

# Identifying dynamics of growth in a competitive and transitioning lighting industry using PESTLE and SWOT analysis

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## Preface

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## Executive summary

The conventional lighting industry had entry barriers in terms of technical know-how, economy of scale advantages and product quality whereas the LED technology has allowed new players from the semiconductor and consumer electronics segments to enter the general lighting market with LED products. While demand for replacement lamps has accounted for significant growth of conventional lighting thus far, that market is dwindling as fewer replacements are needed given LEDs' longer life span. Therefore, the lighting industry structure is rapidly changing due to a disruptive technological innovation in the form of LEDs. From being dominated by few firms, today's lighting industry has become highly competitive with a large number of firms fighting to become the market leader. In this situation, accurately understanding the dynamics of lighting industry becomes very important and challenging.

Therefore, the goal of this thesis is to identify the dynamics of growth in a competitive and transitioning lighting industry and arrive at growth strategies for a lighting company. The scope of the research is limited to European market. Having defined the research objective, the main research question is:

### **How can a firm identify the dynamics of growth in a competitive lighting industry transitioning from conventional to fully LED based lighting?**

Through combining five forces model with various other relevant strategic tools, a holistic industry analysis can be made possible but very little literature is available on this. Therefore, this research addresses this scientific gap where PESTEL (Political, Economic, Social, Technological, Environmental and Legal), Organizational and SWOT analyses are combined with Porter's five forces model to accurately analyze the dynamic lighting industry transitioning from conventional to fully LED based lighting. Based on the qualitative approach, matching research design was defined. The research design selected is a single case study, as it allows for measuring contemporary phenomena in its usual context. By analyzing external and internal environment, and market position using PESTEL and SWOT, determinants for creating a successful strategy are identified and used to arrive at growth strategies for a lighting firm.

The research indicated that the current state of the lighting industry with respect to European market is favouring the transition of the industry towards LED based lighting from existing conventional sources. Additionally, as the case company is a market leader in lighting sector, pursuing 'Grow Strategy' is the best way for them to move forward. In this strategy, their strengths and opportunities can be combined to pursue new product ideas like quality of light and connected lighting solutions, both of which requires immense technical know-how. The case company's strong R&D capabilities guarantees product quality and reliability and that along with its massive sales team and good region wise operational setups can help the case company gain market share in the LED lighting sector. Finally, the main research question was answered. LED technology is rapidly being commoditized, and product performance cannot anymore be the specification where companies differentiate themselves. Therefore, opportunities for lighting companies to gain market share is only possible through developing new value propositions for buyers like quality of light and exploring untapped potential of connected lighting. Lighting companies must orient their research and development in exploring and creating these value propositions. Additionally, equipping their current workforce with the relevant technical and business capabilities will be vital.

Since the lighting industry is rapidly moving towards LED from conventional sources, the expectations of the customers are high, therefore product quality and reliability is very important. LED lighting being an expensive option, educational campaigns clearing the doubts surrounding LEDs and its payback time will also be a major push to stimulate the sales. Low-cost, high volume, and reliable manufacturing methods are important to drive down the first costs of LED lighting. The research also mentioned the need to maintain strategic relationship with LED suppliers as it is expected that the future will consolidate all the existing LED suppliers into 3-4 suppliers. New possibilities in decorative and architectural lighting are now presented by LED lighting, due to their superior colour and special distribution capabilities. Finally, the research showed that LED lighting will clearly be able to outperform existing lighting technologies in terms of efficacy, without sacrificing colour rendition. Therefore, the next step is towards device integration and system architecture to serve the different applications targeted.

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## 1. Introduction

Why do some companies perform better than their competitors and achieve continuous success? How can firms build competitive advantage in regimes of rapid change? These are the fundamental questions in the field of strategic management. Since the early 1960s, managing the planning process has become more important as a means of coping with a turbulent business environment (Drucker, 1964; Hussey, 1979). A number of forces have contributed to this, including an increase in environmental uncertainty, the external interdependence of organizations, organizational diversification and size, societal performance demands on organizations, and more recently the disappearance of conventional marketing structures (Homburg & Workman, 2000; McDonald, 1996; McDonald, 1982; Moorman & Rust, 1999).

The new competitive landscape, driven by the technological revolution and significant globalization, is moving towards hyper competition (rapidly escalating competition and strategic maneuvering), extreme emphases on price, quality and satisfaction of customer needs, and an increasing focus on innovation (both in technology and new products/services). As a result, in the new competitive landscape, firms face significant uncertainty, ambiguity and an increasing number of strategic discontinuities. Firms have to create innovative products and services of high quality and at low prices to satisfy increasingly informed customers with distinct needs. Managers are motivated to reduce the uncertainty by identifying new sources of competitive advantage (Hitt, Keats, & Samuel, 1998). Therefore, such challenging marketing circumstances often require the companies to reformulate their marketing strategies and offerings several times.

Strategic management is defined as a set of managerial decisions and actions of an organization that can be used to facilitate competitive advantage and long-run superior performance over other organizations (Powell, 2001; Wheelen and Hunger, 2004). The dominant paradigm in strategic management was the competitive strategy approach developed by Porter (1980). This approach, rooted in the structure – conduct – performance paradigm of industrial organization (Mason, 1949; Bain, 1959; Lansley, 1994; Grundy, 2006), emphasizes the actions a firm can take to create defensible positions against competitive forces. A second approach, referred to as a strategic conflict approach (Shapiro, 1989), is closely related to the first in its focus on product market imperfections, entry deterrence, and strategic interaction. This approach implicitly views competitive outcomes as a function of the effectiveness with which firms keep their rivals off balance through strategic investments, pricing strategies, signaling, and the control of information. Both the competitive forces and the strategic conflict approaches share the view that rents flow from privileged product market positions (Teece, Gary, & Shuen, 1997).

Another distinct class of approaches emphasizes building competitive advantage through capturing entrepreneurial rents stemming from fundamental firm-level efficiency advantages. These approaches have their roots in a much older discussion of corporate strengths and weaknesses; they have taken on new life as evidence suggests that firms build enduring advantages only through efficiency and effectiveness, and as developments in organizational economics and the study of technological and organizational change become applied to strategy questions. One strand of this literature, often referred to as the ‘resource-based perspective,’ emphasizes firm-specific capabilities and assets and the existence of isolating mechanisms as the fundamental determinants of firm performance. This perspective recognizes but does not attempt to explain the nature of the isolating mechanisms that enable entrepreneurial rents and competitive advantage to be sustained (Penrose, 1959; Rumelt, 1984; Teece D. J., 1984; Wernerfelt, 1984).

Strategic management involves a number of critical steps, including scanning the environment for information, selecting relevant data and interpreting it, building a strategy, testing it and putting it into action (Cray and Mallory, 1998). In recent years, several conceptual frameworks have been developed to better understand the processes of strategy formulation, and for such processes, the term “strategic marketing” is used to describe the decisions taken to develop long-run strategies for survival and growth (Urban & Star, 1991). An important part of strategic marketing is in evaluating the business environment of a firm. Porter’s model (1980) states that the knowledge of specific five forces are crucial to understand the competitive environment that the company is operating within (Lansley, 1994). Until today the framework has been an influential model within business literature and textbooks for analyzing a company’s environment (Grundy, 2006; Bartlett and Sumantra, 2002; Dobbs, 2014). Grundy (2006) compliments the model stating it is “genius” how Porter condensed the complex micro-economic theory into only five key influences.

But, using Porter's five forces model to evaluate today's competitive landscape created by the growth in international trade, technological improvements and global access to information may not be accurate.

According to Thyrlby (1998), the five forces model of Porter is static and does not take account of time. The static nature of the model is a challenge to innovation in a rapidly changing industrial structure such as environmental trends, changes in the ethnic composition of a population or a technological innovation which may pose a greater impact on some industries than on others (Dess et al., 2005). Thus, it is much more difficult to determine markets with higher dynamic competition because they can change very quickly. Flower (2004) and Downes (1997) criticize Porter's model because of the missing attention to 'Digitalization', 'Globalization', and 'Deregulation'. According to them, those three factors are one reason why the industry structures changed during the last decades. Therefore, a need for more accurate analysis of business environment arises especially when the corresponding industry or market is dynamic and growing rapidly.

### **1.1 Industry description**

Lighting industry is entering an era of faster-paced competition. An industry that has been dominated by a few firms now faces competition from new technologies, firms, and regions. Lamp (the industry name for a light bulb) manufacturing was dominated for decades by Philips, OSRAM, and General Electric (GE). But today, not only are these incumbent firms under the threat from low-cost imports, but Solid-State Lighting (SSL), a LED (semiconductor) based technology with greater potential energy efficiency and new capabilities, is revolutionizing the industry and changing how we understand and use lighting. The advantages of LED based lighting include low energy consumption, a long lifetime, and enhanced versatility. These advantages along with falling prices of LEDs are driving the rapid adoption of the SSL (Sanderson, Simons, Walls, & Lai, 2008; Zhu & Humphreys, 2016; Candelon, Creyghton, Hong, Rubel, & Smits, 2015).

The main disadvantages of LEDs are: Lack of standardization, relatively high price, risk of glare as a result of small lamp size, need for thermal management to avoid degradation in lifetime, temperature dependence (ambient temperature greatly influences the LEDs' performance) but the shift towards LED technology is predicted to accelerate for two key reasons. First, although LED technology is still more expensive than conventional lights (currently about five to ten times more) the price is falling precipitously, owing to technological advances in manufacturing and increasing LED efficiency (fewer LEDs are required for a similar amount of light output). Second, there is an increasing focus on the Total Cost of Ownership (TCO) of lighting. Manufacturers can market their products by pushing the message about LED's lower total costs, and as LED prices continue to fall, that TCO calculation will become an even stronger selling point (Sanderson, Simons, Walls, & Lai, 2008; Candelon, Creyghton, Hong, Rubel, & Smits, 2015; Almeida, Santos, Paolo, & Quicheron, 2014).

The light emitting diode (LED) was first commercialized in the 1960s and is now poised to replace conventional lighting. Hundreds of companies worldwide are participating in the LED market. Major outdoor area and commercial retrofit adoptions are taking place. The larger lighting companies have introduced LED products and design approaches for LED fixtures and light engines are becoming more sophisticated. Therefore, the \$ 112 billion global lighting market is undergoing a rapid transformation driven by the growing adoption of Light Emitting Diode (LED) technology. This trend is fundamentally altering the underlying economics and dynamics of the market. As a result, new sources of competitive advantage are emerging, requiring players to revamp their strategies across the lighting value chain (Sanderson, Simons, Walls, & Lai, 2008; Candelon, Creyghton, Hong, Rubel, & Smits, 2015; Baumgartner, Wunderlich, Wee, & Jaunich, 2012).

The shift towards light-emitting-diode (LED) lighting is further helping the adoption of connected lighting systems. These trends, which reinforce one another, are fundamentally altering the dynamics of the lighting market. Existing players are scrambling to adapt while new players—such as manufacturers in Asia and companies that market privatelabel products—are entering the fray. Attractive new product markets are emerging. The result: companies across the complex lighting ecosystem must evaluate where they can compete effectively amid the changes and adopt new strategies to win in the future (Sanderson, Simons, Walls, & Lai, 2008; Craninx, 2017; Pust, Schmidt, & Schnick, 2015).

## **1.2 Problem description**

The conventional lighting industry had entry barriers in terms of technical know-how, economy of scale advantages and product quality whereas the LED technology has allowed new players from the semiconductor and consumer electronics segments to enter the general lighting market with LED products. While demand for replacement lamps has accounted for significant growth of conventional lighting thus far, that market is dwindling as fewer replacements are needed given LEDs' longer life span. Therefore, the lighting industry structure is rapidly changing due to a disruptive technological innovation in the form of LEDs. From being dominated by few firms, today's lighting industry has become highly competitive with a large number of firms fighting to become the market leader. In this situation, accurately understanding the dynamics of lighting industry becomes very important and challenging. Only after a precise situational analysis, a firm can successfully arrive at their growth strategies.

## **1.3 Research objective and questions**

The goal of this thesis is to identify the dynamics of growth in a competitive and transitioning lighting industry and arrive at growth strategies for a lighting company. The scope of the research is limited to European market. Having defined the research objective, the research question is:

### **How can a firm identify the dynamics of growth in a competitive lighting industry transitioning from conventional to fully LED based lighting?**

To answer the main research question, the following sub-research questions are defined:

#### *1. What is the current state of the lighting industry with respect to European market as it is transitioning from conventional to LED based lighting?*

An analysis using an existing framework is performed to scan today's lighting industry and identify factors that are accelerating the transition towards LED based lighting.

#### *2. How to perform a strategic analysis that accurately evaluates the dynamic business environment of a firm?*

An internal and external environment analysis of the case company are performed and is followed by a strategic analysis that combines both to arrive at the determinants for creating a successful growth strategy.

#### *3. After performing the strategic analysis, how can a firm in a transitioning lighting industry arrive at its growth strategies?*

All the possible growth strategies are identified and discussed for its merits and limitations. Also, the most suitable strategy for the case company is suggested.

## **1.4 Thesis outline**

This report started with an introduction to the topic, a brief on today's lighting industry, research objective and questions. In chapter 2, the theoretical framework is established, first the core concepts of the research question are investigated by analyzing existing literature on business strategy. This results in arriving at a research gap and concluding the chapter with the conceptual framework of the research. Chapter 3 contains the methodology description, based on a qualitative, single case study research design. In chapter 4, the results of the research are discussed thoroughly and determinants for creating a successful growth strategy in LED lighting industry are identified. Using Atlas.ti 7.0, a dedicated software for qualitative research, relational and conceptual analysis were carried out, thus enabling a more structured approach. The final chapter entails the discussion of scientific and practical relevance, outlines the limitations and recommendations and provides the conclusion by answering the main research question.



## 2. Literature review

An industry is an arbitrary boundary within which firms compete with each other to produce related or similar products. Almost all firms across all industries are challenged, by the inherent effects of persistent technological developments as businesses increasingly emphasize the utilization of the latest accessible technologies when conducting business and competing with each other (Hove & Masocha, 2014). Technology is a force that is leading the redefining of the competitive spectrum for firms and their interaction with customers. Transformation is instigated by a technological innovation to which companies, new and existing, respond (Chandy & Tellis, 2000). The varying responses collectively transform an existing industry or initiate the formation of a new one (Kaplan & Tripsas, 2008). Radical and disruptive innovations can change the way an industry is organized and cause dominant companies problems or even put them out of the industry (Srinivasan et al., 2002; Danneels, 2004). In contrast, the development of incremental innovations is built on the competences of dominant companies and therefore the new entrants have significant problems in trying to challenge incumbent companies (Henderson & Clark, 1990). Therefore, ability of a firm to recognize and respond to a technological innovation plays an important role in helping it to make the transition to a new technological regime.

Absorptive capacity is defined as the ability to evaluate, assimilate, and apply outside knowledge to commercial ends. It enables the firm to respond to technological opportunities and to appropriate the technological knowledge made available through R&D spill-overs by competitors, and/or firms external to the industry (Cohen & Levinthal, 1989). Absorptive capacity can be explained in terms of two separate, but interrelated, dimensions of technology strategy: how the firm acquires outside knowledge (through its external environment analysis), and how it integrates, uses, and enhances that knowledge (through its internal R&D activities), in order to develop the technological capabilities that will be needed to respond to changes in the prevailing technological paradigm. While absorptive capacity is a firm specific, it is the external environment that impacts the development of internal capabilities (Nicholls-Nixon, 1995). Hence, a thorough and reliable analysis of the external environment becomes very important for a firm when it has to respond to a technological innovation.

In 1979, Michael Porter published his first article in the Harvard Business Review developing five forces that would help to determine the long-term profitability of any industry (Porter, 1980). According to Pearce and Robinson (2005) and Johnson et al. (2002), the strengths of Porter's model are that it provides one simple approach to analyze industry structure, identify and determine the attractiveness of an industry, reveal insights on profitability, inform important decisions about whether to leave or enter industries or sectors, and develop strategic options to improve relative performance in the industry or influence relative position in the industry. As one of the most influential management tools for strategic industry analysis, the model has been applied by numerous practitioners and academics (Karagiannopoulos et al., 2005; Breedveld et al., 2006). For almost three decades, Michael Porter's five forces framework has been a powerhouse under the models studied in strategic management. But, in the era of hypercompetitive and rapidly growing industries and business environments, Porter's Five Forces model is believed to be in need of a reshape as it is missing some known actors such as regulators or globalization (Ural, 2014).

The next sections will provide a thorough literature review of Porter's five forces model followed by the criticisms and limitations of the model. Then a marketing approach to complement and strengthen the model is suggested. Following which, the literature review is summarized, research gap is identified, and importance of this research is justified.

### **2.1 Porter's five forces model**

The Porter's framework shown in fig. 1, consists of five industry forces: (1) Threat of new entrants (2) Threat of substitution (3) Bargaining Power of Buyers (4) Bargaining power of suppliers and (5) Rivalry among existing firms. In general, the firm should find and develop a position in their industry that they can best defend themselves against competitive forces or influence them in their favour, from which determines whether the firm can achieve competitive advantage or disadvantage. The weaker those forces are, the easier it is to establish your business in an industry and strive for increased performance (Porter, 1979).

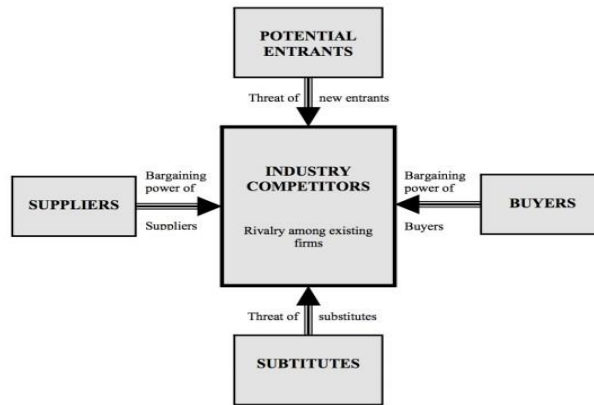


Figure 1 - Porter's Five Forces of Competitive Advantage Framework (Porter, 1980)

Porter (1985) also noted that the fundamental basis of outperforming competitors and achieving superior profits in the long run is referred to as sustainable competitive advantage. Porter also points out that every different industry will have different challenges concerning the forces and those challenges should be made number one priority if a firm in order to position the firm to compete with the best in the industry.

### 2.1.1 Threat of new entrants

Firms that have recently entered the market and industry to share the profits enjoyed by already existing firms in the same market contribute towards the threat of new entrants to any industry (Hellriegel, et al., 2004). New firms to an industry are driven by profitability of an industry as well survival chances. The threat of new entrants depends on that industry's barriers to entry. Porter (1979) distinguishes between six significant barriers to enter the market: (1) Economic of Scale (2) Product Differentiation, (3) Capital Requirements (4) Cost Disadvantages (5) Access to Distribution Channels (6) Government Policy. In his 2008 article, Porter extends the barriers of new entrance to supply side economies of scale, demand-side benefits of scale, customer switching costs, capital requirements, incumbency advantages independent of size, unequal access to distribution channels and restrictive government policy.

