LM Ericsson’s main competitor to win more of the market share, but the same network set the stage for a vicious onslaught on the competitor. LM Ericsson partnered with SAT to take on the Bell Group.

The partnership between LM Ericsson and SAT came to be outstanding in the Swedish market, as it put LM Ericsson in the spotlight besides paving way for its emergence and dominance of the market previously under tight grip by the Bell group of companies. SAT with equipment supplies from LM Ericsson took on the Bell Group of companies, gradually taking with it the market share bit by bit.
The other competitor, the state owned Telegraph Company was also slowly beginning to embrace the telephone and turning to LM Ericsson for supplies. LM Ericsson owed its lifeline to SAT which as a reliable customer and partner enabled it accesses the markets.

As SAT expanded its operations it relied on LM Ericsson for supplies and this also led to the expansion of LM Ericsson’s production activities by volume. Together, the two entities widened their collaboration in many areas including product development. Some of the notable achievements that this collaboration gave rise to was the multiple switchboard in the field of telephone exchange. This was a milestone in telephony as the new large telephone exchanges that were later built based on the success of the multiple switchboard and related improvements, meant that more complete networks could be rolled out. An outstanding example of success is the case of the large telephone exchange installed at Malmskillnadsgatan in 1887.

The beginning of the last decade of the 19th century however brought with it the misfortunes that dislodged LM Ericsson from the market it had a perfect hold on. The state owned Telegrafverket’s decision to embark on the trunk telephone network project turned the tables on LM Ericsson. The buying up of the peripheral customers, the private telephone associations by Telegrafverket took away a good share of the market leaving LM Ericsson to rely only on SAT. Telegrafverket’s seriousness to take on competition head on was fortified by setting up of a factory to guarantee supplies.

As if loosing Telegrafverket as a customer was not enough, LM Ericsson suffered yet another failure, when Telegrafverket’s intensified competitive activities threatened the very existence of SAT. The SAT Telegrafverket competition duel was cost based, with the two trying to outdo each other on the basis of who could offer the cheapest rates. This perhaps informs the decision later in 1896 by SAT to abandon LM Ericsson through setting up own factory to keep track and take charge of its costs.

Despite the superiority of LM Ericsson’s products in comparison to competitors it did not choose to pay more attention to the Swedish market.

The market at the turn of the century had become small and saturated and besides, LM Ericsson was disadvantaged in the sense that competitors who had been engaging in
telephone operation services before could now manufacture their own equipment. As such LM Ericsson which specialized in equipment manufacture could not rely on deliveries of these to a market characterised by price/cost based competition. The next available option was to look beyond Sweden given that LM Ericsson was not a total stranger to the overseas markets.

THEORY BASED ANALYSIS

The role of open innovation in the acquisition of telephone technology

Lars Magnus Ericsson made his first contact with the telephone when Numa Peterson, one of the first telephone importers, brought his Bell type of telephones to his workshop for adjustments. Through the repairs he came into contact with his teenage dreams of the telephone. A year after the first contact with the telephone, Lars Magnus began to manufacture his own telephones based on the Bell’s and Siemens & Halske’s technologies. Through this, he laid the foundation of the future telephone company though with borrowed technology. But it would be unfair to overlook Lars Magnus Ericsson’s contribution in the whole success affair. Were it not for his innate design skills and engineering capacity Lars would have not made anything out of the foreign technologies.

His own contributions of technical character in the laying of the foundation of the telephone company, point to the first incident of open innovation as opined by Chesbrough (2003c; 2004) and Chesbrough et. al, (2006). Chesbrough argues of open innovation as being facilitated by both internal ideas, as provided by this case as well as external ideas. Turning our attention to the external input of foreign technology, it was possible for Lars Magnus Ericsson to use Bell’s technology as the Bell company did not take any patents in telephone technology is Sweden. Most patents were restricted to the UK and USA.
Through patents, firms protect their discoveries and knowledge and even regulate how the knowledge can be used by others. Open innovation once again can be seen to be in play here. But as we acknowledge the applicability of open innovation in this case, we however have to point out that the process was characterised by a one way flow of knowledge from the Americans to Lars Magnus Ericsson and his company. This is in contrast to Chesbrough (2003c; 2004), Chesbrough et.al, (2006) and Trott’s (2008) two way flow system. The version of one way flow of knowledge in LM Ericsson’s favour dominated the company’s earlier years of operation. Lars Magnus Ericsson was free to use Bell’s technology as a basis of manufacturing his own telephones. The helical microphone, Ericsson’s own invention, had some input of American technology. In fact it was based on Blake’s microphone and moreover the telephones fitted the helical microphone had receivers of Bell’s type.