New entrants to an industry bring new capacity, the desire to gain market share, and often substantial resources (Porter, 1980). The existence of entry barriers limits the number of companies in the industry and therefore influences the 'Rivalry among existing competitors' (Johnson et al., 2008). Furthermore, companies who enter an existing market directly affect the competitive advantages. The additional supply for the same demand decreases the profit of the market participants. The lower the barriers to entry are, the higher the threat of new entrants is. The height of barriers to entry has been found consistently to be the most significant predictor of industry profitability (Rothaermel, 2008). Also, the technological front accentuates the entry of new competitors and makes it difficult for incumbents to recognize and react to new competitors (Rodie & Martin, 2001).

Mol, Chiu & Wijnberg (2012) opine that technological impact on industry dynamics is two-thronged. Firstly, new technologies are identified as competence-enhancing whereby the dominance of incumbents is strengthened. This is when huge technological investments turn out to create barriers of entry for potential entrants (Louw & Venter, 2010). Secondly, competence-destroying technologies nullify and mitigate the required economies of scale in an industry, hence, reducing barriers to entry and ultimately increasing the propensity of newcomers. Firms can be either incumbents or the potential entrants and as such how technology impacts them depends on their market position. Unfortunately, technology seems to create exit barriers in the form of sunk costs. This eventually dampens the profitability of that particular industry and intensifies competition as once a firm has entered an industry, they are faced with a "do or die" scenario.

### 2.1.2 The threat of new substitutes

A substitute product is a product that serves the same purpose as the traditional and original product of firms in the market (Louw & Venter, 2010). The threat of substitutes increases where the firm's customers are willing to substitute the traditional product with a new one, where the new product/service offers relatively more benefits than the

traditional one and where there are low switching costs. According to Hubbard and Beamish (2011), there are several factors that influence the Threat of Substitutes, e.g. switching costs between substitute products/services and industry product (Klemperer, 1995), or buyers' addiction to buy substitutes. New technologies result in new products and services for consumers, improved existing products, better customer services and, often, lower prices; these lure customers towards switching and substituting the existing products with new ones (Boone & Kurtz, 1992).

According to Porter (2008), substitutes are always present, but they are easy to overlook due to their nature of being different from industry's products. If the threat of substitutes is high, industry profitability will be low due to the fact that substitutes place a limit on prices. An industries growth potential and profitability will be damaged if the industry does not distance itself from substitutes (Porter, 2008). Porter also mentions that substitutes not only limit profits in normal times, but they also reduce the bonanza an industry can reap in good times (Porter, 2008). Hence the threat of substitute is high if the substitute offers an attractive price-performance trade-off to the industry's product. Also, the buyer's switching costs to the substitute should be low (Porter, 2008). The substitutes have similar purpose as the original products but can limit the potential returns of that industry by placing a ceiling on the prices that firms in the industry can profitably charge (Porter, 1980).

### 2.1.3 Rivalry among existing firms

Competitive rivals are firms with similar products and services which are aimed at the same customer group (Louw & Venter, 2010). This is the most obvious and immediate source of competition. Industry competition intensifies when a market is composed of numerous and almost balanced competing firms. Notably, competitors utilise strategies such as price-cutting, improved service delivery and quality (Hellriegel et al., 2004). New technology causes firms to face more difficulties in upholding proprietary offerings. This reduces differentiation and strengthens the rivalry which exists among these firms, hence, intensifying the overall industry competition (Porter, 2001). A high level of rivalry between existing competitors can influence the profitability of an industry. It depends on the intensity with which companies compete and, second, on the basis on which they compete (Porter, 2008).

This force can be influenced by industry growth rate, fixed costs/ storage costs, number of firms/ competitor balance, switching costs between competitors, differentiation, or exit barriers (Hubbard & Beamish, 2011; Slater & Olson, 2002; Johnson et al., 2008). The intensity and the basis that competitors compete on sum the degree of the rivalry. The rivalry between competitors is high when competitors are big in numbers and share the similar size and power. Also, if the industry growth is slow, it will cause arguments and challenges to capture market share. Rivalry between competitors is also big if exit barriers out of the industry are high. In addition, rivals that are very committed to their business and gaining competitive advantage through good leadership will want to compete against others. At last, firms that are not familiar with each other will also cause great rivalry (Porter, 2008).

### 2.1.4 The bargaining power of buyers

The bargaining power of buyers refers to the ability of buyers/customers to force down the prices of the firm's products and services (Hellriegel et al., 2004). If the buyers have a high market power, they are able to push prices downward, prevail better quality or they can force expanded services. These also reduce the profitability of the industry. The bargaining power of buyer is high if the buyers are large, they are ably to switch easily to another supplier and they are few in numbers (Slater & Olson, 2002). In addition, competition increases in an industry where customers threaten to integrate backwards (Hollensen, 2003).

Technology provides a customer with a wider choice of channels through which to connect with a brand; this intensifies the switching and mobility of customers, thereby boosting buyers' bargaining power (Porter, 2001; Kotler & Keller, 2006; Baker & Bass, 2003). Therefore, the power of buyers is the exercise of pushing down prices, wanting better quality and service and letting suppliers compete against each other for the job. This way the buyer will try to capture more value while probably paying one of the lowest if not the lowest price for good quality. In this matter suppliers are dependent on the buyer and the buyer takes advantage of his position by applying price pressures to suppliers. The power of customers can be described as the "flip side of powerful suppliers" (Porter, 2008).

### 2.1.5 The bargaining power of suppliers

The bargaining power of suppliers refers to the ability of suppliers to force up the prices of the inputs of firms in the industry (Hellriegel et al., 2004). The bargaining power of suppliers tends to be higher when the suppliers are concentrated or when they contribute to the larger component of the products that are bought by customers. Thus, suppliers can bargain for higher prices and thus reduce the profitability of the firms (Jain, 1997). Competition from suppliers is also increased when suppliers threaten to integrate forward (Malcolm & Martin, 2003). New technology, which results in reduced barriers to entry, results in an increase in competitors as suppliers integrate forward. Ultimately, this tends to shift the bargaining power to suppliers, hence increasing competition (Porter, 2001).

Powerful suppliers can thereby squeeze profitability out of an industry unable to recover cost increases in its own prices (Porter, 1979). There are different factors which are determined as indicators for high bargaining power of suppliers: For example, the industry is dominated by a few companies and is therefore more concentrated than the industry it sells to, or the industry is not the most important customer of the supplier group (Porter, 1979). The Bargaining Power of Suppliers can be influenced by the size of the supplier, the number of suppliers, and the availability of alternative customers (Slater & Olson, 2002). The power of suppliers can have an impact on profitability of an industry by raising costs or reducing the quality of purchased good and services (Porter, 1979).

### 2.2 Limitations and Criticisms of the five forces model

Although the five forces model is one of the most known and widely spread management models in practice, the criticism became increasingly severe (O'shaughnessy, 1984; Dulčić, Gnjidić & Alfirević, 2012). One of the first criticisms is the fact that Porter (1979) has no justification for the choice of the five environmental forces, which prove the validity of his choice (O'shaughnessy, 1984). A further criticism is that the model only generates snap-shots. Dulčić et al. (2012) are extremely critical in regard to the use of five forces model. In their opinion, taking the dimension 'time' into account is beneficial for managers as they will be better able to consider market trends and changing environment. In addition, Grundy (2006) notes that the framework doesn't refer to the 'PEST' factors or to the 'dynamics of growth' for a certain industry or market.

According to Johnson et al. (2008), Porter's Five Forces framework is relevant to the majority of organisations and the industry analysis can offer the basis for developing a strategy. The framework adapted traditional supply-demand analyses to include rivals (Karagiannopoulos et al., 2005), which allows organisations to prepare for a stronger strategic position (Dalken, 2014). However, Williams (2011) has identified a limitation of Porter's Five Forces, being that the model assumes perfect competition. In the contemporary market where there is demand for unique and highly differentiated products, there is a large number of monopolistic industries; for companies that dominate the majority of the industry, an industry analysis tool such as Porter's Five Forces may not be relevant. Furthermore, making use of the five forces model does not guarantee a competitive advantage that is inviolable and sustained (Aktouf, 2004). The reason for this again lies in the fact that five forces framework is a static model, which does not include the changing competitive environment (Karagiannopoulos et al., 2005).

The Five Forces model does not assess the resources and capabilities of a company, which are also relevant for analyzing the overall profitability (Rivard, Raymond & Verreault, 2006). According to Spanos et al. (2001), the firm's unique resources should be the catalyzer to define the essence of strategy. Pfeffer et al. (1999) and Aktouf et al. (2005) go further by mentioning intrinsic and intangible factors namely leadership, management, reputation, compensation, selective hiring, people, employment security, teams, information transparency, culture, morale, training, empowerment and communication that are not considered in Porter's Five Forces framework. Furthermore, many managers have lost focus as they are too busy concentrating on the external forces rather than the internal forces that play an important role in achieving competitive advantage (Pfeffer et al., 1999). Aktouf et al. (2005) go on to criticize the model as not guaranteeing a competitive advantage. The framework that is rather a prescription than a dynamic model is not helpful to businesses in terms of improving their shaky market/industry position. Likewise, Srisvastava et al. (2012) argues that Porter's framework is not a dynamic analysis and does not really open up on how the industry participants actually interact with each other in quickly changing industries.

According to Hill and Jones (2008), industry factors are able to justify business performance variations. Those factors can only motivate 20 percent of the variations in terms of market share, growth and industry profitability (Grant, 2011). Today's goal is not only to protect against the five forces, it becomes more and more important to start collaboration and maintain innovation due to the increasing power of the Internet and other information technologies (Karagiannopoulos et al., 2005; Holm, Eriksson & Johanson, 1996). Wang and Chang (2009) argue that the zero-sum game approach is short term and ignores the long-term benefits of a constructive win-win strategy through relationships with all or most of the stakeholders like strong mutual relationship with suppliers and buyers can make the firm enjoy the Just In Time philosophy (JIT), thus saving on storage costs. It has also been noted that power showdowns to competitors may sometimes boomerang on the firm and heavily impact on the firm cost-wise, and that by cooperating with the stakeholders, the banks in an industry can become least-cost producers.

Grundy (2006) argues that the most prevalent criticism of Porter's framework is its static nature; that it only considers the current environment and doesn't anticipate changes in the industry which diminishes its efficacy. It is important to take this into consideration due to the turbulence of the competitive environment – the question becomes whether one must defend themselves against the forces or to create a product innovative enough to expand the industry (Karagiannopoulos et al., 2005). Porter's Five Forces is primarily a tool for analyzing the competition within an industry. However, it fails to acknowledge the existence of complementary companies as well as competitors, and some strategists believe that complementors should be added as a sixth force (Johnson et al 2013). The model ignores the pivotal role of complements by focusing on industry and group structures rather than individual companies (Brandenburg and Nalebuff, 1995) and innovation creates change in industry structures, thus, altering the competitive environment and that the industry structure alone cannot fully explain the performance differences between industry competitors (Moriarty, 1983).

In the modern era of globalization, the dynamic business environment causes industry boundaries to merge, therefore defining and analyzing one specific industry becomes challenging (Johnson et al., 2013; Grundy 2006). These converging industries are comprised of many different markets and segments; therefore, the five forces must be conducted at different levels in order to understand the whole industry; however, having to complete multiple analyses is a limitation of the model. The business environment is divided into three layers – the macro-environment, the industry and competitors. Porter's Five Forces is a framework for analyzing the industry alone; therefore, it might be worthwhile conducting complementary analyses for other layers of the business environment, such as a PESTEL analysis for the macro-environment. Grundy (2006) believes that these strategic tools are interdependent, and a combination would allow for a wider and more accurate analysis of the business environment.

To summarize, Porter's five forces framework is criticized as a static model that does not: include the changing competitive environment, assess the resources and capabilities of a firm, and provide insights on how the industry participants interact with each other in transitioning industries. Therefore, through combining five forces model with various other relevant strategic tools, these limitations can be addressed, and a holistic industry analysis can be made possible. In this context, it is also important especially for firms in dynamic industries to utilize a marketing strategy that not only protects against the five forces but promotes starting and maintaining stakeholder relationships and inter-firm collaborations due to the increasing power of the Internet and other information technologies (Karagiannopoulos et al., 2005; Holm, Eriksson & Johanson, 1996).

### ***2.3 Relationship marketing and its relevance in hypercompetitive and rapidly growing industries***

The marketing mix management paradigm has dominated marketing thought, research and practice since it was introduced. Marketing, the way most textbooks treat it today, was introduced around 1960. The concept of the marketing mix and the Four Ps of marketing – product, price, place and promotion – entered the marketing textbooks at that time (McCarthy, 1960). Eventually the Four Ps of the marketing mix became an indisputable paradigm in academic research, the validity of which was taken for granted (Grönroos, 1989). The paradigm began to lose its position and new approaches have been emerging in marketing research. The globalization of business and the evolving recognition of the importance of customer retention and market economies and of customer relationship economics, among other trends, reinforced the change in mainstream marketing (Grönroos, 1992 and Sheth et al.,

1998). Relationship building and management, or what has been labelled relationship marketing, is one leading new approach to marketing which eventually has entered the marketing literature (Grönroos, 1992; Gummesson, 1987 and Blomqvist et. al, 1993).

In response to the constraints imposed by the globalization of markets, firms and their marketing function have become more international, and recognized a growing need to focus on their core businesses, outsourcing activities and contractual relationships, so as to manage their inputs and distribute their outputs efficiently. Real networks are being developed, focusing on relationships, and continuous and sustainable development (Heide & Miner, 1992; Hertz & Mattsson, 2001; Noonan, 1999; Webster Jr., 1992). Cooperation and collaboration networks can be vertical, between players at technologically distinct stages or horizontal, involving competitors or even firms supplying complementary products to the same target-market (Gemunden & Ritter, 1997; Gulati, 1998). The research of Wang and Chang (2009) further strengthens the need for this approach by suggesting that a constructive win-win strategy through relationships with all or most of the stakeholders is important in today's dynamic industries. Further, this approach is extremely important in an industrial setting which is different from consumer marketing in a number of aspects like the formalized decision-making procedures, the buying practices and rationality of choices and the special character of the industrial customer (Alexander et al., 1961; Kotler, 1984; Wind and Webster, 1972; Fern and Brown, 1984).

An interest in turning anonymous masses of potential and existing customers into interactive relationships with well-defined customers is becoming increasingly important (McKenna, 1991; Rapp et al., 1990 and Clancy, 1991). The interaction and network approach of industrial marketing and modern service marketing approaches, especially the one by the Nordic School, clearly views marketing as an interactive process in a social context where relationship building, and management are a vital cornerstone (Bagozzi, 1975 and Webster, 1992). They are in some respects clearly related to the systems-based approaches to marketing of the 1950s (Fisk, 1967). The marketing mix management paradigm with its Four Ps, on the other hand, is a much more clinical approach, which makes the seller the active part and the buyer and consumer passive. No personalized relationship with the producer and marketer of a product is supposed to exist, other than with professional sales representatives in some cases. This, latter view of marketing does not fit the dynamic industries. Thus, the concept of relationship marketing emerged within the fields of service marketing and industrial marketing (Gummesson, 1991; Grönroos, 1990; Jackson, 1985 and Berry, 1983). Grönroos defines relationship marketing in the following way: Marketing is to establish, maintain, and enhance relationships with customers and other partners, at a profit, so that the objectives of the parties involved are met. This is achieved by a mutual exchange and fulfilment of promises (Grönroos, 1990).

Such relationships are usually but not necessarily always long-term. Establishing a relationship, for example with a customer, can be divided into two parts: to attract the customer and to build the relationship with that customer so that the economic goals of that relationship are achieved. An integral element of the relationship marketing approach is the promise concept which has been strongly emphasized by Calonius (1988). According to him, the responsibilities of marketing do not only, or predominantly, include giving promises and thus persuading customers as passive counterparts in the marketplace to act in a given way. Calonius also stresses the fact that promises are mutually given and fulfilled. Therefore, a firm occupies itself with giving promises can temporarily attract new customers and build relationships initially. However, if promises are not kept, the evolving relationship cannot be maintained and enhanced. Fulfilling promises that have been given is equally important as a means of achieving customer satisfaction, retention of the customer base, and long-term profitability (Reichheld et al., 1990).

Another key element in marketing is trust (Grönroos, 1994). Moorman et al. (1993) defines trust as "...a willingness to rely on an exchange partner in whom one has confidence". This definition means, first of all, that there has to be a belief in the other partner's trustworthiness that results from the expertise, reliability or intentionality of that partner. Second, it views trust as a behavioural intention or behaviour that reflects reliance on the other partner and involves uncertainty and vulnerability on the part of the trustor. If there is no vulnerability and uncertainty, trust is unnecessary, because the trustor can control the other partner's actions (Zaltman et al., 1988). Trust is an important part of relationship marketing. Kotler (1992) concludes that "companies must move from a short-term transaction-oriented goal to a long-term relationship-building goal". Webster (1992), comes to a similar conclusion: "There has been a shift

from a transactions to a relationship focus”, and “from an academic or theoretical perspective, the relatively narrow conceptualization of marketing as a profit maximization problem, focused on market transactions or series of transactions, seems increasingly out of touch with an emphasis on long-term customer relationships and the formation and management of strategic alliances”.

Because of the lack of personal contacts with their customers and their focus on mass markets, firms pursuing a transaction-type strategy will probably benefit most from a traditional marketing mix approach. For a firm applying a relationship strategy, the marketing mix often becomes too restrictive. The most important customer contacts from a marketing success point of view are the ones outside the realm of the marketing mix. In transaction marketing, there is not much more than the core product, and sometimes the image of the firm or its brands can keep the customer attached to the seller. When a competitor introduces a similar product, which is quite easily done in most markets today, advertising and image may help in keeping the customers, at least for some time, but price usually becomes an issue. A firm that offers a lower price or better terms is a dangerous competitor, because in transaction marketing the price sensitivity of customers is often high. A firm pursuing a relationship marketing strategy, on the other hand, has created more value for its customers than that which is provided by the core product alone. Such a firm develops over time more and tighter ties with its customers. Such ties may, for example, be technological, knowledge-related or information-related, or social in nature. Of course, price is not unimportant but is often much less an issue here. Thus, relationship marketing makes customers less price sensitive (Grönroos, 1994).

Value is considered to be an important constituent of relationship marketing and the ability of a company to provide superior value to its customers is regarded as one of the most successful competitive strategies. This ability has become a means of differentiation and a key to the riddle of how to find a sustainable competitive advantage (Christopher et al., 1991; Grönroos, 1994; Heskett et al., 1994; McKenna, 1991). By adding more value to the core product (the product quality is improved, supporting services are included into the offering, etc.) companies try to improve customer satisfaction so that the bonds are strengthened, and customer loyalty thereby achieved. Firm’s offering should be seen as a “value carrier” and in order to achieve a sustainable competitive advantage the firm must provide an offering which the customers perceive offers a greater net-value than the offerings of the competitors. An interesting issue from a relationship marketing perspective, however, is how the product or the offering is to be defined.

The traditional approaches describing the firm’s total offering or augmented product (Grönroos, 1990; Levitt, 1983) as a core product supported by surrounding services or goods consider only one episode regarding the customer. The relational aspect as a constituent of the offering is not taken into account. The value of having a relationship, e.g. the value of commitment from both parties, in our opinion also needs to be taken into account when analysing the offering provided and the manner in which it influences the customer’s perception of the value. The importance of developing relationships in building effective marketing strategies has been emphasized by researchers and practitioners in the field of marketing (Webster, 1992; Parvatiyar et al., 1992; Grönroos, 1994). Considering, today’s dynamic business setting, they call for a change from the dominating marketing management school epitomized by McCarthy’s (1960) 4P model and Kotler’s (1988) “analysis, planning and control” approach and referred to as transaction marketing (TM), to the relationship marketing (RM) model.