Incidences of open innovation are rife throughout the history of LM Ericsson, but much of it as is evident here involved the one way flow of knowledge in favour of LM Ericsson. However one example that makes the case for Chesbrough (2003c; 2004), Chesbrough et.al,(2006) and Trott’s(2008) position of two way flow of technology aspect involves the case of Carl Söderberg, the Swedish director of Kristiania Telefonförening in Norway, who after sourcing equipment from LM Ericsson after some time, began manufacturing own equipment using LM Ericsson’s equipment as prototype. Lars Magnus Ericsson, on being notified of the development, quipped that he was also a beneficiary of American technology thanks to open innovation.

LM Ericsson’s collaboration with SAT also exhibits some traits of open innovation. The collaboration is much in agreement with Gassmann & Enkel’s (2004) coupled process of open innovation. In line with Gassmann & Enkel’s (2004) opinion the collaboration was of a strategic network nature and the two firms engaged in joint knowledge development efforts that were aimed at improving their joint competitive position. The two firms began working closely especially in the area of product development. Examples of these efforts include the joint manufacture of small automatic switching devices to solve exchange problems.

As the larger exchange capacity needs became urgent the two firms jointly applied American C.E Scribner’s invention of the multiple system to help them build the
multiple switchboard back in 1884. And in 1885 they took off to America to assess the level of development in exchange technology and to discern the technological inputs they needed to take back with them to improve their stock of exchange technology. All these were possible thanks to open innovation that facilitated the flow of knowledge. A contribution that went into the opposite direction as in Carl Soderberg’s case was probably the handset solution, involving joining the transmitter and the receiver in a handset. Originally a Swedish innovation, it was finally conventionally adopted by other industry actors, including by the Bell Company.

Having set the foundation of telephone manufacture based on the technological inflows from mainly the American Bell company, the subsequent designs that followed became a success due to a combination of Lars Magnus’ design skills and the accumulated technical experience acquired through learning. The learning process is central to LM Ericsson’s success in that he could tap technology external to his firm, thanks to learning capabilities. In the process of acquiring technology through learning, Lars Magnus also had the opportunity to sharpen his innate practical skills. The tacit knowledge embedded in his innate skills was perhaps what enabled him to develop and perfect already existing technology to produce products of marvellous design and superior quality.

Path dependence and technology

The technological paradigm on whose principles the telephone is based is electromagnetism. But before the advent of the telephone, the telegraph also functioning on electromagnetic principles was widely in use. It can be recalled that Lars Magnus Ericsson learnt of the launching of the telephone through a newspaper article in which the telephone was referred to as the “talking telegraph”.

There is an element of path dependence in this, supported by the argument that the development of the telephone can be traced to efforts aimed at improving the telegraph. This argument in support of path dependence is quite in line with an observation advanced by Rosenberg (1994), where he posited that today’s technology can be understood by studying its origins.
Having addressed the transition from the telegraph to the telephone, we now turn our attention to the three major functions that enable the telephone to function, all of which are based on principles of electromagnetism.

The initial endeavours by scientists in improving the telephone technology are characteristic of path dependence, in the sense that they were sequential, and somehow a carry on of the same scientific principles. The three functions namely the transducer, switching and the transmitter functions were in Dosi’s (1982) terms of defining a technological paradigm, models of the solutions and related technological problems associated with technological paradigm of electromagnetism at which scientific efforts were directed to develop the telephone. Alexander Graham Bell was credited with the practical application of the most fundamental of the functions, the transducer function which involves the conversion of sound waves of speech into electric current and back to sound waves. After applying this on his telephone, which initially experienced weak transmission problems successive improvements were carried out by among others D.E Hughes, the inventor of the microphone T.Edison, Phelps, Blake, Hunnings, and of course Lars Magnus Ericsson with his helical microphone.

The same can be said of the switching function especially with regard to the successive improvements that took place from the manual exchange to Aven’s call distributing system all the way to the automatic exchange. These apart from the initial recognition of path dependence in the transition from telegraph to the telephone, are outstanding examples that are also in agreement with Rosenberg’s (1994) position that technical progress is sequential to the extent that novelty in technology arises from the technology that precedes that novelty. In other words, today’s technology derives from yesterday’s technology.

In summary, the three related functions which are the cornerstones of the principles on which the telephone works, together with the successive improvements that were done to the telephone with regard to the microphone, typify technical progress within the framework of electromagnetism as a technological paradigm.
The telephone trajectory

After the invention of electromagnetism and its first use in Morse telegraphy, a much more elaborate application emerged with launching of the telephone. It can be said that this application informed the direction of advance or trajectory in Dosi’s (1982) words, within the framework of electromagnetism as a technological paradigm.