#### **2.4 Research gap**

Porter’s five forces framework is criticized as a static model that does not include the changing competitive environment, assess the resources and capabilities of a firm, and provide insights on how the industry participants interact with each other in transitioning industries. Grundy (2006), in his article “Rethinking and reinventing Michael Porter’s five forces model”, emphasizes that Porter’s work tends to over-stress macro analysis at the industry level instead of the analysis of more specific product-market segments at micro level. He also mentions that the framework appears to be self-contained and does not really take into consideration political, economic, social and technological factors and the dynamics of growth in particular markets. Finally, Grundy suggested that a using a combination of strategic tools that are interdependent would allow for a wider and more accurate analysis of a firm’s dynamic business environment. Through combining five forces model with various other relevant strategic tools, a holistic industry analysis can be made possible but very little literature is available on this (Williams and Figueiredo, 2011). Therefore,

this research addresses this scientific gap where PESTEL (Political, Economic, Social, Technological, Environmental and Legal), Organizational and SWOT analyses are combined with Porter’s five forces model to accurately analyse the dynamic lighting industry transitioning from conventional to fully LED based lighting.

### 2.5 Conclusion

An overview of the theoretical framework used in this research is given in the below table:

Table 1: Conceptual framework

Research stage	Approach	Theoretical model
Macro-environment analysis of a firm	Analysis of Macro-environmental forces <ul style="list-style-type: none"> <li>- Political force</li> <li>- Economic force</li> <li>- Social force</li> <li>- Technological force</li> <li>- Environmental force</li> <li>- Legal force</li> </ul>	PESTEL framework
Micro-environment analysis of a firm	Organizational analysis <ul style="list-style-type: none"> <li>- Company structure</li> <li>- Financial analysis</li> </ul>	Organization chart Value-chain analysis Porter's five forces model
Strategic analysis combining micro- and macro-environment analysis of a firm	Analysis of strengths & weaknesses (internal) versus opportunities & threats (external)	SWOT-analysis

The next chapter will address the research methodology used in this research. In chapter 4, the complete analysis of lighting industry is presented and determinants for creating a successful growth strategy are identified and discussed. Finally, in chapter 5, the overall conclusion of the thesis is presented by providing an overview of the findings.



### 3. Methodology

This chapter describes the research methodology used for the research project, including data collection tools. Furthermore, it elaborates on the details of the case study research design. The research design follows the theoretical framework that was proposed in chapter 2. This research design was chosen because of its empirical nature and since it was based on in-depth qualitative research. Furthermore, the research design facilitated the possibility of data collection within the context, balancing the data available and realization of the research objectives both theoretical and practical (Bryman, 2012). The case study research design is elaborated upon in Section 3.2. The same section also introduces the data collection plan, followed by case study protocol in Section 3.3 and data analysis strategy in Section 3.4. The chapter ends with research quality considerations in Section 3.5.

#### 3.1 Research strategy

The aim of a research design is to describe and analyse methods used, hence clarify their presuppositions and consequences, and highlight their limitations (Leedy, 1993). The nature of the research problem (as discussed in section 1.2) typically suits a qualitative research approach because the latter allows for in-depth probing of issues and greater detail in responses (Denzin and Lincoln, 1994) and can gain in-depth and holistic insights into a process or object that is confined to a particular context (Verschuren & Doorewaard, 2010). Further, it allows for interaction between group members in focus group interviews, which often stimulates discussion and uncovers issues unanticipated by the researcher (Dixon et al., 1988; Hussey and Hussey, 1997). To enhance the validity and reliability of the research it is important to be aware of the limitations of qualitative research, which are related to: subjectivity, difficulty to replicate, problems of generalization and the lack of transparency (Bryman, 2012; Yin, 2009). In this research design, these limitations were considered and minimized as much as possible by using a protocol.

As discussed in Section 1.3, the main research question is concerned with how a firm can identify the dynamics of growth in a competitive lighting industry transitioning towards a disruptive technology because very little literature is available on how it can be done, underpinning that research on this topic would be of great added value. Methodologically, the how question refers to understanding of how strategic analysis of a company and its market position can help to increase its market share. This study can be further categorized as exploratory research for the same reason, as the concept of arriving at strategies to increase market share based on analysis of both internal and external analysis and market position has attracted little attention thus far. Based on the qualitative approach, a

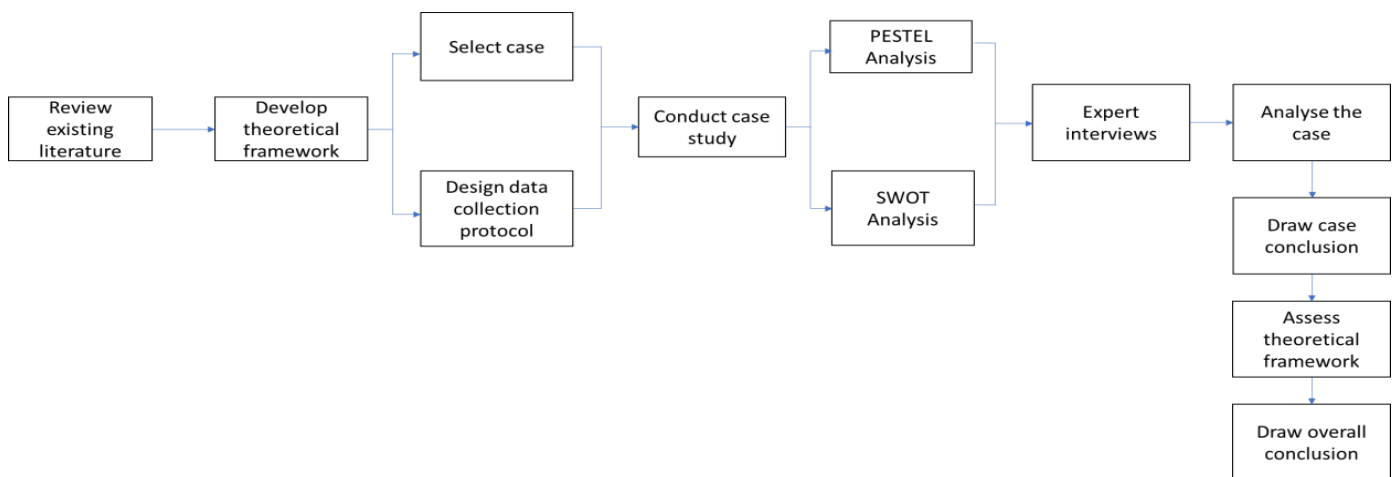


Figure 2 – Research Framework

matching research design was defined. The research design selected is a single case study, as it allows for measuring contemporary phenomena in its usual context. The single case study is typically used to answer research questions concerned with how and why (Yin, 2009). Section 1.1 already stated that the objective of this research is in proposing strategies to a company to help increase its market share in European market. By analysing external and internal

environment, and market position, determinants for successful strategy are identified and subsequently used to make recommendations. Finally, the activities involved in this research are displayed in fig. 2.

### 3.1.1 Desk research

To start the research, an initial literature review was carried out to build the theoretical framework. In order to fulfil the research objective of the study, the Business Unit Strategic-Planning Process of Kotler (2003) was chosen as a basis. For the purpose of this study, focus was on situational (external and internal environment) analysis, goal formulation and strategy formulation. Only this way a company can responsibly choose the best matching strategies among all those theoretically available. The internal environment analysis in this study was carried out using organizational analysis and Porter's value-chain analysis (Porter, 1985). The former is often used to analyse the structure of the organization whereas the latter is used to identify the strong and weak points of the company in terms of its primary and support activities. Both these analyses are performed through desk research using secondary data.

The external environment analysis in this study was carried using PESTEL framework. The PESTEL framework refers to the political, economic, social, technological, environmental and legal factors influencing the environment in which a firm must operate (Day, 1990; Sanchez and Heene, 1997; Gay, 2002; Hopkinson, 1993; Mayer-Wittman, 1989). This framework was chosen for this study as it allows identification of the environment within which the company operates and provides data and information that will enable the company to predict situations and circumstances that it might encounter in future. The outcome of the PESTEL analysis provided the basics for the SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis, mainly in its opportunities and threats. After carrying out the situational analysis, the results of the separate previous analyses were synthesized in a strategic analysis. For this a SWOT-analysis were used. This analysis is mentioned by several authors as an instrument for the overall evaluation of a company's strengths, weaknesses, opportunities and threats. The Strengths (S) and Weaknesses (W) are measured by the internal analysis, while the Opportunities (O) and Threats (T) are measured by the external analysis (Blythe, 2006; Kotler, 2003; Zikmund & d'Amico, 1996).

In the coming sections, PESTEL framework will first be discussed. This model divides the macro environmental forces into the following six categories: Political, Economic, Social, Technological, Environmental and Legal. Each of these categories will be discussed in detail. In the next section, all the four dimensions (Strengths, Weaknesses, Opportunities, Threats) of SWOT analysis will be introduced and explained in-depth. By performing PESTEL and SWOT analysis sequentially, influence of a firm's external and internal environment on its business can be evaluated.

### 3.1.2 PESTEL framework

Environmental analysis is important for developing a sustainable competitive advantage; identifying opportunities and threats; and providing opportunities for productive co-operation with other companies. A review of the literature reveals that different approaches and techniques were used for the analysis of macro environment (Lynch, 2009). The framework used in this study is PESTEL analysis. PESTEL analysis has different definitions within the literature, such as PEST (Dare, 2006) and STEPE (Richardson, 2006). The original form of PESTEL was first conceived by Aguilar as ETPS (economic, technical, political, and social). This was subsequently reorganized as STEP for the Arnold Brown Institute of Life Insurance for use in strategic evaluation of trends. It was later modified to address macro analysis of the external environment or scanning for environmental change and was defined as STEPE. In the 1980s, the legal dimension was added to this approach (Richardson, 2006). Apart from a technique for strategic analysis, PESTEL analysis began to be used in different fields (Katko, 2006; Richardson, 2006; Shilei & Yong, 2009).

The PESTEL framework seeks to evaluate how these external forces affect the firm. Furthermore, it assists companies in the selection of attractive markets and the appropriate entry mode. Hence, countries are often compared along the dimensions that are identified in the PESTEL framework before the industry-specific conditions are evaluated. As the macro-environmental forces changes over time, it is important to understand the key drivers of change and the impact they have on particular industries, markets and companies. The key drivers of change will be different according to various industries and also vary from nation to nation. Hence, this framework is used to analyze the current and future impact of environmental factors, which may be different from their past impact.

### **Political environment**

The political environment, in which a firm operates, has a major impact on its operations and profitability, and is mainly influenced by the political forces in an industry or country. The political forces refer to political trends, governmental policies and interventions, and political risks (O' Connor, 2000). Governmental policies and regulations on taxation and foreign trade affect companies by offering incentives for foreign investments, or on the other hand, disincentives to engage in foreign production (Johnson et al., 2005). Also, the political stability and type of government are political factors that determine the attractiveness of a particular market. Hence, the choice of entry mode is dependent on whether the foreign market's economy is a market economy or a centrally planned socialist economy (Root, 1998). Political and social events that can have an impact on the security and profitability of a firm are considered to be political risks. It is important that a firm is aware of the degree of political risks in a country before entering. Key types of political risks include (Johnson et al., 2005):

- Sovereign risks which arise from the policies and decisions of host governments, including changes in tax laws, restrictions on expatriate employment and regulations on foreign trade.
- The lack of consistent legislation and effective polices, which can lead to corruption and contractual and financial difficulties for companies in operation.
- International risks that are linked to developments in the international political economy.
- Security risks relating to wars, civil unrest, violence and crime, diplomatic relations, trade treaties and economic sanctions.

### **Economic environment**

The economic environment has a significant impact on a company's activities in the market place and the size of a potential market both at the local and international level. The fluctuation of a country's currency, as well as interest and inflations rates can considerably affect a company's revenues (Johnson et al., 2005). Moreover, GDP figures, unemployment rates, labour cost, stock market values and business cycles are other examples of economic forces (O' Connor, 2000). The size of the economy measured in terms of its gross domestic product per capita (GDP), is an important determinant for firms to calculate the potential size of a market. Moreover, the GDP of a country also influences the choice of entry mode, as smaller market favours entry modes that need low sales volumes to breakeven and demands a low degree of control. This is also the case when a company only focusses on a smaller segment of a larger market (Root, 1998).

Another economic factor to consider is the population's disposable income as it influences a firm's strategic decisions on whether or not the potential customers will have the purchasing power to buy the firm's product offerings (Johnson et al., 2005). Moreover, in order to successfully compete on the local market, it is important to establish good relationships with local distribution channels and suppliers. This is particularly important, when the total sales are too low to justify a separate distribution channel. Other issues to consider for a company going global are the need for local sales people and services, adjustment of prices and products to fit local needs, as well as transportation time and costs. Transportation costs can be very high if the product needs to be delivered in a short time or if the product is of great value and requires special delivery methods (Porter, 1998).

### **Social environment**

Social forces can be defined as the ways in which businesses are influenced by changes in society. Even tough, most social forces can also be classified either as political or economic, in the PESTEL framework they mostly relate to the cultural forces of an environment. A first important social force is the cultural distance between the home and host country of a firm and refers to the differences in cultural norms, values, language, and religion. This will affect whether a firm will enter a particular market and also how they will enter (Johnson et al., 2005). The impacts of cultural forces have previously been underestimated, however more and more firms understand the importance of considering cultural differences when operating in foreign markets (Hill, 2008). Due to changes in lifestyles and differences in consumer preferences across countries, companies might have to adapt their products and services accordingly (Johnson et al., 2005).

Consumer lifestyles are an accepted basis for market segmentation. In consumer behaviour, lifestyles reflect different modes of living and the patterns of consumption that tend to accompany them. As lifestyles offer more comprehensive

view of behaviour and the motives that underlie many of the purchases made by the consumers, they are regarded as advantageous for market segmentation (Todd, Lawson and Faris, 1996). Many academia and marketers use the lifestyle concept to identify existing or potential customers and to understand their decision making process (Hawkins et al., 2004; Senauer et al., 1991) because the concept is deeply connected to consumerism (Chaney, 1996) and helps to account for how people express their identity in many areas such as activities, interests, and opinions (AIO) (Wells & Tigert, 1971).

Since its early introduction by Lazer in 1963, consumer lifestyle analysis information has become a very popular tool in marketing management decision making. Segmentation using attitudinal and behavioural measures as bases was the most popular segmentation development in 1990s (Piiro, 1990). Within this approach, consumers who hold similar beliefs, attitudes or preferences within a particular category are grouped together (Honkanen et al, 2004). Market researchers use psychographics to describe a consumer segment so as to help an organization better reach and understand its customers. Thus, a study of relationship between consumer demographics and values and life-styles is likely to provide marketing managers with valuable visions for marketing segmentation, value creation, product positioning/re-positioning, and promotional decisions.

### **Technological environment**

The infrastructure of national markets also is an important factor in assessing the attractiveness of markets. Infrastructure refers to the availability of roads, electricity, telecommunications, railroads, water supply, and so on. The availability of roads and railroads for instance, determines the choice of entry mode, as high transportation costs make it difficult for exported products to compete with the local products. This is especially the case for logistics and supply chain companies with large geographical distances between the two countries in trade. Infrastructure is mainly funded through governmental investments; however, there is today an increasing trend towards privatization of infrastructure throughout the world. Generally, national markets with good existing infrastructure are more attractive for firms. Moreover, the availability of necessary local resources such as appropriately skilled labour and technology are key factors in deciding what markets to enter and entry modes to pursue. The availability of new and emerging technology depends on governments' spending on R&D and focus on technological efforts (Johnson et al., 2005).

### **Environmental environment**

Environmental issues refer to the matters related to environmental protection laws, waste disposal, energy consumption and emission of greenhouses gases. In recent years environmental governance has become increasingly important and huge resources are put in place to ensure effective and efficient environmental control. More and more companies adapt environmentally friendly practices and try to act in a manner which is sustainable for the environment. This applies however mainly to producing companies. Moreover, customers are demanding that companies use environmentally friendly packaging and invest in energy saving transportation methods. Consequently, it is important for a firm to consider the governmental regulations concerning environmental issues before entering a new market (Johnson et al., 2005).

### **Legal environment**

Legal forces refer to governmental regulations and policies that affect the entry of foreign companies. Examples of legal forces can be restrictive import policies such as tariffs, quotas and other trade barriers. The purpose of tariffs is to protect a country's own production from foreign companies by making the foreign products more expensive. Quotas, on the other hand, are restrictions in quantities of a certain product that are allowed to be exported to a country and this puts a limit on the amount of products a firm can sell abroad (Porter, 1998). Hence, these barriers to trade are important factors in a firm's decision on whether to produce locally or to export. Furthermore, a company entering a foreign market has to consider the local competition law, the employment law, consumer protection laws as well as environmental laws and health and safety restrictions. Local competition laws can obstruct the entry of companies with monopoly power or prevent anti-competitive behaviour among existing companies. Moreover, employment laws can favour the employment of local workers, and consumer protection laws can force companies to modify their product according to the local markets (Johnson et al., 2005).

Therefore, PESTEL analysis has two basic functions for a company. First, it allows identification of the environment within which the company operates. The second function is that it provides data and information that will enable the company to predict situations and circumstances that it might encounter in future (Yüksel, 2012). As mentioned already, PESTEL analysis provides the basics for the SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis, mainly in its opportunities and threats. The synergy between SWOT and PESTEL provides an extensive and more accurate analysis of a complex system and its multidimensional interaction with the environment (Vorthman, 2008). In the next section, SWOT analysis will be explained in detail starting from its origin and its usage as a strategic planning tool.

### 3.1.3 SWOT Analysis

The origin of the term “SWOT” is unknown. SWOT analysis was described by Learned et al. (1969) and has grown as a key tool for addressing complex strategic situations by reducing the quantity of information to improve decision making. Online sources credit SWOT’s origination with Stanford University Professor Albert Humphrey who led a research project in the 1960s and 1970s based upon the United States’ Fortune 500 companies but no academic references to support this claim can be found (King, 2004). Haberberg (2000) stated SWOT was a concept used by Harvard academics in the 1960s while Turner (2002) attributed SWOT to Igor Ansoff (1987). Koch (2000) credited the contributions of Weihrich (1982), Dealtry (1992), and Wheelan and Hunger (1998) to SWOT’s further development and innovation. Wheelan and Hunger (1998) used SWOT to find gaps and matches between competences and resources and the business environment in their popular business policy and strategy text while Dealtry (1992) approached SWOT in terms or groups and vectors with common themes and interactions. Regardless of the exact historical credit for coining the term “SWOT”, it has a half-century of use and documentation in the literature.

Researchers in strategic management (Ansoff, 1965; Andrews, 1987; Porter, 1991; and Mintzberg et al., 1998) agree SWOT (Strengths, Weakness, Opportunities, and Threats) analysis provides the foundation for realization of the desired alignment of organizational variables or issues. By listing favourable and unfavourable internal and external issues in the four quadrants of a SWOT analysis grid, planners can better understand how strengths can be leveraged to realize new opportunities and understand how weaknesses can slow progress or magnify organizational threats. In addition, it is possible to postulate ways to overcome threats and weaknesses (e.g. Hofer and Schendel, 1978; Schnaars, 1998; McDonald, 1999; Kotler, 2000), or future strategies, from SWOT analysis. Valentin (2001) advocates SWOT analysis as the traditional means for searching for insights into ways of crafting and maintaining a profitable fit between a commercial venture and its environment. Panagiotou (2003) contends SWOT analysis is used more than any other strategic planning tool.