With regard to attributes of technological trajectories, the telephone trajectory can be regarded as somehow powerful, and general in application, much in line with Dosi’s (1982) analysis of features of technological trajectories. Though initially invented for use in voice communication, the use of the telephone has been extended to other spheres of communication namely telex, fax, and the internet. It is however important to quickly point out that most of the telephone trajectory attributes are limitedly discernible within the period covered by the thesis. The analytical attempt we are making is only wholly valid if we look beyond 1900.

A closer look at the history and development of the telephone albeit outside the brackets of the period that this study covers reveals a cumulative pattern of development where the telephone has improved tremendously from cable-reliant telephones to wireless telephone communication common today. As much as the telephone principle has persisted and is continuously in use in other spheres of communication, including the most modern of all, the internet, the trajectory appears almost irreversible.

With such an array of applications, it is unlikely to opt for a new alternative, with regard to market uncertainty among other issues.
The effects of properties’ of path dependence

Non-predictability, non-ergodicity and inflexibility

During the infancy of the telephone in the last two decades of the 19th century, the conditions were such that market intelligence and other marketing aspects that are common today were probably non-existent. The simple case for this is that, modern day economics including marketing had not yet been born. This meant that, any forecasts of the market specifics could not be attempted unlike today where tools for doing this are readily available. But the unpredictability associated with the lack of information of this era, is also realisable today in path dependent processes. This unpredictability is largely attributed to increasing returns as observed by Sydow et.al, (2009). As noted before Bell’s telephones were not that recognised for high quality standards, nevertheless history had chosen them as the pioneers and the only and widely used telephones, and therefore their potential of bringing returns weighed heavily over other considerations.

With regard to the persistence of history, as has already been discussed from the telegraph telephone transition and the successive improvements thereafter with the principles remaining the same, other no-ergodic examples are found in the combination of the microphone or transmitter with the receiver-the handset. This is in concurrence with Sydow et.al, (2009) argument that history chooses and retains an alternative among multiple possible alternatives that path dependence processes yield. Today’s telephones, whether cable based or wireless mobile phones are still applying the handset principle, which was invented by an SAT engineer Anton Avén and perfected by Lars Magnus Ericsson.

With Bell having pioneered the telephone, and drawing increasing returns from his investments, other entrants interested in the profits that the market offered, as a matter of fact had to follow in the same line of technology.

Profits were realisable with the carrying out of improvements while the base technology remained the same.
In other words the prevailing technological set up became more “locked-in” as Arthur (1989) observes. As can be recalled, Lars Magnus Ericsson’s first telephones were based on Bell and Siemens’ prototypes. With Bell’s telephones as the frame of reference in the telephone industry, the development of the telephone borrowed heavily from the Bell Company in many fronts. With the accruing increasing returns enforcing inflexibility associated with sticking with the Bell Company’s telephone prototype, another aspect associated with inflexibility also emerged. The actors, joining the telephone industry did so in the hope of sharing in the returns the new technology in the market was offering. As such they had to make investments in production facilities. Backing out of these investments would be a costly affair and as such as observed by David (1985), (1994), the irreversibility of these investments resulted in inflexibility.

If there were any other technological possibilities out there in the market that would have facilitated the creation of another device other than the telephone, it would be difficult to predict how the market would react to it. As such the increasing returns contributed more to the irreversibility of investments owing to the unpredictability of new outcomes and the inherent switching costs.

The inflexibility and the resultant irreversibility of investments, apart from being driven by increasing returns, became also reinforced by system complementarities or interrelatedness. Apart from the interrelatedness of the three enabling telephone functions, relations in the telephone industry are reminiscent of David’s (1985) QWERTY keyboard market. The telephone industry just like in the QWERTY keyboard case had a system of production comprising manufacturers, buyer firms, and subscribers or private persons and businesses using the telephone.

LM Ericsson as the manufacturer first and foremost, depended upon SAT, Telegrafverket and a host of private telephone associations to buy its telephones which were to be sold to those who had subscribed telephone services.

As such the subscribers in the process became accustomed to LM Ericsson telephones which were widely available in the market, and thus any other unknown brands would have not done well, given the time it would have taken for the subscribers to learn and get used to the features of the new brand. Therefore the web of connection was such that
the subscribers depended upon telephone service providers comprising SAT, Telegrafverket, and the private telephone associations who in turn depended upon LM Ericsson for telephone and telephone equipment deliveries.

**Learning**

LM Ericsson won hugely from the adoption and domination of the Bell type of telephone that had pioneered the telephone industry. Initial advantages accrued from Lars Magnus Ericsson’s earlier acquaintance with the basics of the telephone during his study time in Germany and Switzerland, at the height of concerted efforts to develop the telephone, and only years away from the commercial introduction of the telephone by Alexander Bell. As such, he had been exposed to the idea of the telephone before its introduction and perhaps what made this encounter more crucial and valuable was his childhood dream about the telephone during his teenage. The childhood dream and the early acquaintance with the telephone acted as a head start and significantly enhanced Lars Magnus Ericsson’s learning capability.

His other personal attributes that enhanced his learning capability were his industriousness and cautiousness coupled with his background and belief in thorough and long practical training. But as we acknowledge the role that learning played in Lars Magnus Ericsson’s own success as an individual, it is also worth pointing at some of the efforts he made to make learning pivotal in the company management.

The evidence is found in technology management especially with regard to training and dissemination skills, which was done through the “helper system”.

Having perfected the art of learning, LM Ericsson gained more experience became more efficient as Sydow et.al, (2009) observes, producing high quality products at affordable prices. With this strategy LM Ericsson grew in size and ultimately edged the Bell Company out of the Swedish market; a clear indication of a firm experiencing increasing returns. It was therefore wise for LM Ericsson to continue on the same path, improving the quality of existing products, and developing new ones based on the rich experience gained from learning. In this way learning helped re-enforce path
dependence as LM Ericsson was relying on experience built through his background of practical training to develop superior products which brought good profit margins. Besides, where was the need to shift to a different and much better type of technology or substitute product? First, the early periods of the industrial revolution did not offer an array of technologies in many fields and thus there were neither viable alternatives of technologies nor substitutes, and second and most important, LM Ericsson was earning profits.

In summary LM Ericsson’s success can be attributed to the inherent path dependence in telephone technology. Lars Magnus Ericsson did not to come up with or invent totally new technologies. What he did was to develop the successive inventions in telephony mostly originating from the USA, to develop superior products. This put Lars Magnus Ericsson with his company in the path of incremental innovation as a way of pushing the company to greater heights of development. With incremental innovation to pursue LM Ericsson had to rely on product innovation or development to stay ahead of competition. LM Ericsson knew that its success depended on the new and superior products it manufactured with the help of borrowed technology. LM Ericsson’s strongest domain was the telephone.

Some examples of LM Ericsson’s successful telephone products include the wall set which was a compact unit with a completely new design. The desk set combined design with superior technical features. It should also be remembered that it is Lars Magnus Ericsson who perfected the commercialisation of the idea of combining the receiver and the transmitter into a handset.

**Key industry players and the role they played**

**Buyer’s role**

The beginning of LM Ericsson’s active participation in the telephone industry can be attributed to the emergence of the private telephone associations. It all began in Gävle where the first association was formed. Similar to the Gävle incident is the Bergen effect which opened up the markets for LM Ericsson outside Sweden. The main aim of
the formation of the telephone associations which were later joined by SAT was to
snatch the market from the then powerful industry actor the Bell Group of Companies.
This was to be done through a price war that would see the Bell Company lose out.
Even though the private telephone associations existed all along through much of LM
Ericsson’s lifetime until the turn of the century, it was SAT that was at the centre of
attention as a result of becoming the biggest customer. The relationship was such that it
was more of a symbiotic relationship where the two firms depended on each other for
survival.

LM Ericsson competed successfully against Bell through delivering cheap telephones
and telephone equipment to its customers. This implies that the customers or the buyers
who bought in large volumes were keen on procuring their merchandise at lower prices
and as such they could be seen to be exercising some power through keeping prices low
in accordance with observations made by Porter (2004). The low price mechanism was
a way of staying in business through ensuring that they kept the relatively expensive
Bell Company away from the market, while the same mechanism also ensured that they
did not buy merchandise from the very same Bell Company.

Buying from the Bell Company as Porter (2004) observes would have implied high
switching costs. Most of LM Ericsson’s customers were of the opinion that Bell’s prices
were way too high. This shows how crucial the lower prices were for the buyers.

As a result lower prices could be considered to be their competitive tool and they would
stop at nothing to ensure that they exerted pressure on LM Ericsson to continue
delivering at lower prices. More pressure to maintain the lower prices could have
resulted from the fact that the purchases were a significant fraction of the costs incurred
by the buyers and thus they had to exert pressure to buy at lower rates. This is very
much the case with LM Ericsson’s customer’s led by SAT. With SAT almost owing its
existence to LM Ericsson through supply agreements, there was no doubt, SAT was
engaging in what Porter(2004) describes as concentrated buying with a view to having a
good profit margin. This profit margin was only to be realised if the procurements from
LM Ericsson were kept cheap.
But the arguments for the cheap prices signifying buyer power addressed above did not imply that LM Ericsson was totally defenceless before the buyers. Had the Bell Company been charging prices closer to LM Ericsson’s, the buyers would have faced few switching costs and would have as such had a field day playing the sellers against each other to further lower the prices. Nevertheless, this was not the case, and LM Ericsson was shielded from such actions. Given that Bell’s products were expensive, the buyers faced high switching costs, in any case they attempted to switch to Bell, and this ensured that LM Ericsson had power to ward off any further price reductions that would have sliced his profits. Besides the high switching costs and the favour that came with them LM Ericsson was better placed in the market due to differentiated products of high quality, a feature that kept the buyers coming for more and this would have probably shielded the company against further price reductions. The scenario of price driven buyer power counterbalanced by high switching costs and product differentiation characterised the Swedish telephone industry during the first decades of infancy. Towards the turn of the century however, this state of affairs was upset when the threat of backward integration became real (Porter, 2004).