SWOT-analysis brings together the results of internal and external analysis of a company. The purpose is to find the most favourable match of internal resources, capabilities and core competences to build competitive advantage, and to identify a position in the industry where a company best can defend itself against competitive forces or influence them to their own favour (Friend & Zehle, 2009). In order to do so, the SWOT-analysis must have a customer focus, since competitive advantage is a result of satisfying customer needs (Friend & Zehle, 2009). SWOT analysis was firstly developed as a strategic planning tool (Afuah, 2009). Strengths and weaknesses in that perspective are considered to be internal factors, since they are specifically connected to a company’s resources, capabilities and core competences (Afuah, 2009). Likewise, opportunities and threats are external factors and depending on the external environment. The best strategies accomplish an organization’s mission by exploiting an organization’s opportunities and strengths while neutralizing its threats and avoiding its weaknesses (Barney & Griffin, 1992). The results of these analyses can be placed in a SWOT-matrix, in which the strengths and weaknesses are placed against the threats and opportunities. The attractiveness of a SWOT-matrix is that it allows for identifying the right strategy for a firm to select. Some of these general strategies are shown in table 2.

Table 2: SWOT-combinations and strategies (Alsem, 1993)

	<i>Strengths</i>	<i>Weaknesses</i>
<i>Opportunities</i>	Grow	Improve
<i>Threats</i>	Defend	Problems/Run

### **Evaluating an organization's strengths and weaknesses**

Organizational strengths are skills, capabilities and core competences that enable an organization to conceive of and implement its strategies. Different strategies call upon different skills and capabilities. An organization that possesses distinctive competences and exploits them in the strategies it chooses can expect to obtain a competitive advantage. However, the competences can be duplicated by other firms called strategic imitation. A sustained competitive advantage that exists after all attempts at strategic imitation have ceased is therefore to be preferred. Therefore, organizational strength defines the characteristics and situations in which an organization is more effective and efficient compared to their competitors.

The evaluation process of an organization's weaknesses is similar to when evaluating its strengths. Organizational weaknesses are skills and capabilities that do not enable an organization to choose and implement strategies that supports its mission. An organization with organizational weaknesses either can make investments to improve its weaknesses or change its mission. When competing organizations have implemented valuable strategies that the organization in focus has not done, it has a competitive disadvantage. Therefore, organization weakness means the aspects or activities in which an organization is less effective and efficient compared to its competitors (Barney & Griffin, 1992).

### **Evaluating an organization's opportunities and threats**

Opportunities are those that would yield positive results for the organization determined as a result of the analysis of its environment. According to Harrison and John (2004), opportunities are conditions in the external environment that allow an organization to take advantage of organizational strengths, overcome organizational weaknesses or neutralize environmental threats. Evaluating an organization's opportunities and threats is directly related to the tools described in the chapter about the external analysis (Barney & Griffin, 1992). Moreover, organizational opportunities are events or phenomena in an organization's environment that, if exploited, may generate above normal economic performance.

Threats are events or phenomena in an organization's environment that make it difficult for an organization to create or maintain above-normal economic performance, or even normal economic performance according to Barney & Griffin (1992). For organizational managements, a threat is the element that makes it difficult or impossible to reach the organizational goals. Threats are the situations that come out as a result of the changes in the distant or the immediate environment that would prevent the organization from maintaining its existence or lose its superiority in competition, and that are not favourable for the organization (Ülgen and Mirze, 2010). They can constitute an impediment to the success of the organization and cause unrecoverable damages. Therefore, both system enhancing opportunities as well as threats directs organizational managements to be more careful and act strategically on the developments in and outside their environments.

#### **3.1.4 Expert interviews**

The Expert interview is a kind of individual interview carried out with a specialist in the subject in question. Unlike an ordinary person, this type of respondent is a carrier of deep knowledge of the research object. If the usual in-depth interviews aimed at studying the individual's personal life and his everyday opinions, the purpose of the expert interview is to obtain additional unknown or reliable information, authoritative opinions serious and professional assessments of the research topic. Therefore, the expert interview cannot be formalized. This type of research involves open nature of questions that allows the expert to tell their point of view on the issue under study, to assess or predict the possible options.

Expert interviews have significant advantages over other methods of data collection. For example, due to the fact that respondents are highly qualified in the subject matter, it eliminates the need to use additional screening and clarifying questions aimed at revealing true but hidden from the interviewer respondent views. This type of survey is uniquely aimed at obtaining reliable data because respondents' competence is very high (Dorussen, Lenz and Blavoukos, 2005). Expert interviews in this research helps in validating the conclusions drawn from PESTEL and SWOT Analysis.

### 3.2 Data collection

Qualitative data gathering methods consisting of desk research, individual interviews and focus group interviews were used for this study to analyze the case company. Documentation is a stable source of evidence and was partly used to verify the findings from the interviews. Because of their overall value, documents play an important role in the data collection plan. The use of interviews is traditionally an important source of evidence for case study research. Interviews were merely used to identify the current situation and future transitions. It enables the researcher to find opinions, non-documented or sensitive information. In this case, semi-structured focused interviews were held with open-ended questions to gain in-depth knowledge. The semi-structured interview, therefore, not only gives interviewers some choice in the wording to each question but also in the use of probes (Hutchinson & Skodol-Wilson 1992). Probing, in particular, can be an invaluable tool for ensuring reliability of the data as it: allows for the clarification of interesting and relevant issues raised by the respondents (Hutchinson & Skodol Wilson 1992); provides opportunities to explore sensitive issues (Nay-Brock 1984, Treece & Treece 1986); can elicit valuable and complete information (Gordon 1975, Austin 1981, Bailey 1987).

The criteria for triangulation, the application of different data gathering methods to study the same phenomenon, was used to test the consistency of findings obtained through the individual interviews and focus group interviews because it has been argued that triangulation increases the reliability and validity of the final result (Baskerville, 1999; Dixon et al., 1988). It is based on the assumption that any bias inherent in a particular method can be neutralized when used together with other methods, i.e. the weakness from one method can be overcome with another method (Hussey and Hussey, 1997; Yin, 1994). A focus group takes advantage of the interaction between small groups of people. Participants respond to, and build on, what others in the group have said. Focus group interviews allowed the researcher to elicit ideas, insights and experiences from a small group of participants in a limited period of time (Lincoln and Guba, 1985).

In total, 12 participants contributed to this research. Five of them were interviewed individually to gain insights for PESTEL and SWOT analysis and another five participated together in focus group interviews for SWOT analysis. The other two of them were experts chosen for expert interviews. All the participants were chosen through nonrandomized purposive sampling as it adds reliability to the data (Maxwell, 1992). Participants in this study were only involved with one data gathering method, i.e., if a participant was interviewed individually, then that candidate did not participate in the focus group interviews. The data collection method used in this study is face to face interviews in order to have face validity and escape the drawbacks related to phone interviews (Wilson, 2014). All individual interviews lasted between 15 to 30 minutes. The duration of the focus group interview was between two to three hours and were conducted as two sessions, one before and after lunch. Further, all the participants asked not to be named and are therefore not identified in this research. It was emphasized that the interviews will solely be a contribution to science and will not be impacting the competitive advantages of the participants. The interview questions were sent to the participants before the interview took place. The interviews took place at the case company. To better structure the interview questions, organizational and value chain analysis performed through desk research is explained below.

#### 3.2.1 Case Company: Signify

The case company for the present research will be Signify which was formerly Philips Lighting. It became a standalone company following its spin-off from Royal Philips in 2016. Signify is the world leader in lighting as the industry transitions from conventional to LED lighting technologies and now moving towards connected lighting. Their lighting products, systems and services are sold in 180 countries and their corporate mission is to unlock the extraordinary potential of light for 'Brighter Lives and a Better World'.

Signify's current strategy is based on six key strategic priorities:

- Optimize cash from conventional lighting products to fund their growth.
- Innovate in LED products commercially and technologically to outgrow the market.
- Lead the shift to systems, building the largest connected installed base.
- Capture adjacent value through new services business models.
- Be customers' best business partner locally, leveraging their global scale.
- Driving operational excellence improvement journey.

In the coming sections, Signify's organizational structure and their individual strategies and performances will be analysed. The organizational levels were identified as Business group, Business unit, Business division and Product group. By broadly starting from Business group level, this section will narrow down towards the Product group level, Linear modules, as the qualitative study was carried out in this product group. The scope of the research is based on the interviews carried out at this product group.

### 3.2.2 Signify: Business group level strategy

Signify's businesses are divided into four business groups: Lamps, LED, Professional and Home. The sales by business groups is shown in fig. 3 below:

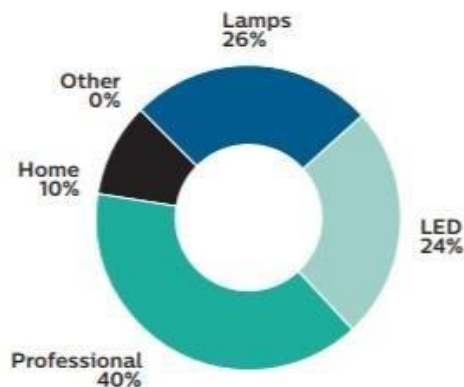


Figure 3 - Sales by business groups

#### Lamps

Lamps is the global market leader in the conventional lighting business and comprises the company's conventional lamps and lamp electronics business. It produces and sells lamps based on a wide variety of non-LED based technologies including incandescent, halogen, fluorescent and HID, as well as electronic components (electronic ballast and drivers). Lamps aims to optimize free cash flow through its last man standing strategy. While the overall conventional market continues to decline, Lamps' focus is on winning market share in key segments and markets. Due to the transition from conventional to LED lighting, the conventional lamps market is expected to continue to decline in the coming years.

#### LED

LED sells a wide variety of LED lamps, namely spots, bulbs and tubes, to the professional and consumer channels. In addition, the Business Group sells LED electronic components, consisting of LED drivers and LED modules, to luminaire Original Equipment Manufacturers (OEMs) for professional luminaire applications in the retail & hospitality, office & industry and outdoor segments. In the LED electronics business, the aim is to generate more revenues from global OEMs by increasing the number of OEM customers and growing the share of wallet with existing OEM customers. The company's ambition is to drive market share gains and leadership in this segment as the market is forecasted to continue its growth annually through 2020.

#### Professional

Professional products and Systems & Services are used in multiple market segments such as offices, commercial buildings, shops, hospitality, industry and outdoor environments including smart cities. The products in Professional have historically experienced a rapid shift from conventional to LED and have been integrated into broader Systems & Services capabilities. Professional focuses on strengthening its global lighting leadership position by accelerating the rollout of its leading architectures for connected lighting systems to customers in all market segments. One of the contributing factors to the increased use of LED technologies is the expanding offering of systems which enable users to program and control lights through connectivity with sensors and networks.



## Home

Home is a leader in connected home lighting and a top-three player in selected home luminaires markets. The Business Group develops and sells connected lighting systems, functional and decorative home luminaires, and premium luminaires. Philips Hue, introduced in 2012, is the market leader in connected home lighting. Home aims to realize profitable growth by driving the transition to LED luminaires and connected lighting. Demand for Philips Hue increased significantly in 2017, illustrating the success of Home's connected lighting system strategy, largely as a result of the company's continued focus on innovation, and its strong partnerships with the makers of recently introduced voice activated smart home devices.

### 3.2.3 Signify: business unit level strategy

The LED business group is divided in to two business units: **LED lamps and LED Electronics**. As mentioned earlier, LED lamps sells a wide variety of LED lamps, namely spots, bulbs and tubes, to the professional and consumer channels. LED electronics sells LED electronic components, consisting of LED drivers and LED modules, to luminaire Original Equipment Manufacturers (OEMs) for professional luminaire applications in the retail & hospitality, office & industry and outdoor segments. This group aims to further strengthen its leadership position in LED lamps and LED electronics by increasing sales through the ongoing introduction of new products and meaningful product differentiation. On the consumer LED lamps side, this includes broadening the multi-tier approach through private label business, and further growing in developing markets. On the professional LED lamps side, the Business Group focuses on growing business to-business LED lamp sales by continuing to lead in product innovation, expanding business-to-business trade, further growing in developing markets and increasing focus on locally-relevant products. In the LED electronics business, the aim is to generate more revenues from global OEMs by increasing the number of OEM customers and growing the share of wallet with existing OEM customers.

### 3.2.4 Signify: business division level strategy

LED Electronics business unit consists of two divisions, **LED Drivers and LED Modules**. The LED Electronics business group is expected to grow with the rate at which conventional lighting is replaced by LED lighting. Technically, driver is the component in LED that helps regulate the current flow and module contains the light source (LED). The LED Modules division consists of product groups, Linear Modules and Point Modules. Linear Modules has been a product leader in its category due to quality performance, good system offer and (local) service offer that helps retain business at smaller OEMs.

### 3.2.5 Summary

The following figure (fig. 4) is a summary of the organizational structure of the case company.

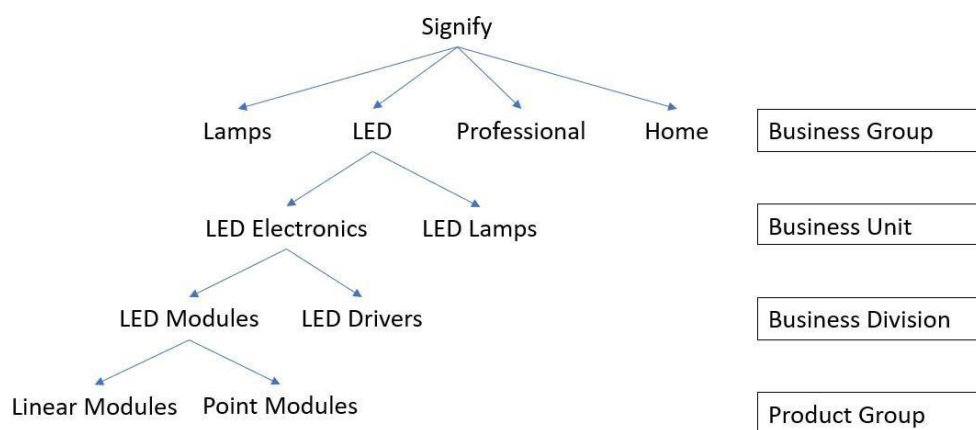


Figure 4 - Organizational structure at Signify

## 3.3 Case study protocol

The case study research design is sometimes criticized for lacking formal approaches. Case studies tend to be relatively ill-structured and highly dependent on the capabilities and competences of the researcher. Therefore, a case study

protocol was developed as an essential guide for the case study conducted in this research project. It is a standardized data collection instrument for the researcher, based on the steps suggested by Yin (Yin, 2009). It contains the instrument, the procedures and general rules to be followed. It gathers the conceptual and practical matters of collecting the data and is meant to structure the inquiry (Yin, 2009). This increased the reliability of the case study. An overview of the case study project is provided below, and the case study selection is discussed. The case study questions, describing what information is collected and what sources are used, and interview protocols are provided in Appendix 1.

### 3.3.1 Case study overview

The research goal of this project was to propose strategies to a lighting company to help increase its market share in European market as the industry is shifting towards LED based lighting. A case study approach was used as it allows to gain in-depth knowledge of the research problem. In this research, a qualitative study was performed at Linear Modules product group. This product group was chosen for this research for two reasons: 1) It aimed to increase its market share by 5% in 2017 but its strategy had failed and faced a significant drop in sales compared to previous year. 2) The Linear Modules product group is an integral division in Signify in its march towards LED based Lighting as it contributes to 32 million euros in sales.

### 3.4 Data analysis strategy

After the participants had completed the individual interviews and focus group interviews, data analysis was conducted with the data collected. According to Strauss (1987), a data analysis strategy is a process of systematically applying logical techniques to describe, summarize, and compare data. The following strategy was applied to the analysis of individual interviews and focus group interviews independently.

#### 3.4.1 Data management

Data management was designed to maintain as much of the participants' ideas as possible from the individual and focus group interviews, as well as to permit ongoing analysis (Patton, 2001; Strauss, 1987). As previously stated, the researcher wrote abbreviated notes in a section of the interview protocol (Maxwell, 1992) called "interview comments" (see Appendices C and D). These are referred to as "raw" field notes gathered from individual and focus group interviews (Patton, 2001).

After each individual and focus group interview, the "raw" field notes were transcribed by the researcher into a notebook and are referred to as "expanded" field notes (Morse, 1994). These "expanded" field notes were written as full sentences, with the researcher adding commentary as well as anything relevant which he remembered but had not had time to write down (Mathison, 1988; Maxwell, 1992; Patton, 2001). The individual and focus group interviews were analysed separately. The technique used to analyze this data follows in the next section.

#### 3.4.2 Content analysis and analysis within and between interviews

Content analysis is a procedure for organizing non-structural information into a standardized format that allows a researcher to make inferences about the characteristics and meaning of written or recorded material (Merriam, 1998). Analysis within and between interviews was used to analyze the "expanded" field notes (Merriam, 1998).

"Content analysis is necessary to systematically and objectively derive categories of responses that represent homogenous thoughts or opinions. This is done to facilitate interpretation of the large volume of lengthy and detailed responses. This form of content analysis is known as open coding or context sensitive scheme coding. This form of analysis involves a researcher firstly coding, and then naming categories through a detailed examination of the data. A pre-determined framework of possible responses is not used, but the actual text provided by participants is used to generate the categories as well as to summarize the data. This involves an iterative interpretation process of first reading responses, then rereading to establish meaningful categories, and finally rereading select responses to refining the number and meaning of categories in a manner deemed most representative of the participants' text" (p106).

The "expanded" field notes from the individual and focus group interviews were analyzed independently using the content analysis procedure above. The "expanded" field notes from each data gathering method did not influence or

feed into each other. Analysis within and between interviews was also conducted to increase the reliability of the data (Merriam, 1998). The data coding approach follows in the next section.

### 3.4.3 Data coding

Strauss (1987) suggests that for open coding, codes may emerge from a preliminary examination of the data. He states codes may be based upon words or themes that identify text or premises that relate to the research objectives. Using this process, codes were assigned by the researcher, to responses received from the individual interviews and focus group interviews. Codes were written in the margins of the notebook containing the expanded field notes (Morse, 1994; Strauss, 1987). In an effort to reduce potential coding error, responses deemed “incomprehensible” within the context of the question were not coded (Silverman, 2000). The category construction strategy follows in the next section.

### 3.4.4 Category construction

Category construction was performed using the following procedure, recommended by Strauss (1987): “The researcher gives each response a label known as a code. The researcher assigns these labels (codes) to units or sections of interview transcripts, notes or other sources of data. Then the researcher defines conceptual categories - i.e. clusters of concepts or ideas that may be suggested by the research questions” (p109).

After the data coding, categories for external and internal environment analysis were defined. Based on the research questions, categories and subcategories such as phases, activities, techniques and tools were represented in the form of tables (Merriam, 1998; Strauss, 1987). Responses were then summarized into the tables for each question, and the number of times each response was mentioned was counted (Merriam, 1998; Strauss, 1987). Each question’s response was then ordered in descending number of mentions, causing the most popular responses to be at the top of each table (Merriam, 1998; Strauss, 1987).