The decision by SAT and the other significant buyer Telegrafverket to secure own supplies were the climax of how devastating buyer power can be. This was serious and LM Ericsson had to explore other options among them eyeing the international markets.

**Intensity of industry competition**

LM Ericsson successfully competed against the Bell Company in the Swedish market through offering cheaper prices that the competitor could not match. Apart from the cheap prices, LM Ericsson’s products were of high quality as opposed to those of competition. Besides SAT and the small private telephone associations nationwide, LM Ericsson also won the confidence of the much larger substitute product provider, Telegrafverket. Telegrafverket abandoned the Bell company and together with SAT and the private associations, they took on the Bell company with cheaper prices as the theme. The Bell Company had no chance but to dislocate from the Swedish market.
Supplier role

At the time of the discovery of the telephone, the level of technology was much lower compared to contemporary times. The low level of technological development at that time implied that discoveries that could make use of certain raw materials were not many as opposed to today’s situation. LM Ericsson in its years of infancy found itself in this situation. Given the level and nature of technological development at that time, most of the available raw materials did not at least have multiple uses. With this in mind it is difficult to discern any sources of supplier power.

Most of the sources of supply power identified by Porter (2004) were particular to the supply relations that LM Ericsson was subjected to but as mentioned above it is difficult to single out any powers exerted by the suppliers.

The supplier group was indeed dominated by a few notable companies such as Österby Bruk, Skültuna Mässingsbruk, the Sieverts Company and Harburger Gummi Kamm, to mention but a few, but strikingly enough, the empirical data does not suggest the exercising of any supplier powers.

Likewise, the supplier products could have been an important input to LM Ericsson as the buyer, but again any moves suggesting the existence of supplier power are not easily detectable. As such the absence of substitutes to the supplies helped by the low level of technological development could have implied more powers to the suppliers but this was as well not detectable.

Role of Substitutes

The only substitute to the telephone at this particular time of history was the telegraph. Telegraph services were offered by state owned Telegrafverket. It was the telegraph that was widely in use before the discovery of the telephone. A glimpse at the history of the telephone indicates that both the telegraph and the telephone operate on the same principle, and that the telephone can be said to be an improvement of the telegraph. An example to support this argument was given when the telephone was referred to “the
“talking telegraph” when the news of its discovery was broken through the press in Sweden.

The notion of the telephone being superior to the telegraph was given credibility by Telegrafverket’s transition to the telephone. This by implication meant that the telegraph could not further be regarded as a substitute to the telephone. And with the exit of Telegrafverket from telegraph services provision there was no way the telegraph could be considered to be wielding any powers whether through performance or price.

**New Entrants and the threat they posed**

The formation of SAT strengthened the otherwise weak LM Ericsson which prior to SAT’s emergence could not match the resource endowed Bell Company.

With SAT, Telegrafverket and the private telephone associations on board, the prospects looked good for LM Ericsson and better than that could they not be, when competition finally forced Bell out of the Swedish market.

LM Ericsson was at the helm of the Swedish market, as the main supplier of telephones and related equipment, at least for a decade until the end of 1880’s when events took a negative turn.

As Porter (2004) observes firms can lock out new firms aspiring to enter into their domain through economies of scale. This was however not the case with LM Ericsson as it could not block the entry of Telegrafverket and SAT into its domain of equipment manufacture. This was probably due to the fact that the two had assembled the necessary expertise that would enable them secure owns supplies at prices that would not see them switch to LM Ericsson. Also tied to the expertise was the absence of or low switching costs resulting from the fact that no retraining was needed, as the firms in question were conversant with telephones, and they had enough resources to enable them manufacture own equipment. Both SAT and Telegrafverket were not bound to have any distribution problems as the factories they set up for equipment manufacture were to deliver equipment to facilitate telephone operations; an area they were well conversant with. In other words their engagement in telephone operations nationwide
ensured they had elaborate distribution networks and as such the equipment manufacture section could not suffer any distribution setbacks.

Owing to the resource base they had built over the years before venturing into equipment manufacture, there was no likelihood that both SAT and Telegrafverket could face any cost disadvantages that were not related to scale of operations would it have occurred that some new company or companies were interested in the Swedish telephone market.