### 3.4.5 Cross-checking of results

After the data coding and category construction were performed on the individual and focus group interviews, the data from each these methods were cross-checked against each other. Silverman (2000) suggests a researcher should “cross-check data by selecting high frequency mentions and eliminating low frequency mentions” (p188). Therefore, the data from the individual interviews was cross-checked against the data from the focus group interviews by selecting the most frequently mentioned responses for each category and eliminating responses with a low frequency of mentions. This strategy allowed the comparison of one data set against another to check for patterns, contradictions and examine overlapping facets, to increase the reliability of the final result (Baskerville, 1999).

## 3.5 Research quality

### 3.5.1 Reliability of the research

Reliability refers to the extent to which a measure yields the same results after repeated trials (Carmines and Zeller, 1979; Yin, 1994). This research supports the diachronic, synchronic and inter-judge criteria for reliability.

**Diachronic reliability** refers to the stability of observed outcomes (Kirk and Miller, 1986). Content analysis showed consistent patterns in the identification of phases, activities, techniques and tools, from the business analysts, product managers, heads of research and development, legal officers and global product managers from the case company.

**Synchronic reliability** refers to the similarity of outcomes determined from multiple sources of different measures (Yin, 1994). For this research, standardized instruments were used in the form of protocols for the individual interviews and focus group interviews, whereby similar patterns of results were produced.

**Inter-judge reliability** is achieved by determining the degree of agreement between participants (De Vellis, 1991). This research compared the interview responses from the individual and focus group interview responses (Yin, 1994). Consistent patterns in the responses from each method indicated the degree of consistent agreement in the responses analyzed.

### 3.5.2 Validity of the research

Lincoln and Guba (1985) state that validity “determines whether the research truly measures that which it was intended to measure and how truthful the research results are” (p57). The criteria of validity which apply to this research appear below.

**Instrumental validity** addresses whether or not generated observations from one instrument match those from an alternative measure (Kirk and Miller, 1986; Nunally, 1978). In this research, data from semi-structured interviews and focus group interviews were compared. Similar patterns in the results from each method showed the validity of instruments used in this research (Ragin, 1990; Trochim, 1989).

**Internal validity** occurs by “applying pattern-seeking and matching methods across cases” (Yin, 1994). For this research, internal validity was achieved through pattern matching, during the content analysis which revealed similarities in outcomes from different data collection methods and different participants (Yin, 1994; Glaser and Strauss, 1967). Analysis within and between interviews, recommended by Merriam (1998), was conducted to increase the internal validity of the results. Finally, the “convergence of multiple sources of evidence” (Patton, 2001, p83) from the individual interviews and focus group interviews contributed to the internal validity of this research.

**Construct validity** is accomplished by the establishment of correctly defined and consistently applied operational measures for the concepts being studied (Kirk and Miller, 1986). This was achieved with standardized protocols for individual as well as focus group interviews. Kirk and Miller (1986) suggest multiple sources of evidence encourage convergent lines of inquiry and this was accomplished by a diverse sample of participants consisting of business analysts, product managers, heads of research and development, legal officers and global product managers. Finally, construct validity was also achieved by handing over the draft of the interview data to the participants to examine whether they agreed with the way the researcher presented the information (Patton, 2001; Yin, 1994). This method, called re-negotiation, was utilized in this research. After the individual interviews and focus group interviews, the transcripts were discussed with the participants for their approval (Patton, 2001).

**Generalizability**, also referred to as external validity (Kirk and Miller, 1986; Patton, 2001), was achieved in this study through the use of multiple participants with different characteristics and the observed similarities within the outcomes. These outcomes lent themselves to generalizability across cases (Kirk and Miller, 1986; Patton, 2001; Yin, 1994).

## 4. Results

The qualitative research methodology used for this research was presented in the previous chapter. As discussed in Section 1.1, the main research question is concerned with how a company can increase its market share when its whole sector is transitioning towards an innovative technology. Therefore, identifying the determinants for creating successful strategy to increase market share is crucial in answering the research question. By analysing external and internal environment, and market position using PESTEL and SWOT, these determinants for creating a successful strategy are identified and discussed in this chapter and are subsequently used to make recommendations in the next chapter. This chapter also summarizes the findings from the individual and focus group interviews. Moreover, the content analysis done on these findings and the categories derived are also presented. The structure of the chapter is as follows: Section 4.1 presents the findings from interview setting and findings, Section 4.2 discusses the consolidation and interpretation of the results and the chapter ends with Section 4.3 conclusion.

### 4.1 Interview setting and findings

The research goal of this project was to propose strategies to a lighting company to help increase its market share in the European market as the industry is shifting towards LED based lighting. Qualitative data gathering methods consisting of individual interviews and focus group interviews were used for this study to analyze the external and internal environment of the case company. A case study approach was used as it allows to gain in-depth knowledge of the research problem. The use of interviews is an important source of evidence for a case study research. In this research, semi-structured focused interviews were held with open-ended questions to gain in-depth knowledge. Also, to better structure the interview, organizational and value chain analysis was first performed through desk research, as explained in detail in the previous chapter.

#### 4.1.1 Sample and procedure

The unit of analysis for this study are the external and internal environment, and market position of the case company. The method of sample selection used in this study is known as the expert sampling and is widely accepted in the field of research (Sutherland, 1994). From this expert sample, nonrandomized purposive sampling was conducted to add reliability to the data (Maxwell, 1992). Nonrandomized purposive sampling is a sampling method based on the judgement of the researcher, where participants are chosen, based on their knowledge of the phenomenon the researcher is studying (Leedy, 1993). This type of sampling technique makes the most effective use of limited resources especially when the research involves identifying and selecting individuals or groups of individuals that are knowledgeable about or experienced with a phenomenon of interest (Cresswell & Clark, 2011 and Patton, 2002).

The final sample of participants represented senior business analysts, project managers, global product managers, heads of research and development, legal officers and product managers. The anonymized characteristics of the participants are discussed in table 3 below:

Table 3 – Characteristics of interviewees

Code	Role	Responsibility
SBA-1	Senior business analyst	Drives the business by linking analytics and commercial performance with operational execution and deployment
POM-1	Project manager	End to end execution of customer projects
GPM-1	Global product manager	Translate marketing strategy/plans into a business plan and bridge the business offerings with the local market requirements
HRD-1	Head of research and development	Ensure that the company develops new products or technologies and improve existing products to stay ahead of the competition

LEG-1	Legal officer	Support all the company's legal entities in matters relating to contracts, litigation and product and corporate compliance
SBA-2	Senior business analyst	Drives the business by linking analytics and commercial performance with operational execution and deployment
POM-2	Project manager	End to end execution of customer projects
GPM-2	Global product manager	Translate marketing strategy/plans into a business plan and bridge the business offerings with the local market requirements
LEG-2	Legal officer	Support all the company's legal entities in matters relating to contracts, litigation and product and corporate compliance
PDM-1	Product manager	Manage the global product managers and efficiently allocate responsibilities within the team to maximize sales, market share and volume.

Additionally, fig. 5 summarizes the positions of the participants within the case company. The upcoming sections (4.1.1 and 4.1.2) will present the findings from individual and focus group interviews respectively.

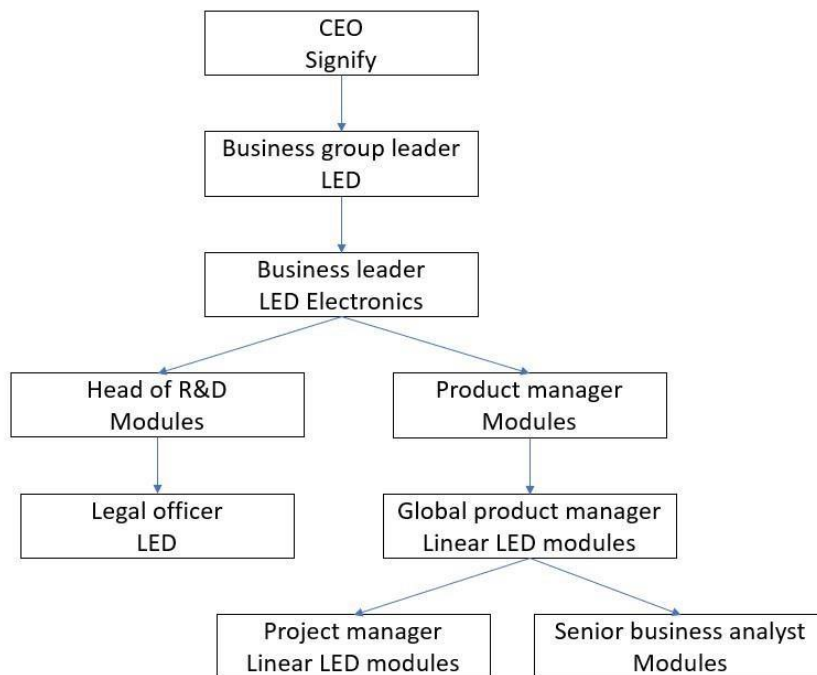


Figure 5 – Organization chart illustrating the position of participants in the company

#### 4.1.2 Individual interviews

The purpose of the individual interviews was to gather data on the external and internal environment of the case company. Individual interviews in general offer researchers the chance to explore topics in depth and to gain appreciation of the subject area (Campbell, 1996; Goguen and Linde, 1993). The general set-up of the individual interviews was discussed in section 3.2 and as mentioned there, a total number of five people participated in the interviews.

Based on the data collected through individual interviews, raw field notes were first gathered. After each interview, these raw field notes were transcribed by the researcher in to expanded field notes. Content analysis was performed on expanded field notes to systematically and objectively derive categories of responses that represent homogenous thoughts or opinions. This form of content analysis known as open coding or context sensitive scheme coding was used (Saldana, 2009). Based on the research questions, categories and subcategories were represented in form of tables (see table 4). Responses were then summarized into the tables for each category, and the number of times each response was mentioned was counted. Each category’s response was then ordered in descending number of mentions, causing the most popular responses to be at the top of the table. This type of analysis is known as conceptual analysis. Relational analysis builds on conceptual analysis by examining the relationships among concepts in a text. Atlas.ti 7.0, a dedicated software for qualitative research that enables a more structured approach and analysis was used for content analysis.

Through individual interviews analyses (see table 4), categories relating to external environment of the case company were identified based on the responses of the participants. These categories were then named as Political (POL), Economical (ECO), Social (SOC), Technological (TEC), Environmental (ENV) and Legal (LEG). These categories formed the basis for PESTEL analysis and each of them are further discussed in detail in section 4.2.1. The second part of analysis identified categories relating to internal environment of the case company. These categories were then named as Strengths (STR), Weaknesses (WEA), Opportunities (OPP) and Threats (THR). These categories formed the basis for SWOT analysis and each of them are further discussed in detail in section 4.2.2.

Table 4: Mentions and percentages from individual interviews

Codes	Category	Responses	Mentions
POL1	Politics	Banning incandescent lamps	5
POL2		Banning halogen lamps	5
POL3		EU’s energy security	3
POL4		Unstable EU political situation	2
POL5		Away from nuclear energy	2
ECO1	Economics	USD vs CNY vs EUR valuation	5
ECO2		Raw material prices	3
ECO3		Europe’s GDP	3
ECO4		Increasing LED lighting applications	3
ECO5		Decreasing LED prices	4
ECO6		Manufacturing efficiency	3
SOC1	Social	Payback time	3
SOC2		Country wise LED adoption rates	3
SOC3		Connected lighting	4
SOC4		Total Cost of Ownership	5
SOC5		New value proposition	3

SOC6		High consumer expectations	4
TEC1	Technological	Commoditization of LED technology	4
TEC2		Quality of light	5
TEC3		Haitz law	3
TEC4		Standardization and quality testing	4
LEG1		Legal	Regulations on Hazardous Substances
LEG2	Energy efficiency directives		4
LEG3	Building directives		4
LEG4	General Product Safety Directive		2
ENV1	Environmental	LED dyes	4
ENV2		No mercury usage in LEDs	5
ENV3		Conventional light sources disposal	3
ENV4		Blue light emission	5
STR1	Strength	Biggest buyer of LEDs	5
STR2		Product quality and reliability	4
STR3		Connected solutions	4
STR4		Market leader in LED lamps	5
STR5		Broad portfolio	3
STR6		Strong R&D Capabilities	4
STR7		Good operational setups by region	4
STR8		Strong sales team in OEM	4
WEA1	Weakness	Not the cheapest	4
WEA2		Tight inventories	5
WEA3		Slower in bringing new ideas to market	5
WEA4		Data capability like internet companies missing	3
WEA5		Educational barriers	3
OPP1	Opportunity	Banning of fluorescence	5
OPP2		Quality of light	3
OPP3		Connected lighting	4



OPP4		New business models	2
THR1	Threat	Increased competition in LED	5
THR2		Low end Chinese imports	5
THR3		Few suppliers	3
THR4		Aggressive pricing	4

#### 4.1.3 Focus group interviews

The purpose of the focus group interviews is also to gather data on external and internal environment of case company, but it takes advantage of the interaction between small groups of people. Focus group interviews allowed the researcher to elicit ideas, insights and experiences from a small group of participants in a limited period (Lincoln and Guba, 1985). The general set-up of the focus group interview was discussed in section 3.2 and as mentioned there, a total number of five people participated in the interviews.

The raw field notes were obtained based on the data collected through focus group interview, a single interview with 5 participants. Then these notes were transcribed by the researcher into expanded field notes. Content analysis was performed on expanded field notes to systematically and objectively derive categories of responses that represent homogenous thoughts or opinions. This form of content analysis is known as open coding or context sensitive scheme coding (Saldana, 2009). Based on the research questions, categories and subcategories were derived and is shown in table 5. After arriving at categories, conceptual analysis was performed. Responses were summarized into the tables for each category, and the number of times each response was mentioned was counted. Each category's response was then ordered in descending number of mentions and the most popular responses were placed at the top of the table. Relational analysis builds further on conceptual analysis by examining the relationships among concepts in a text. Both relational and conceptual analysis were carried out using Atlas.ti 7.0, a dedicated software for qualitative research that enables a more structured approach.

Focus group interview analysis is similar to individual interviews analyses (see table 5). First, the categories relating to external environment of the case company were identified based on the responses of the participants. These categories were then named as Political (POL), Economical (ECO), Social (SOC), Technological (TEC), Environmental (ENV) and Legal (LEG). These categories formed the basis for PESTEL analysis and each of them are further discussed in detail in section 4.2.1. The second part of analysis identified categories relating to internal environment of the case company. These categories were then named as Strengths (STR), Weaknesses (WEA), Opportunities (OPP) and Threats (THR). These categories formed the basis for SWOT analysis and each of them are further discussed in detail in section 4.2.2. The only difference is in the number of responses per category. It is higher in focus group as it takes advantage of the interaction between small groups of people. Participants respond to, and build on, what others in the group have said.

Table 5: Mentions and percentages from focus group interviews

Codes	Category	Responses	Mentions
POL1	Politics	Banning incandescent lamps	4
POL2		Banning halogen lamps	4
POL3		EU's energy security	3
POL4		Unstable EU political situation	2
POL5		Away from nuclear energy	3

ECO1	Economics	USD vs CNY vs EUR valuation	5
ECO2		Raw material prices	4
ECO3		Europe's GDP	2
ECO4		Increasing LED lighting applications	4
ECO5		Decreasing LED prices	4
ECO6		Manufacturing efficiency	3
SOC1	Social	Payback time	3
SOC2		Country wise LED adoption rates	3
SOC3		Connected lighting	4
SOC4		Total Cost of Ownership	5

SOC5		New value proposition	3
SOC6		High consumer expectations	4
TEC1	Technology	Commoditization of LED technology	4
TEC2		Quality of light	5
TEC3		Haitz law	3
TEC4		Standardization and quality testing	4
LEG1	Legal	Regulations on Hazardous Substances	5
LEG2		Energy efficiency directives	5
LEG3		Building directives	3
LEG4		General Product Safety Directive	3
ENV1	Environment	LED dyes	3
ENV2		No mercury usage in LEDs	4
ENV3		Conventional light sources disposal	2
ENV4		Blue light emission	4
STR1	Strength	Biggest buyer of LEDs	5
STR2		Good operational setups by region	4
STR3		Product quality and reliability	4
STR4		Connected solutions	4
STR5		Market leader in LED lamps	5

STR6		Strong sales team in OEM	4
STR7		Strong R&D capabilities	4
STR8		Broad portfolio	3
WEA1	Weakness	Not the cheapest	4
WEA2		Tight inventories	4
WEA3		Slower in bringing new ideas to market	4
WEA4		Data capability like internet companies missing	4
WEA5		Educational barriers	3
OPP1	Opportunity	Banning of fluorescence	5
OPP2		Quality of light	4
OPP3		Connected lighting	4
OPP4		New business models	3
THR1	Threat	Increased competition in LED	5
THR2		Aggressive pricing	4
THR3		Low end Chinese imports	5
THR4		Few suppliers	2

#### 4.1.4 Spearman correlation

Correlation analysis is a statistical method used to assess a possible linear association between two (continuous) variables. There are two main types of correlation coefficients: Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient. The correct usage of correlation coefficient type depends on the types of variables being studied. Spearman's rank correlation coefficient is denoted as  $\rho_s$  for a population parameter and as  $r_s$  for a sample statistic. It is appropriate when one or both variables are skewed or ordinal and is robust when extreme values are present. For a correlation between variables x and y, the formula for calculating the sample Spearman's correlation coefficient is as seen below in fig. 6:

$$r_s = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1)} \text{ where } d_i \text{ is the difference in ranks for } x \text{ and } y$$

Figure 6: Formula for Spearman's correlation coefficient

The spearman correlation coefficient was calculated for PESTEL categories identified through two distinct data collection methods, focus group and individual interviews (Table 4 and 5). Each of the PESTEL categories have various codes under them. Therefore, the first step is to calculate the rank of each code in their category (POL1 (individual interview) is x and POL1 (focus group) is y). Then  $d_i$  is calculated by the difference in x and y. The next step is to calculate the value of 'n' and that is given by the total number of codes in a category. Finally, the spearman correlation coefficient ( $r_s$ ) calculated for each of the PESTEL category are shown in table 6. When  $r_s$  is close to 1, it signifies a strong overlap

between the two variables (x and y) compared. Therefore, from Spearman correlation coefficient values in table 6, it can be concluded that there is a strong overlap in the results of the two data collection methods used in this research.

Table 6: Spearman correlation coefficient

PESTEL category	Spearman correlations coefficient
Politics	0,854167
Economics	0,7
Social	0,857143
Technology	1
Environment	0,933333
Legal	0,766667

## 4.2 Consolidation and interpretation of results

### 4.2.1 PESTEL analysis

The external environment analysis in this study was carried using PESTEL framework. The PESTEL framework refers to the political, economic, social, technological, environmental and legal factors influencing the environment in which a firm must operate. The role of PESTEL analysis was to identify the key factors which affect the lighting industry in general and the case company. Individual and focus group interviews were used as two distinct data collection methods for PESTEL analysis. PESTEL factors were identified through coding, categorizing and comparing the responses of interviewees in focus group and individual interviews. Due to larger and significant overlap in the results of the two data collection methods (confirmed through Spearman correlation coefficient in Table 3), interpretation of the results is condensed into one and presented. Also, the PESTEL factors were again confirmed through expert interviews.