Even though LM Ericsson suffered somehow with the entry of former customers/buyers into its domain, all was not lost at once. LM Ericsson’s product differentiation exhibited in quality levels were still in its favour, and it could still continue to sell in the Swedish market despite the setbacks.

**The role of networks**

The positive role of industry is conspicuous throughout the early life of LM Ericsson. Apart from the unique attributes possessed by LM Ericsson, it was the industry that gave relevance to the attributes. As is the case with innovation, LM Ericsson could have not only counted on the technological qualities and design capabilities for excellence. The industry, which incorporates the markets, had to be involved to foster the success registered by the company

When addressing the issue of networks we move a step further from the general and detached industry participation addressed in the previous chapter of industry actor roles into a deeper relationship. Here, LM Ericsson is looked at from the perspective of its closest and the most significant of the relationships within the industry.

Of the industry actors identifiable by De Wit et.al, (2005), LM Ericsson co-operated more closely with its main customer, in this case SAT.

Objectives of LM Ericsson’s networking with SAT are outlined as follows;
Knowledge development

Håkansson (1987) observes that firms co-operating with an objective of developing knowledge do so in the hope that such an exchange would result in new products or processes. This can be said of the LM Ericsson/SAT co-operation especially with regard to their joint efforts in advancing improvements in the field of telephone exchange.

The joint LM Ericsson/SAT efforts led to the launch of the multiple system of 1884 which enabled the manufacture of large switchboards to accommodate more telephone lines and further spread the telephone network.

Another example where joint efforts geared towards new products bore fruit was the launch of the handset telephone.

The idea of combining a receiver and a microphone originated from SAT engineer Anton Aven who passed it for perfection by Lars Magnus Ericsson.

Resource Mobilisation

Resource mobilisation as observed by Håkansson (1987) aims at pooling resources with an aim of benefiting both or all firms involved. Moments of resource mobilisation are evident at the beginning of the co-operation between LM Ericsson and SAT. LM Ericsson as a technology based firm was at the onset oriented in this direction. It can be recalled that at the beginning of LM Ericsson/SAT co-operation Lars Magnus Ericsson focussed on his sharpened engineering skills and hoped to use them to make a significant contribution to their joint efforts. The founder of SAT Mr Cedergren on the contrary had no engineering background and contributed to the joint LM Ericsson/SAT efforts through his vast social network and knowledge in financial matters. The two diverse pools of resources proved to be necessary in jointly propelling both LM Ericsson and SAT to prominence. And as Schilling (2008) asserts, the resource mobilisation efforts resulted in quicker and cheaper gains that each individual firm could have not achieved single-handedly within such a short time span.
Position Alignment

Before the formation of SAT, LM Ericsson was already active in the Swedish market, but it was the Bell Company that was the dominant force in the market with the high prices it charged.

SAT’s formation as can be recalled was out of dissatisfaction with Bell’s high tariffs, and was a big favour to LM Ericsson as far as competing with Bell was concerned.

Both SAT and LM Ericsson, thus had a common enemy, the Bell Company. The common goal uniting them was to undo Bell’s stranglehold on the market, and to ultimately see it off the Swedish market. The two therefore came together to both enhance their positions as observed by De Wit et.al, (2005), and to make things worse for the Bell Company, which finally was forced out of the Swedish market. Their resolve to continue with their network relationship was strengthened by the common technological challenges they encountered as well as their common interests in the field of telecommunications. Their networking yielded some remarkable contributions to telephony in Sweden. Examples include their working together to launch the multiple switchboards and the handset.

The inherent network arrangements and the roles they played

Strategic Alliances

LM Ericsson and SAT had a reason to work together, and the reason or reasons according to Schilling (2008) was to access critical capabilities they did not possess individually. This was done through the exploitation of each firms capabilities and leveraging the capabilities into each other’s development efforts. Already mentioned was the different orientations that both the personalities and by extension their firms possessed at the onset of their co-operation.
LM Ericsson was more technically oriented while SAT was endowed with social network that was crucial in securing finance and markets. The two firms thus collectively needed to pool resources, in order to facilitate faster technological development resulting into superior commodities, and they also needed SAT’s social network to penetrate the markets as observed by Schilling (2008). Some of the examples of the fruits of the strategic alliance between LM Ericsson and SAT which are repeatedly mentioned in this thesis include the multiple system project for the telephone exchange as well as that of the handset initially developed by SAT engineer Anton Aven and perfected by Lars Magnus Ericsson.

The strategic alliance that the two firms built can apparently be said to have worked well for them as the two firms jointly managed to dislodge the Bell Company from the Swedish market. The other benefit of strategic alliances as observed by Schilling (2008), but was of detrimental nature to LM Ericsson was the ability of SAT to gain expertise in telephony through learning it from LM Ericsson so as to finally be able to establish its own production facilities.

**Outsourcing**

During infancy LM Ericsson faced the problem of inadequate capacity, and this was solved through outsourcing, described in simpler terms by Schilling (2008) as contract manufacturing. The outsourced tasks included joinery, lacquering nickel-plating and electroplating. Much as the outsourcing helped LM Ericsson in meeting market demand, other benefits of outsourcing identified by Schilling (2008) such as having more time to dedicate to other value adding activities, economies of scale and agility to respond to business environmental changes did not apply in the case of LM Ericsson. Instead, the major risk associated with outsourcing as identified by Schilling (2008) weighed more than the benefits. The risk of over-reliance on outsourcing at the expense of in-house competence development prompted LM Ericsson to expand capacity so as to have the outsourced tasks internally secured.
Due to the fact that the theories applied in this thesis came to exist much later than the period the study covers, it is important to reflect over the applicability of the theories. This reflection is important in explaining how theory has been applied in analysing the collected data. Questions as to why some theories have not been extensively applied will be addressed here. The reflection begins with technology related theories of open innovation and path dependence, followed by industry based theories of competitive strategy and networks.

Open innovation is a much more recent theory. The sources used in this the thesis indicate the development to be as recent as 2003. Despite the novelty, it can still be applied in part to analyse how LM Ericsson acquired the technology that was crucial to its success. The case for the use of this theory is strengthened by the concept of patents which played an instrumental role in LM Ericsson’s technology acquisition. The characteristic two way flow of knowledge in open innovation as observed by both Chesbrough (2003c; 2004) and Chesbrough et al (2006) as well as Trott (2008), only limitedly took place in the case of LM Ericsson. The scenario is dominated by a single flow of external knowledge from the Americans to LM Ericsson, with a case or two of knowledge leaving LM Ericsson for external entities. Gassmann & Enkel’s (2004) outside-in and inside-out processes of open innovation in their pure forms are hardly applicable here, however, the coupled process qualifies for application.

With respect to path dependence, the increasing returns aspect associated with non-predictability of path dependent processes apply only partially. We cannot argue as literature indicates that increasing returns rendered market intelligence not as useful as we do not know if market intelligence existed in the period covered by this thesis. However the assumption arrived at through interpretation is that the features of the Bell’s telephone were widely used because returns were realisable. With regards to non-ergodicity the difficulty arises mainly from the fact that the period 1876 to 1900 is not such a long period to make these properties discernible within LM Ericsson’s lifespan.

However a couple of examples have been given to argue for its applicability. The inefficiency property of path dependence is not applicable based on the reason that the
period covered by this thesis was characterised by the emergence of initial technologies with no immediate alternatives to enable comparison. As such it is difficult to tell whether the telephone technology was inferior to another useful and applicable technology because there is no traceable evidence to confirm the existence of another technology.

The technological trajectory properties equally pose a major problem. It is difficult to apply the properties to analyse what happened in the first decades of the invention of the telephone.

This clearly points out the major problem of a mismatch between the early period covered by this thesis and the much younger theory that came much later. The younger theory thus makes it difficult for us to analyse happenings that took place when much of the theory in use today had not been developed.

In the case of competitive strategy’s first of the five forces of threat of entry, LM Ericsson did enter the market as a new firm, with low prices as the main competitive tool. The company however did not bring into the industry new capacity and resources as observed by Porter (2004). What it did was to combine the low price perspective with the design capacity to be able to compete against the resource endowed Bell Company. As for the intensity of rivalry within the industry, Porter’s argument centring on increased customer service and massive advertising do not apply. When it comes to the buyer bargaining power, incidences of pressure to lower prices on suppliers’ side did not arise. With respect to supplier bargaining power, there were no threats of quality reduction or price increments as Porter (2004) observes. Likewise, the issue of forward integration is not applicable to LM Ericsson’s case.

On the applicability of network theories, resource mobilisation as an objective was only partially applicable, due to the absence of interested external parties. As for network arrangements, licensing and joint ventures were not used in building networks in the telephone industry in the period covered by this study. The same can be said of collective research organisations; which is a much more recent phenomenon.
DISCUSSION

Whereas the preceding discourse over the applicability of the chosen theories sounds like an indictment of these theories, it is important to point out the inclusion of this section is not to purportedly indict the very theories to be applied, but is just a candid attempt to address the challenge of the mismatch of the ages of the events that took place at LM Ericsson and the theories which have been applied to analyse these events. Leaving out this section could have solicited a lot of questions from a section of readers as to whether or not the huge gap in the ages of the events covered and the theory applied to analyse them should be an issue of concern or not. Nevertheless the attempt to reconcile the ages of the events and the theories does not wholly disqualify their applicability. The very fact that the events that took place at LM Ericsson do not perfectly fit with the theories applied is not an impediment to applicability of the theories. That the theories cannot be applied wholly has not hindered the author from applying the theories in explaining the foundations of LM Ericsson’s success. The author, in spite of the inconsistencies has however managed to apply those relevant pieces of the theories to at least showcase the pillars of LM Ericsson’s success. We continue in the ensuing discourse with a summarising discussion of the general applicability of the theories to explain the foundations of LM Ericsson’s success.