PESTEL factors provide the input in identifying critical threats (are compounded by corresponding weaknesses) and promising opportunities (are matched by corresponding strengths). This section discusses each of the PESTEL categories in detail. As discussed in chapter 3, PESTEL analysis provides the input for SWOT analysis (Section 4.2.2). By performing PESTEL and SWOT analysis sequentially, influence of a firm's external and internal environment on its business can be evaluated.

#### Political environment

In table 7 and 8 below, the findings from the individual and focus group interview for political environment are presented. The regulation affecting lighting products is a key determinant of the future lighting market.

*The shift to LEDs from conventional lighting accelerated when European Union decided to ban incandescent bulbs and eventually completely phased it out. This ban additionally created awareness among our customers and eliminated their doubts regarding the potential of LEDs. (GPM-1)*

*Incandescent bulbs made way for LEDs only because the latter is a better and much more sustainable technology. European Union's decision to ban incandescent bulbs was crucial for success of LED lighting especially as the latter was in its nascent stage and needed such a huge platform to reach the masses. (SBA-1)*

Governments around the globe are accelerating initiatives in the lighting industry along two dimensions. Banning inefficient technologies is one. The other is to pass more stringent legislation on energy efficiency requirements and offer incentives for entire building infrastructures. This in turn is further propelling energy-efficient lighting technologies, such as Light Emitting Diodes (LEDs). The European Commission issued a press release stating, "EU Member States experts endorsed the European Commission's proposals for a regulation progressively phasing out incandescent bulbs starting in 2009 and finishing at the end of 2012. By enforcing the regulation of switching to energy

saving bulbs, EU citizens will save close to 40 TWh (roughly the electricity consumption of Romania, or of 11 million European households, or the equivalent of the yearly output of 10 power stations of 500 megawatts) and will lead to a reduction of about 15 million tons of CO<sub>2</sub> emission per year." (Member States approve the phasing-out, 2008). This statement shows the commitment of EU in supporting the transition to LED lighting and reaching its energy efficiency and climate protection targets.

*The halogen lamps are a huge waste of energy. They consume four to five times the electricity than that of a LED lamp and have very less lifetime compared to the latter. Therefore, banning halogen lamps is an expected move. This ban will definitely increase the sales of LED lamps especially in homes where LED has not made heavy inroads. LED lamps entering a home is also the first step towards connected lighting as customers can experience the benefits of LED technology [.....] Also, increased usage of LEDs means European Union can reduce its import of oil as overall electricity consumption will fall steadily. (PDM-1)*

The European Union is further accelerating the switchover to more ecological lighting sources by extending its regulations to ban low-voltage halogen lamps. It was witnessed in 2015 when it decided to phase-out inefficient "D" class halogen lamps, but it was eventually postponed by two years to 1 September 2018. In general, Halogen lamps are very inefficient (energy efficiency class "D"). Novel technologies, such as LEDs offer a high savings potential: the consumption of a halogen lamp is often more than five times higher than an energy-efficient LED. But, by analyzing the lighting market and technological developments, the commission concluded that 1 September 2016 would be too early for LED technology to fully replace halogen lamps; a more appropriate phase-out would be 2018 ("Phase-out of inefficient lamps postponed to 1 September 2018 - Energy - European Commission", 2015). This is in line with the priority of improving Europe's energy efficiency, with the final goal of ensuring secure, sustainable, competitive and affordable energy. In fact, every day the European Union pays over 1 billion Euros for its energy imports. This is reflected in the high electricity and fuel prices all Europeans pay, but it also has implications for the EU's security of energy supply. The switch to energy-efficient lamps in 2018 will bring yearly energy savings equal to the annual electricity consumption of Portugal (48.0 TWh of electricity) and will save 15.2 million tonnes of CO<sub>2</sub> emissions by 2025. This means, reducing the EU's import of oil by 73.8 million barrels.

*Lighting is an essential commodity and therefore any political pressure ranging from Brexit to Greek debt crisis will not affect the lighting industry. When the day ends, you need light no matter what. LED lighting is just not an alternative lighting technology, but it can make significant cut down on a country's electricity needs [.....] The numbers from the 'En.lighten' initiative of United Nations prove the same. (LEG-2)*

*With usage of LED lighting, a country's electricity requirements can be brought down by a huge margin and that means dependence on nuclear energy can be gradually cut down. The trend of moving away from nuclear energy picked up after the Fukushima disaster and will only further strengthen the need for energy-efficient lighting, fuelling LED penetration. (HRD-1)*

Even though the EU faces a range of political pressures (the June 2016 vote in the United Kingdom (UK) in favour of leaving the EU; the Greek debt crisis and lingering concerns about the Eurozone; ongoing migrant and refugee flows; a resurgent Russia; and a heightened terrorism threat), it doesn't pose a threat to the lighting industry, as lighting is an essential commodity. Another transformation happening, especially after 2011 nuclear disaster in Japan, is the shift of energy production towards more non-nuclear sources by including renewables. Germany has also implemented a fundamental shift in energy policy by shutting down eight of its 17 nuclear power stations and committing to nuclear free energy production by 2022. On the energy supply side, these developments will accelerate the penetration of renewable energy sources. The demand side will also need to alter its practices as greater energy efficiency will help to close the energy supply gap. The lighting market, which consumes approximately 20 percent of total electricity generation, can greatly contribute by providing energy-efficient lighting solutions, such as LEDs (En.lighten, 2012). Overall, the trend away from nuclear energy is expected to give a further boost to energy-efficient lighting, fuelling LED penetration (McKinsey Global Lighting Market Model, 2012 and IAEA, 2012).

*EU is making small but significant steps towards LED lighting. Therefore, currently the political scenario is favouring LED industry and it will remain so considering the benefits LED technology brings to the table [.....] The main benefit is that it will help governments reach its climate targets and eventually earn the respect of its citizens. (SBA-2)*

As summarized in table 7 and 8, through banning incandescent lamps and proposing a ban on halogen lamps, the political environment in EU is favouring the transition of lighting industry towards LED. Also, changes in the lighting legislation are highly visible to the public and brings immediate attention to the government. As mentioned above, through energy efficient LED lighting, governments will be able to slowly move away from nuclear energy. Therefore, by supporting LED transition, governments will be promoting sustainable initiatives and can earn the respect of its citizens.

Table 7: Findings from individual interviews

Codes	Category	Responses	Mentions
POL1	Politics	Banning incandescent lamps	5
POL2		Banning halogen lamps	5
POL3		EU's energy security	3
POL4		Unstable EU political situation	2
POL5		Away from nuclear energy	2

Table 8: Findings from focus group interviews

Codes	Category	Responses	Mentions
POL1	Politics	Banning incandescent lamps	4
POL2		Banning halogen lamps	4
POL3		EU's energy security	3
POL4		Unstable EU political situation	2
POL5		Away from nuclear energy	3

### **Economic environment**

In table 9 and 10 below, the findings from individual and focus group interview for economic environment are presented.

*The most used raw material used in LED lighting is aluminium and the price of it affects the production costs and ultimately determines the Net Net Selling Price (NNSP) or the price a customer pays for a product. The second and most important factor that needs to be continuously monitored is the behaviour of USD [.....] A company's profit, be it seller or supplier is heavily dependent on how strong or weak the USD is. (GPM-2)*

With exception of the light bulbs, the other parts of the light (bells, projectors, street lighting, etc.) are, for the most part, made of aluminium. This means that fluctuations in the price for this material greatly affect production costs of professional LED lighting. Another key element which determines production costs for LED lighting is the behaviour of the US Dollar (USD). This is due to two factors: Firstly, the currency rate used for aluminium on financial markets is the USD. If the USD is devalued, less aluminium can be bought for the same amount of dollars. Secondly, the main producer

and exporter of LEDs in the world is China. The benchmark currency used (which Chinese factories are paid in when they export) is the USD. If they are paid in USD and the USD is devalued, each time material is bought they will be able to buy less material. Whenever they change USD into the local currency, the Chinese Yuan (CNY), to pay salaries, rents, etc., they have less CNY, resulting in a fall in their profits. This means that, if the price of aluminium rises and the value of the USD drops, LED lighting production costs rise. This is a major economic factor that always needs to be monitored when it comes to LED lighting.

*The single market trade policy and common currency usage among EU members means that fluctuation of EU with respect to USD is a trend that every lighting company in Europe will have a keen eye on. (LEG-1)*

*For lighting companies in Europe who also have their top customers located in Europe, the variation of Euro with USD is a factor as important as the behaviour of USD. As top customers mean huge sales and volume, even the slightest difference between currencies such a strong USD vs Euro will affect the ICOS (cost price of a product) and bring down the profit margin for a company. (SBA-1)*

Furthermore, EU members share a customs union, a single market in which goods, services, people, and capital move freely, and have a common trade policy and currency (Euro), which is used by 19 member states (collectively referred to as the “Eurozone”). Therefore, when it comes to lighting industry, variation of Euro with respect to USD is also a factor that needs to be monitored continuously. The global economic situation has developed less favourably than expected since mid2011, leading to downward adjustments of the 2016 GDP forecast by approximately 2 percent. This adjustment stems from several unfavourable developments in the aftermath of the global financial crisis and Europe’s ongoing debt crisis. Europe’s debt crisis is increasingly threatening the region’s economic stability especially with the bailout of Greece in Q1 2012, a parallel government crisis in the country and disagreements between governments at an EU level on how to best tackle fiscal issues (Hall 2013 and Copelovitch et al., 2016). Europe’s 2016 GDP forecast has been lowered by 3 percent compared to 2011. Europe’s struggles impact the world economy as the region contributes almost 30 percent to global GDP (IMF World Economic Outlook Database, 2016).

*LED lighting market has a clear correlation with GDP. This is because LED’s lifetime is very long and therefore its market is driven only new installations and not by replacements. So, when economy is under strain, new installations of lighting fixtures will be very less. (POM-2)*

*LED Lighting is expected to further dominate the lighting industry as the price of LEDs are reducing much faster than the anticipated trend and it mainly due to huge investments in L1 LED production line in Asia. Because of steady LED price drop, first cost burden on the customers will reduce drastically. (GPM-1)*

The market for luminaire and LED lighting system control components is predominantly driven by new installations. New installations are linked to construction activity, and there is a clear correlation with GDP. This is supported by the fact that heavy investments in the installation of fixtures are more likely to be postponed when the economy is under strain. However, the conventional lamp market is mainly driven by replacements. The latter is a market by nature more resilient to overall macroeconomic trends: it depends almost solely on the number of installed sockets and the lifetime of the technologies in place. Even if incomes deteriorate significantly, consumers will still need to replace a failed light source. The lamp market therefore correlates with GDP to a lesser degree (McKinsey, 2012). Next, the price of LEDs is tumbling even faster than anticipated and this reduction in the price of LEDs is driven by several factors. One is that considerable overcapacity of LED chips and packages has built up due to huge investments in LED chip/package production lines in China (Strategies Unlimited, 2011 & US Department of Energy, 2012).

*The new CRI 90 (notation to represent highest quality of light) market is growing because of the special lighting needs in the application areas of architecture, horticulture and decorative lighting. In these applications, quality of light (colour, uniform distribution) is very important and only LED lighting can provide such features. (HRD-1)*

*Even though the Total Cost of Ownership of LED lighting is much lower than conventional lamps, the initial cost of LED lighting is still high. This is mainly due to small scale of production of LEDs compared to conventional sources. Increasing*

*the demand for LED fixtures and combining it with highly efficient production plants is the way forward! (POM-2)* Initially, the LED lighting market was dominated by signalling and display applications like traffic signal, exit signs and large LED displays in highways and stadiums. Mobile, automotive and entertainment applications followed, with lighting applications becoming more and more diversified in the last decade (Anderson, 2010). New possibilities in decorative and architectural lighting are now presented by LED lighting, due to their superior colour and special distribution capabilities, as well as lower maintenance costs and improved design possibilities (Aníbal et al., 2014). The initial cost of LED-based general illumination sources is still high, in comparison with conventional lighting technologies. Prices are high due to the smaller scale of production. Since the lighting market has historically been strongly affected by first cost, although their life cycle cost may be lower due to their long lifetime and high energy efficiency. Therefore, low-cost, high volume, and reliable manufacturing methods are important to drive down the first costs of LED lighting.

As summarized in Table 9 and 10, the economic environment for LED lighting is dependent on the following factors: raw material prices (mainly aluminium), currency exchange rate (Euro vs USD and USD vs CNY), economic growth (GDP), new LED lighting applications, price of LEDs and manufacturing techniques. These factors together will determine the acceleration in growth of LED lighting market in the coming years and therefore have to be monitored continuously.

Table 9: Findings from individual interviews

ECO1	Economics	USD vs CNY vs EUR valuation	5
ECO2		Raw material prices	3
ECO3		Europe's GDP	3
ECO4		Increasing LED lighting applications	3
ECO5		Decreasing LED prices	4
ECO6		Manufacturing efficiency	2

Table 10: Findings from focus group interviews

ECO1	Economics	USD vs CNY vs EUR valuation	5
ECO2		Raw material prices	4
ECO3		Europe's GDP	2
ECO4		Increasing LED lighting applications	4
ECO5		Decreasing LED prices	4
ECO6		Manufacturing efficiency	3

### Social environment

In table 11 and 12 below, the findings from the individual and focus group interview for social environment are presented.

*Since the cost of LED production is falling steadily, the first cost is also reducing for the customers which means they can break even on their investment at a much faster rate than earlier times. This is fuelling LED market penetration and the trend is expected to continue for few more years. (SBA-2)*



*Lack of consumer awareness has been a problem for LED lighting. They are not familiar with the advantages of LED. It's just not end customers but customers at all experience levels must be made more aware of the benefits of LED and only that in the long run will make LED lighting a commercial success. (GPM-2)*

The payback time is the time necessary for a LED customer to break even on his/her investment in a more expensive LED bulb. Therefore, the time to payback metric helps to predict LED adoption with some historical and empirical accuracy. The fact that payback periods are shrinking along with LED retail prices ensure significant market penetration in the next decade. Moving on, LED-based lighting remains a new technology that is not well known in the marketplace. This unfamiliarity applies equally for users at all experience levels: lighting designers, residential and commercial users, installers, building inspectors, and government code officials. Most lighting designers are used to thinking, designing, and working with white light sources, instead of coloured light sources. They are also not accustomed to taking advantage of the energy-efficiency, long-life and maintenance characteristics of LEDs. Therefore, consumers must be made aware of the advantages of LED lighting by removing the educational barrier through advertisements and government funded campaigns (Ecos Consulting, 2003).

*Overall, when looking at the trends in LED adoption, Japan and China are the ones leading the LED transition followed by Europe and North America. Developing countries still prefer cheaper lighting options but there is a possibility that emerging markets (fast developing economies like India) can make jumps from incandescent to LED lamps directly. (PDM-1)*

The rate of LED adoption differs region by region. Japan and China are the countries that are moving most rapidly towards LED, owing to high rates of customer acceptance and strong regulations, followed closely by Europe and North America. LED adoption is a bit slower in developing economies as they are expensive relative to existing lighting technologies, but as LED prices decline over the next decade, emerging markets are likely to leapfrog fluorescent lamps, moving directly from incandescent to LED. Adoption rates for various lighting technologies and the amount that customers are willing to pay for those technologies—also differ across geographies based on customer preference for warm or soft light.

*Connected lighting is the next significant shift in the lighting industry and with the features that LED offers, it is the ideal candidate for light source. The reason that connected lighting is the next big thing because it can be customized for a user's needs and offers huge cost savings. (HRD-1)*

*Connected lighting has multiple dimensions. It's just not about lighting efficiency but has two other dimensions. First, it provides the user complete control over the lighting system (brightness control, colour options, automatic notification for maintenance) and second, the amount of data the system generates can be analyzed and that offers huge additional potential for cost savings. (POM-1)*

The increasing popularity of LED gives momentum to another significant shift, the adoption of connected lighting systems (also called smart systems). Given the versatility of LED in terms of factors such as brightness and colour variation, connected systems make more sense for use with LED than when conventional lighting technology is used. Connected lights can be programmed and controlled in an expanding variety of ways, which further strengthens the demand for systems (Boston Consulting Group, 2012). In offices, for example, lighting can be automatically adjusted in response to the level of natural lighting, which in turn can enhance employee productivity and smartphone apps can be used to easily manage connected lighting systems, a feature that makes those systems increasingly accessible to a broader group of customers. Connected lighting also offers cost-saving opportunities. Energy cost reductions from efficiently controlled systems can be substantial—another 40 percent on top of the already hefty savings offered by LED alone. And data generated by connected systems— automated alerts to show where lamps have burned out, for example—can spare other costs, such as maintenance expenses.

*As LED lighting comes in as an expensive replacement for existing conventional technologies, the consumer expectations will be high and therefore, product quality is very important especially at the beginning stages. (PDM-1)*

*Expectations of LED lighting is at one end, but the other is that, LED as such is a new technology and it is therefore susceptible to unforeseen or unanticipated consequences brought upon by field application. Also, LEDs are electronic light sources and are sensitive to thermal and field conditions and this in turn may adversely impact the overall performance. (POM-2)*

As with any early market transformation activity, particularly with the introduction of new technology, the opportunity for consumer issues is extremely high, stemming from unanticipated consequences with product failure. Next generation LED lighting technology is particularly susceptible to unforeseen or unanticipated consequences because of failures brought upon by field application. Electronic light sources like LEDs are sensitive to thermal and field conditions and that may adversely impact the performance of the overall device. Shortened lifetime or unexpected failures will significantly erode consumer acceptance of this technology, potentially creating long-term barriers. Therefore, consumer perception of LED technology is driven by product quality and early prices. Additionally, there are high consumer expectations associated with LED lighting as it is meant to replace the existing fluorescent lamp technology and departures from this expectation could lead to consumer dissatisfaction. Early failures of LED technology in commercial applications also will have significant influence on long-term market acceptance, particularly by large end-use purchasers and decision makers (Siminovitch, 2010).

*The value offer in terms of TCO for LED lighting is expected to saturate soon. Manufactures have always marketed their products with TCO, but a stronger selling point will be needed for a company to differentiate itself and make significant profit margin. (GPM-2)*

Although LED technology is still more expensive than conventional lights (currently about five to ten times more), the price is falling precipitously, owing to technological advances in manufacturing and increasing LED efficiency (fewer LEDs are required for a similar amount of light output). It is projected that the average price of an LED point will slip from more than \$6 in 2014 to less than \$3 in 2020. A saturation is being reached on the Total Cost of Ownership (TCO) value of LED lighting technology (TCO includes not only the initial cost of lamps and luminaires but also the expense of replacing lamps and costs for energy). Earlier, buyers paid greater attention to this measure and manufacturers marketed their products by pushing the message about LED's lower total costs, LED technology gained additional traction. And as LED prices continue to fall and with a saturation being reached on TCO, an even stronger selling point or value proposition is needed.

*The opportunities that connected lighting provides are many and yet it is unexplored and remains a new territory. Combining a new value offer with connected lighting or providing a separate new value offer for the buyers will be way forward in the lighting industry. (SBA-1)*

When it comes to social factors, there are significant factors that present both opportunities and threats to LED lighting industry and are summarized in Table 11 and 12. The opportunities are in the form of developing a new value proposition for buyers and exploring untapped potential of connected lighting whereas the threats are the high consumer expectations, payback time and its influence on LED adoption and high initial cost of LED lighting.

Table 11: Findings from individual interviews

SOC1	Social	Payback time	3
SOC2		Country wise LED adoption rates	3
SOC3		Connected lighting	4
SOC4		Total Cost of Ownership	5
SOC5		New value proposition	3
SOC6		High consumer expectations	4

Table 12: Findings from focus group interviews

SOC1	Social	Payback time	3
SOC2		Country wise LED adoption rates	3
SOC3		Connected lighting	4
SOC4		Total Cost of Ownership	5
SOC5		New value proposition	3
SOC6		High consumer expectations	4

### Technological environment

In table 13 and 14 below, the findings from the individual and focus group interview for technological environment are presented.

*L1 stage of LED lighting involving LED suppliers will soon consolidate to 3-5 larger LED chip suppliers due to commoditization of LED technology. Therefore, the next stage in LED production is device integration and system architecture. To further drive down the already falling production costs, implementing high degree of automation is a possibility but this is more worthwhile to look when the industry consolidates to small number of suppliers. (POM-2)*

Commoditization of LED technology is happening due to overcapacity in manufacturing. Also, the performance roadmaps of LEDs are flattening out and hence differentiation through product performance will soon diminish. It is predicted that the LED industry will consolidate by 2020 to 3-5 large LED chip suppliers. LED lighting will clearly be able to outperform existing lighting technologies in terms of efficacy, without sacrificing colour rendition. Therefore, the next step is towards device integration and system architecture to serve the different applications targeted. System architecture is the proposed way to deal with the diversity of the different segments targeted, whilst creating volume leverage with standard processes and components. Finally, there is the need for low-cost manufacturing. High speed assembly processes, larger area deposition and patterning processes as well as a much higher degree of automation will be key in order to bring the manufacturing costs down from the present level.

*LED efficiency will soon reach the highest possible theoretical value and therefore R&D investments into LED light sources capabilities will decrease and research on connected lighting will increase. At the same time, the major ongoing research is now towards quality of light. Human centric lighting is still very young but is being eagerly looked at. (HRD1)*

Investments in downstream industry are shifting towards addressing controls, software, service propositions. Therefore, there is a prediction that R&D investments into LED light sources capabilities will decrease and research on connected lighting will increase. Another major ongoing research is in the value proposition of 'Quality of Light' (tight colour control, tunable white light with the ability to combine with available the day light i.e. human centric lighting, customized spectra for various applications like horticulture, poultry, and museums etc). Research on human centric lighting is still very young and is further being strengthened and accelerated to take full advantage of potential benefits.

The advantages of LED are that it is efficient, more beautiful, and similar to day light, low power consumption and low operating voltage. LED lighting also has physical robustness and compactness, small weight and size, and long lifetime expectancy (25,000 to over 50,000 hrs of life). With special design, lifetimes of 150,000 hrs can be achieved. LED lights can be instantaneously switched-on with no re-strike time and is mercury-free. The main disadvantages of LEDs are: Lack of standardization, relatively high price, risk of glare as a result of small lamp size, need for thermal management to avoid degradation in lifetime, blue pollution (this applies for cool-white LEDs which can cause light pollution) and finally ambient temperature dependence (operating temperature greatly influences the LEDs' performance) (Halonen,2010).

*Like Moore's law, the one for LED lighting is Haitz law and according to the latter, LED lighting is only expected to get cheaper with time, but LED market lacks one significant feature when it comes to product quality and that is the lack of availability of uniform testing standards. This means that critical performance attributes cannot be compared in a consistent manner. (POM-1)*

Haitz's Law is an observation/prediction about the steady improvement over the years of LEDs. It states that every decade, the cost per lumen (unit of useful light emitted) falls by a factor of 10 and the amount of light generated per LED package increases by a factor of 20 for a given wavelength (colour) of light. It is considered the LED counterpart to Moore's Law, which states that the number of transistors in a given integrated circuit doubles every 18–24 months. Therefore, LED lighting is expected to get cheaper with time. Finally, it is important to know that the LED market lacks suitable uniform testing standards that measure efficacy, lifetime and other critical performance attributes such as reliability and compatibility in a consistent manner. Also, the available LED standards only have limited coverage of LED products, and significant variations exist between the product scope and test methods of different standards.

As discussed above, the technological factors are summarized in table 13 and 14. As such the LED lighting market is bound to expand as LEDs get cheaper, but product performance cannot be the way companies differentiate themselves as LED technology is becoming commoditized. Therefore, the way to go forward for firms is by offering more value in terms of either quality of light or connected lighting, both of which requires immense technical know-how. Therefore, failure to develop capabilities in either of these upcoming fields will pose a significant threat to firms and rob them of their opportunities to increase their sales.

Table 13: Findings from individual interviews

TEC1	Technology	Commoditization of LED technology	4
TEC2		Quality of light	5
TEC3		Haitz law	3
TEC4		Standardization and quality testing	4

Table 14: Findings from focus group interviews

TEC1	Technology	Commoditization of LED technology	4
TEC2		Quality of light	5
TEC3		Haitz law	3
TEC4		Standardization and quality testing	4

**Legal environment**

In table 15 and 16 below, the findings from the individual and focus group interview for legal environment are presented.

*The EU is focussed on making lighting industry sustainable and energy efficient. With that in mind it came up with initiatives like EPBD, EED and GGP. All of these are aimed at improving the lighting standards in buildings across the member states of EU. The proposed way for that is by improving luminous efficacy of light sources and that is the core feature of LED lighting. (LEG-1)*

The energy efficiency of lighting is explicitly addressed as a subject, mainly for the non-residential sector, in the recast of the Energy Performance of Buildings Directive (EPBD) of EU. Annex I point 3 stipulates that ‘the methodology shall be laid down taking into consideration at least the following aspects: (e) built-in lighting installation (mainly in the nonresidential sector)’. Annex I point 4 stipulates that ‘The positive influence of the following aspects shall, where relevant in the calculation, be taken into account ... (d) natural lighting.’ (Proposal for a Directive of the European Parliament, 2010). Also, the Energy Efficiency Directive (EED) requires Member States to set up National Energy Efficiency Action Plans. New EU Green Public Procurement (GPP) criteria for indoor lighting were introduced in 2012 by EU. They relate not only to minimum luminous efficacy of the light sources (in lm/W), but also to lighting levels (W/m<sup>2</sup>/100 lux), lighting controls, etc.

*Design standards and energy efficiency ratings are finding widespread use now and is being increasingly adopted in EU, Japan, China and USA. This is extremely important for consistent quality in LED products of different manufacturers. Eventually, this makes it easier for the customer to choose his/her product for different requirements. (LEG-2)*

The EU ruled that by 2020, all new building structures should consume “nearly zero” energy (European Council for an Energy Efficient Economy, 2010). Corresponding design standards and ratings classifying energy efficiency are finding widespread and growing adoption across geographies, such as BREEAM in the European Union, CASBEE in Japan and standards for green construction in China. In the US, LEED and the newly introduced International Green Construction Code (IGCC) are being adopted by an ever-greater number of local jurisdictions. In addition to regulatory action, global campaigns to raise awareness have been put in place to emphasize the role that energy-efficient lighting can play in reducing global energy consumption. A prominent example of this is the ‘en.lighten’ initiative by the United Nations Environment Programme (UNEP) and key lighting players (en.lighten, 2012).

*Even though the EU is favouring LED transition, it is extremely strict in enforcing safety and environmental standards. RoHS, GPS and Low Voltage directives are a few of them. These directives from EU make it tough for low quality products to enter the European market. (LEG-1)*

The EU Restriction of Hazardous Substances (RoHS) Directive lays down rules on the restriction of the use of hazardous substances in electrical and electronic equipment (EEE) with a view to contributing to the protection of human health and the environment, including the environmentally sound recovery and disposal of waste EEE. The General Product Safety (GPS) Directive 2001/95/EC and the Low Voltage Directive 2014/35/EU requires as safety principles that with light sources and luminaires no danger from radiation can occur. In Europe, EN 62471 is the product safety standard for lamps and lamp systems and is harmonized under the European safety directives EN 62471, which is based on the international IEC 62471 standard, classifies light sources into Risk Groups 0, 1, 2 and 3 (from 0 = no risk through to 3 = high risk) and provides for cautions and warnings for consumers if needed. Typical consumer products are in the lowest risk categories and are safe for use.

All the above legislations show that the EU is increasingly extending energy efficiency requirements and incentives to entire building infrastructures and are summarized in Table 15 and 16. This will help accelerate the transition towards LED lighting and continuously maintain safety standards through the process. As mentioned above, the EU is also keen on creating design standards and ratings to bring uniformity in LED lighting sector. Therefore, legislations and safety standards are helping the lighting industry to move towards LEDs from conventional light sources.

Table 15: Findings from individual interviews

LEG1	Legal	Regulations on Hazardous Substances	5
LEG2		Energy efficiency directives	4
LEG3		Building directives	4
LEG4		General Product Safety Directive	2

Table 16: Findings from focus group interviews

LEG1	Legal	Regulations on Hazardous Substances	5
LEG2		Energy efficiency directives	5
LEG3		Building directives	3
LEG4		General Product Safety Directive	3

### Environmental environment

In table 17 and 18 below, the findings from the individual and focus group interview for environmental environment are summarized and presented.

*LED lighting is competing with conventional sources not just with its efficiency features but also in its sustainability attributes. Overall, when you look at economic and environmental advantages, LED is simply the best available alternative to current technologies even though it is expensive. It has easier waste disposal process and leads to lower carbon emission. (PDM-1)*

LEDs are emerging not only as having high energy efficiency, but also as having some important environmental advantages compared to conventional light sources (Gaston et al., 2012). Lower energy consumption leads to lower carbon emissions. Additionally, LEDs do not contain glass, filaments or mercury. This makes LEDs a much safer alternative to the current lighting technologies in retail, commercial and industrial applications (IEA, 2006). Therefore, LEDs have many economic and environmental advantages, being one of the most cost-effective technologies to reduce GHG. The handling of conventional light sources, metal halide, compact fluorescent, and linear fluorescent involves the use of strict waste disposal protocols that results in a cost of ownership to any commercial venture. In addition, the residential applications and disposal of compact fluorescent have become significant issues given the substantial increase in production and future application. LED technology does not involve the use of mercury and therefore would not require this level of sophistication in the waste-disposal process, thereby reducing the stress on municipal waste disposal.

*Even though LEDs don't contain mercury like in the case of conventional light sources, it still has very small amounts of additional metals like copper, gold, nickel and other metals in the LED chips. Also traces of group 13 elements are present in LEDs. The other potential risks raised are in terms of spectral and energetic characteristics of LEDs but are not proven yet. (POM-1)*

However, LEDs contain one or more chips (also called dies) that may contain very small amounts of mildly problematic materials such as arsenic, gallium, indium, and/or antimony (combined with nitrogen and phosphors) with potential environmental impacts, human health and ecological toxicity effects, especially when disposed of at the end of their lifecycle (Almeida et al., 2012). Furthermore, the LED chips are assembled into usable pin-type devices through the application of leads, wires, solders, glues, and adhesives, as well as heat sinks for thermal dissipation management. These ancillary technologies contain additional metals, such as copper, gold, nickel, and other metals, such as aluminium. It will be desirable to find proper ways to recycle these materials as well as gallium and indium as more LEDs enter the market. The potential health risks of these new light sources were explored. Due to the specific spectral and energetic characteristics of white LEDs, as compared to other domestic light sources, some concerns have been raised regarding their safety for human health, particularly potential harmful risks for the eye. In general, "cool" white LEDs are more efficient than those having a "warm" appearance, since short-wavelength spectral content plays a role in the photopic efficacy of LEDs.

*High efficacy, low CCT LEDs will eventually minimize impact of artificial lighting. This technological achievement has pushed the LED manufacturers to strive for further reductions in short wavelength and thereby, eliminate blue light emission. (GPM-1)*

The new high-efficacy (above 100 lm/W), low CCT warm-white LEDs are an environmental, ecological, and technological breakthrough that will help over time to minimize the impact of artificial lighting on the night environment. Their development is a significant technological achievement to encourage all LED manufacturers to strive for further reductions in short wavelength and thereby, eliminate blue light emission (US Department of Energy, 2010). So as such there is no present environmental or safety hazard in LED lighting. Therefore, environmental factors do not possess any threats but only certifies LED lighting in a positive way and are evident from findings in table 17 and 18.

Table 17: Findings from individual interviews

ENV1	Environment	LED dyes	4
ENV2		No mercury usage in LEDs	5
ENV3		Conventional light sources disposal	3
ENV4		Blue light emission	5

Table 18: Findings from focus group interviews

ENV1	Environment	LED dyes	3
ENV2		No mercury usage in LEDs	4
ENV3		Conventional light sources disposal	2
ENV4		Blue light emission	4

#### 4.2.2 SWOT Analysis

As discussed in previous chapter, SWOT analysis brings together the results of internal and external analysis of a company. The purpose is to find the most favourable match of internal resources, capabilities and core competences to build competitive advantage, and to identify a position in the industry where a company best can defend itself against competitive forces or influence them to their own favour (Friend & Zehle, 2009). In order to do so, the SWOT analysis must have a customer focus, since competitive advantage is a result of satisfying customer needs (Friend & Zehle, 2009). Strengths and Weaknesses are considered to be internal factors, since they are specifically connected to a company's resources, capabilities and core competences (Afuah, 2009). Likewise, Opportunities and Threats are external factors and depend on the external environment. The best strategies accomplish an organization's mission by exploiting an organization's opportunities and strengths while neutralizing its threats and avoiding its weaknesses (Barney & Griffin, 1992).

To analyse which SWOT factors are more important than other, the different factors have been weighted (see Table 19). The number 5 means a point is very important, 3 means it is normally important, and 1 means it is not important. These scores are based on interpretation by the researcher and discussion with two experts. The SWOT factors can then be placed in a SWOT-matrix, in which the strengths and weaknesses are placed against the threats and opportunities. The attractiveness of a SWOT-matrix is that it allows for identifying the right strategy for a firm to select and is discussed in the next section.

Table 19 – SWOT analysis

<b>Strengths</b>	<b>Points</b>	<b>Weaknesses</b>	<b>Points</b>
------------------	---------------	-------------------	---------------

Biggest buyer of LEDs	4	Not the cheapest	3
Good operational setups by region	4	Low inventories	3
Product quality and reliability	5	Slower in bringing new ideas to market	5
Connected lighting solutions	3	Data capability like internet companies missing	3
Market leader in LED lamps	4	Educational barriers	3
Strong sales team in OEM	4		
Broad portfolio	3		
Operational efficiency	4		
Strong R&D capabilities	4		
<b>Opportunities</b>	<b>Points</b>	<b>Threats</b>	<b>Points</b>
Quality of light value proposition	4	Aggressive pricing	5
Applications based lighting	4	Increased competition in LED	4
Connected smart lighting	3	Low end Chinese imports	3
New disruptive business models	3	Market change (lighting as a product to service)	2
Banning of fluorescence lamps	3	Few suppliers	3
		Unclear payback time	3
		High initial cost	4

### 4.3 SWOT Matrix and strategies

In this matrix, the strengths, weaknesses, opportunities and threats that are considered most important are set out against each other, which results in several possible strategies. These strategies are based on the possible strategies given by Alsem (1993) as described in chapter 3: grow, improve, defend or run. These identified strategies help accomplish an organization's mission by exploiting an organization's opportunities and strengths while neutralizing its threats and avoiding its weaknesses (Barney & Griffin, 1992). Each factor has been matched in a way to either take advantage of an opportunity (grow - combines strengths and opportunities), to identify areas that can be improved (improve - combines strengths and threats), to fight competition (defend – combines weaknesses and opportunities) or to identify major risks and issues (run – combines weaknesses and threats).

Based on the coded interviews, a network view (visualization of system of linkages) as seen in Figure 3-6 was built using Atlas.ti 7.0, where the most relevant codes are incorporated and analyzed in relation with each other. First, for each of the four strategies, their relevant codes were first chosen from Table 3 and 4. Then their neighbours (other codes connected to the chosen ones) were imported. Then a suitable layout can be chosen to visualize the imported codes. Then the codes are connected through the default or newly created semantic linkages that captures the relationship between the imported codes. After connecting the codes through the applicable relation, their frequencies have to be added. This is seen in figure 3-6 as parenthesis with two numbers next to each element. The first number represents Groundedness, the number of quotations that are connected to a code and the second one represents Density, the inter-connections that different codes have between them.

Figure 7 displays the elements of Grow strategy (SO). It shows the relationship between different elements (strengths and opportunities). In this strategy, pursuing new product ideas involving quality of light and connected lighting solutions is the way forward. Both of these product ideas are made possible through strong R&D capabilities. When entering connected lighting solutions, the case company has to start looking at new business models as the business is no more about only hardware but also involves software. Strong R&D capabilities guarantees product quality and reliability and that along with strong sales team and good region wise operational setups has helped the case company remain a market leader in LED lamps.



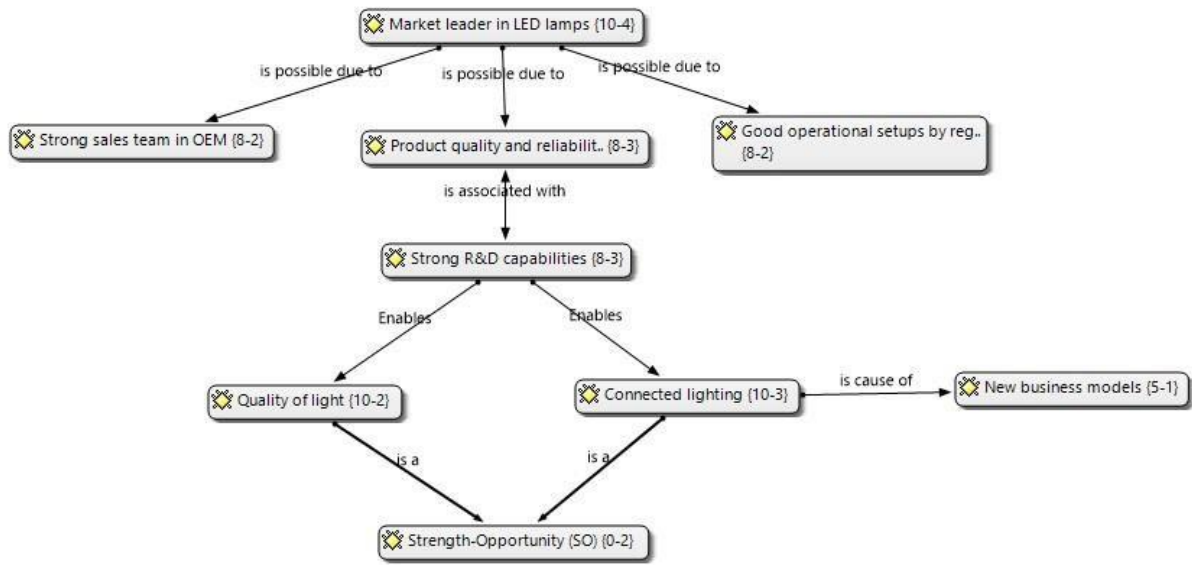


Figure 7 – Grow strategy

Figure 8 displays the elements of Defend strategy (ST). It shows the relationship between different elements (strengths and threats). Being a market leader in LED lamps, through strategic agreements, the weakness of few LED suppliers can be negated. The increased competition in LED can be tackled by moving to new value propositions like quality of light and connected lighting as they companies to possess strong R&D capabilities. Low end Chinese imports are another reason for increased competition in LED lighting and it is better for large organizations like the case company to not compete in there. Another element that needs attention is unclear payback time and it is something that organizations need to focus on through their campaigns and advertisements.