While acknowledging the essential roles played by different factors in LM Ericsson’s success endeavours, it is worth noting that some factors are more conspicuous than others.

Open innovation comes to mind probably as the eye opener, owing to the fact that it signifies the first instance of the company life. Had Lars Magnus Ericsson not been able to engage symbiotically with the telephone fraternity, things would have not turned out to be what they are today.

Open innovation made it possible for Lars Magnus Ericsson to supplement and sharpen his innate skills, and conversely the telephone fraternity has to thank him for his contributions that also found their way into the common pool of the telephone technology.
But the exchange facilitated by open innovation would have not been fruitful were it not for the continuity and technology relatedness inherent in path dependence. The two facilitated participation of various actors with the results being constant improvements that brought benefits to both the companies and personalities involved as well as the consumers.

But as can be recalled in the beginning of this thesis, innovation succeeds only if both the technical aspects as well as market aspects are given consideration. Not much would have happened despite the exchange facilitated by open innovation and path dependence had the market forces been totally ignored. In fact there would not have been any reason to engage in these endeavours as such. This brings us to the discussion of the most crucial factors of all the success factors. As pointed out all efforts facilitated by open innovation and path dependence would have been in vain had the markets not been secured.

LM Ericsson owes its success to the industry or the market for that matter. Specifically, networking is worth singling out as the success factor. Prior to the close working relationship that developed between LM Ericsson and SAT, LM Ericsson was all alone there in the market appearing quite insignificant when compared to the resourceful and much larger Bell Company.

However when the mutual partnership began as a producer buyer relationship, their market penetration strategy worked and results were clearly visible thereafter. Bell’s influence began to wane and with this they were buoyed and deepened their relationship. It could probably be that LM Ericsson’s rise to prominence through cheaper prices and expertise attracted Telegrafverket which previously had confidence in the Bell Company.

The relationship between LM Ericsson and SAT and the inherent benefits associated with that relationship overshadows anything else and more or less relegates others factors of importance with respect to success to be regarded as support factors in spite of being probably of equal relevance.
Today we still see much evidence of cross company co-operation through information flows and exchanges between firms engaged in for example joint research programs. Path dependence encourages co-operation between firms applying the same technology as they strive to improve the performance of their products. All these are ways through which networking manifests itself and with them we can advance an argument in favour of networking and proclaim its superiority. The distant and detached buyer seller relationship and the enemy competitor inclination doctrine of the neo-classical economics do not apply much in today’s world. Networking has transcended the old boundaries and examples abound of closer relationships involving different industry actors such as suppliers, buyers and competitors, extending even to entities outside the industry.
CONCLUSION

Lars Magnus Ericsson was no revolutionary innovator. In one of the books containing stories of some of the most influential Swedish entrepreneurs, the author refers to the entrepreneurs as geniuses. In the chapter that talks about Lars Magnus Ericsson he is referred to as the telephone king. When he ventured into Stockholm the author refers to him and as a genius without certificates.

Indeed he is a genius, for even though he did not invent the telephone, he had conceived the telephone idea during his teenage, long before Alexander Graham Bell’s commercial introduction of the telephone. It is no wonder he was able to turn this invention into enormous success, and he did it remarkably well.

He made use of his inborn skills combined with the technology he had borrowed from the Americans, to make superior quality products, and become one of the market leaders. The fact that the Americans had no patents in Scandinavia was of huge benefit to Lars Magnus Ericsson and his company. This allowed him to make commendable contribution in the development of telephony. This piece of work offers a good account of how everything started for Sweden’s telecommunications giant.

Of specific interest is especially the identification of the pillars of early success. This work would thus be relevant to any efforts of carrying out further studies on establishing the connection between the past and the present. Path dependence considerations lend credence to this kind of effort. A study of the technological history of LM Ericsson would be recommended as possible but more precisely a longitudinal study of the sequence of technological events which explains today’s success, would be more appropriate.
REFERENCES


Brian W. Arthur (1989). *Competing Technologies, Increasing Returns and Lock-In by Historical Events*


Paul, A. David. (1994). *Why are institutions the carrier of history? Path dependence and the evolution of conventions, organisations and institutions*: Structural and Economic Dynamics Vol.5 No.2