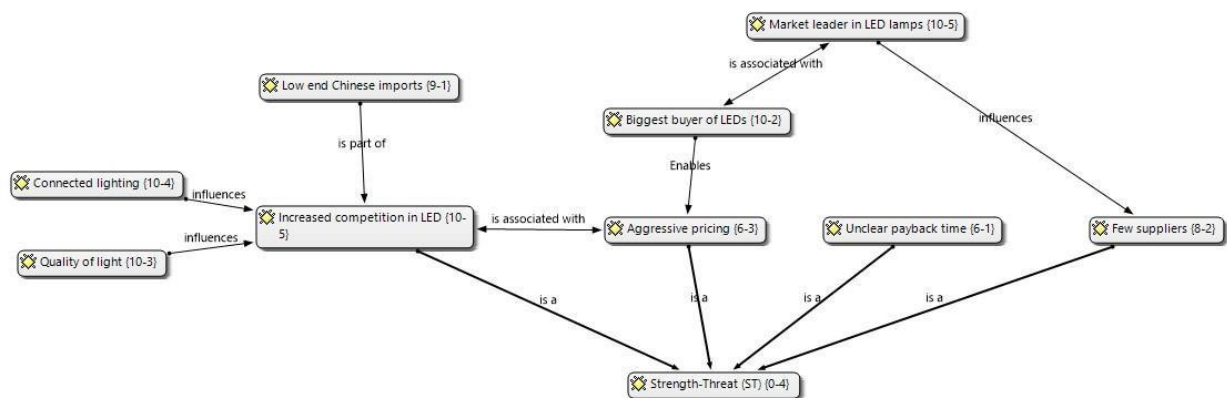


Figure 8 – Defend strategy

Figure 9 displays the elements of Improve strategy (WO). It shows the relationship between different elements (weaknesses and opportunities). When looking at connected lighting as the new value proposition, the internet data mining capabilities of lighting companies including the case company are poor. So, it is crucial factor to be considered when creating new business models. By being the first to introduce connected lighting and quality of light products, the case company can influence its image from being a slow to a relatively fast company in bringing new ideas. Tight inventory is a factor considered as a weakness in the lighting industry and could eventually become a threat for the case company. The strategy must also include educational campaigns around the reason for ban of fluorescent lamps and how and why one must transition to LED lighting.

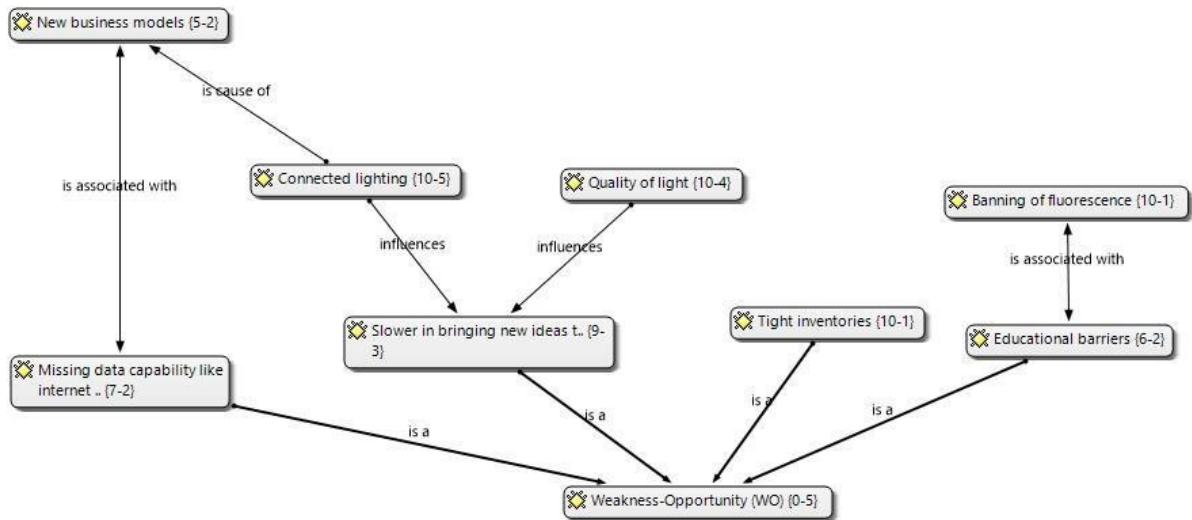


Figure 9 – Improve strategy

Figure 10 displays the elements of Run strategy (WT). It shows the relationship between different elements (weaknesses and threats). The strategy involves in identifying the significant threats and ways to handle it. The case company has tight inventories mainly due to few suppliers, high organizational costs and aggressive market pricing. Through strategic partnerships and offering new value propositions, a company can improve its profit margin and that will in turn improve the supply chain flexibility. The other elements that threaten the case company are lack of data handling capabilities and slow in bringing new ideas to the market. Unclear payback time is not a significant threat and can be overcome through educational campaigns.

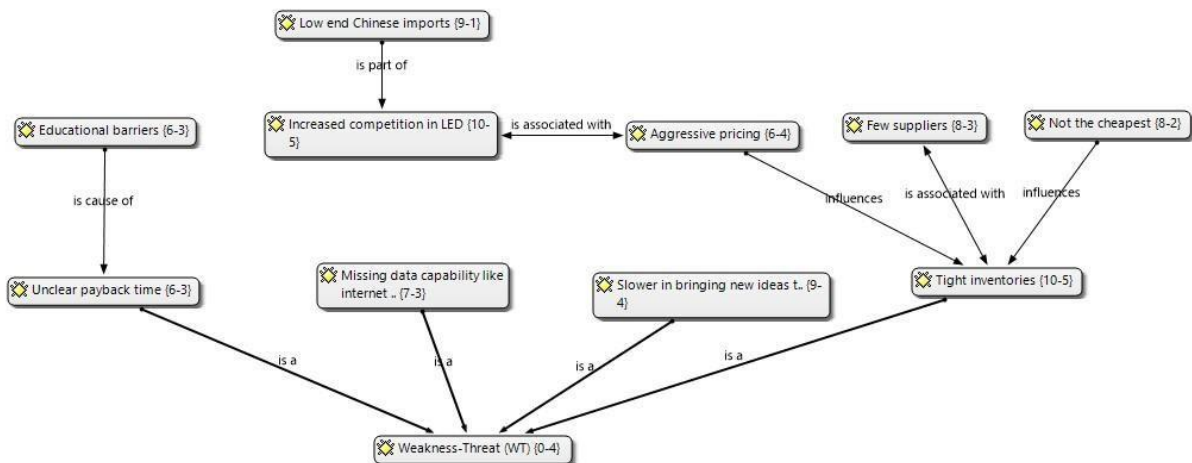


Figure 10 – Run strategy

#### 4.4 Conclusion

Table 20 below is a summary of the SWOT analysis and it is called a SWOT matrix. The column headers are Strengths (W) and Weaknesses (W). The row headers are Opportunities (O) and Threats (T). The possible strategies (Grow, Defend, Improve and Run) are represented within a two by two matrix denoted by SO, ST, WO and WT respectively.

Table 20 – SWOT matrix

<p><b>Strategies</b></p>	<p><b>Strengths (S)</b>          Biggest buyer of LEDs          Good operational setups by region          Product quality and reliability          Connected lighting solutions          Market leader in LED lamps          Strong sales team in OEM          Broad portfolio          Strong R&amp;D capabilities</p>	<p><b>Weaknesses (W)</b>          Not the cheapest          Low inventories          Slower in bringing new ideas to market          Data mining capability like internet companies is missing          Educational barriers</p>
<p><b>Opportunities (O)</b>          Quality of light value proposition          Connected smart lighting          New disruptive business models          Banning of fluorescence lamps</p>	<p><b>SO -&gt; Grow</b>          1. New product ideas involving quality of light and applications based lighting.          2. Secure strong market position in connected lighting          3. Explore new business models for lighting industry</p>	<p><b>WO -&gt; Improve</b>          1. Educate customers          2. Improve supply chain flexibility          3. Innovate faster and reach the market first with quality of light technology          4. Develop new skills in the workforce regarding connectivity and understanding lighting data</p>
<p><b>Threats (T)</b>          Aggressive pricing          Increased competition in LED          Low end Chinese imports          Market change (lighting as a product to service)          Few suppliers          Unclear payback time</p>	<p><b>ST -&gt; Defend</b>          1. Adapt to competition price to using volumes          2. Focus on premium/mid-end segment          3. Work on further reducing costs          4. Create more value differentiators in product portfolio and position the firm accordingly</p>	<p><b>WT -&gt; Run</b>          1. Improve supply chain flexibility          2. Innovate faster and reach the market first with quality of light technology          3. Develop new skills in the workforce regarding connectivity and understanding lighting data          4. Create a standardized portfolio and specific applications only oriented streamlined portfolio, overall forming an efficient broad portfolio.</p>

In the next chapter, we will discuss the overview of the findings from the research and answer the main research question. Also, the scientific and practical relevance of the findings will be presented together with the limitations of this study and the chapter will conclude with suggestions on directions for future research.

## 5. Discussion and conclusions

In the next sections, we first present the overall conclusion of the thesis by providing an overview of the findings. After that, we analyze the contribution of this research from a scientific perspective followed by outlining the practical relevance. Third, we provide a set of recommendations based on the findings. Finally, we discuss the limitations of this study and suggest multiple directions for future research.

### 5.1 Key findings

The goal of this thesis was to analyze how a lighting company can increase its market share in the European market as the industry is transitioning from conventional to LED based lighting. The findings allow us to answer the main research question, as outlined in the next paragraphs.

As discussed above, the main research question is concerned with how a lighting company can increase its market share in European market when the whole industry is transitioning towards an innovative LED technology. The internal environment of a company was studied through an organizational analysis and the external environment analysis was carried out using the PESTEL framework. The results of the separate internal and external environment analyses were synthesized by performing a strategic SWOT analysis. Through SWOT analysis, determinants for successful strategy were identified and used to answer the main research question and subsequently to provide recommendations.

The research indicated that the current state of the lighting industry with respect to European market is favouring the transition of the industry towards LED based lighting from existing conventional sources. Additionally, as the case company is a market leader in lighting sector, pursuing 'Grow Strategy' will be the best way for them to move forward. In this strategy, their strengths and opportunities can be combined to pursue new product ideas like quality of light and connected lighting solutions, both of which requires immense technical know-how. The case company's strong R&D capabilities guarantees product quality and reliability and that along with its massive sales team and good region wise operational setups can help the case company gain market share in the LED lighting sector. Finally, the main research question was answered. LED technology is rapidly being commoditized, and product performance cannot anymore be the specification where companies differentiate themselves. Therefore, opportunities for lighting companies to gain market share is only possible through developing new value propositions for buyers like quality of light and exploring untapped potential of connected lighting. Lighting companies must orient their research and development in exploring and creating these value propositions. Additionally, equipping their current workforce with the relevant technical and business capabilities will be vital.

### 5.2 Theoretical contribution

This research contributes to improving the Porter's five forces model by addressing its significant limitations. According to Grundy (2006), the model doesn't refer to the 'dynamics of growth' for a certain industry or market. This study addresses that limitation through its detailed situational analysis by combining tools like PESTEL framework, Porter's five forces model, Organizational analysis and SWOT analysis. Through using strategic tools that are interdependent, a more accurate analysis of the business environment was made possible. The threats and opportunities involved in a rapidly changing and highly competitive lighting industry could be identified. In today's environment, there is an increasing power of the internet and other information technologies and therefore it becomes more and more important to start collaboration and maintain innovation and not just protect against the five forces (Karagiannopoulos et al., 2005; Holm, Eriksson & Johanson, 1996). This research is an additional proof to the need for collaborations in today's rapidly changing business environment. From the findings of this research, it was evident that the market expansion of lighting industry as it moves towards connected lighting is purely dependent on the strategic collaborations between different lighting companies and that in turn has the potential to disrupt the current market position of incumbents and new entrants.

The nature of the forces in the today's competitive landscape requires a continuous rethinking of current strategic actions, organization structure, communication systems, corporate culture, asset deployment, investment strategies, in short, every aspect of a firm's operation and long-term health (Hitt et al., 1991; Hitt et al; 1998). In this research,

existing strategic tools were combined to arrive at a research design that carried out strategic marketing planning for an incumbent firm that is transitioning towards LED based lighting. This study applied the existing knowledge on strategic management to help a firm facing significant uncertainty and ambiguity to arrive at long term strategies for growth. Therefore, firms facing uncertainty due to changing industry structure or hyper competition can follow a similar approach or use this study as a reference to arrive at long-term strategies for growth. Finally, the study suggested that the use of conventional structure of marketing (Four Ps marketing mix) is not sufficient for the transitioning lighting industry. With the advent of LED based lighting, the LED suppliers' market is expected to aggregate to few suppliers and the move towards connected lighting increases the role of software in lighting technology. Strategic partnerships and maintaining stakeholder relationships will become an important part in the future of lighting industry. Therefore, the role and need of relationship marketing (a new and leading approach) in lighting industry is identified through this research.

### **5.3 Practical relevance**

This study offers significant insights for LED lighting industry and they are presented in the following paragraphs.

The key PESTEL factors that affect the current lighting industry were discussed. Through banning incandescent lamps and proposing a ban on halogen lamps, political environment in EU is favouring the transition of lighting industry towards LED. The economic environment for LED lighting is mainly dependent on raw material prices, currency exchange rate (Euro vs USD and USD vs CNY) and falling LED prices. These factors together determine the acceleration in growth of LED lighting market. The social factors present both opportunities and threats to LED lighting industry. The opportunities are in the form of developing a new value proposition for buyers and exploring untapped potential of connected lighting whereas the threats are the high consumer expectations, payback time and high initial cost of LED lighting. As LED technology is becoming commoditized, the way to go forward for lighting companies is by offering more value in terms of either quality of light or connected lighting. Therefore, failure to develop capabilities in either of these upcoming fields will pose a significant threat to firms and rob them of their opportunities to increase their sales. The EU is increasingly extending energy efficiency requirements and incentives to entire building infrastructures and are helping the lighting industry to move towards LEDs but at the same time is careful in determining safety standards. EU is also keen on creating design standards and ratings to bring uniformity in LED lighting sector. Finally, the environmental factors do not possess any threats but only certifies LED lighting in a positive way.

Since the lighting industry is rapidly moving towards LED from conventional sources, the expectations of the customers are high, therefore product quality and reliability is very important. LED lighting being an expensive option, educational campaigns clearing the doubts surrounding LEDs and its payback time will also be a major push to stimulate the sales. Low-cost, high volume, and reliable manufacturing methods are important to drive down the first costs of LED lighting. The research also mentioned the need to maintain strategic relationship with LED suppliers as it is expected that the future will consolidate all the existing LED suppliers into 3-4 suppliers. New possibilities in decorative and architectural lighting are now presented by LED lighting, due to their superior colour and special distribution capabilities. Finally, the research showed that LED lighting will clearly be able to outperform existing lighting technologies in terms of efficacy, without sacrificing colour rendition. Therefore, the next step is towards device integration and system architecture to serve the different applications targeted.

LED lighting is expected to get cheaper with time, but it is important to know that the LED market lacks suitable uniform testing standards that measure efficacy, lifetime and other critical performance attributes such as reliability and compatibility in a consistent manner. Also, the available LED standards only have limited coverage of LED products, and significant variations exist between the product scope and test methods of different standards. Next, there is a prediction that R&D investments into LED light sources capabilities will decrease and research on connected lighting will increase. When entering connected lighting solutions, the companies must start looking at new business models as the business will be no more about only hardware but also involves software. Therefore, developing strategic partnerships with software companies having data handling capabilities from early stages is important.

The main strengths, weaknesses, opportunities and threats of the case company were analyzed. Biggest buyer of LEDs, good operational setups by region, excellent product quality and reliability, market leader in LED lighting, strong sales team in OEM and strong R&D capabilities are its strengths. The weaknesses are that it is not cheapest, has low

inventories and is slower in bringing new ideas to market. The opportunities for the case company due to its R&D capabilities are in the form of offering quality of light value proposition and new applications-based lighting whereas the threats are the aggressive pricing due to increased competition in LED industry and high initial cost of the product.

The best possible strategy for the case company out of the available four (Grow, Defend, Improve and Run) is the 'Grow Strategy' that shows the relationship between its strengths and opportunities. Therefore, pursuing new product ideas involving quality of light and connected lighting solutions must be included in their strategy.

#### **5.4 Limitations**

The first limitation of the research is it employs a single-case study method and the drawback of a single-case design is its inability to offer a generalizing conclusion or external validity (Jacobsen, 2002). In multiple case study design, the advantage is that researcher is able to analyze the data both within each situation and across situations. Multiple case studies can be used to either augur contrasting results for expected reasons or either augur similar results in the studies (Yin, 2003). In this way the author can clarify whether the findings are valuable or not (Eisenhardt, 1991). By triangulating the study using two separate data collection methods, focus group and individual interview, this study tried to overcome the limitation of a single-case study design. Additionally, in order to mitigate this effect, the high ranks of the respondents allowed to increase the generalizability of the findings, due to their broader perspective. The single case study design was chosen also due to time constraints and the difficulty to get into contact with other large companies and receive permission to access the data needed for the study.

In general, the limitations of case studies methodology are that it is seen as only a preliminary research method and cannot be used to describe or test propositions (Yin, 2009). Miles (1979) also critique case research because collecting and analyzing the data is a highly labour-intensive activity, often causing much stress, even for skilled research staff. Merriam (2009) agrees that although rich, thick description and analysis of a phenomenon may be desired, a researcher may not have the time or money to devote to such an undertaking. Usually the studies take a long time to execute (Yin, 2009) and the product may be too lengthy, too detailed, or too involved for busy practitioners to read and use (Merriam, 2009). The next limitation of the study is that the coding procedure might have suffered from a certain level of subjectivity, especially during the identification and categorization of patterns as the study used only one coder. Due to time constraints, multiple-coders could not be employed for the analysis and this negatively reflects on the internal validity of the findings. Through performing content analysis using a software called Atlas.ti and by continuously referring to respondents' quotes throughout the study, we tried to reduce this effect.

Since it is a single case study and the sample size was small, there is a possibility that positive factors are emphasized, and negative factors neglected by the interviewees, since they have personal connections to the company. An appropriate sample size for a qualitative study is one that adequately answers the research question (Marshall, 1996). The concept data saturation entails bringing new participants continually into the study until the data set is complete, as indicated by data replication or redundancy (Bowen, 2008 and Miles et al., 1994). While qualitative methodologists do not agree on exact sample sizes needed for qualitative studies, they generally agree that a number of factors can affect the number of interviews needed to achieve saturation. In addition to the nature and scope of the researcher, some other factors that can influence sample size needed to reach saturation include quality of interviews, number of interviews per participant, sampling procedures, and researcher experience (Morse, 2000; Richardson et al., 2005; Sandelowski, 1985). Patton (2002) explains that sample size depends on what you want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility, and what can be done with available time and resources. Due to limitation in resource and time, a small sample size was chosen but there was a large and significant overlap in the results of the two separate data collection methods with completely different set of respondents and was confirmed through spearman correlation in section 4.1.4.

#### **5.5 Future research**

Based on the findings of this research and on its limitation, new directions for future research are proposed.

First, further research is needed to assess whether the findings of this study can hold for the whole lighting industry. A future research with multiple-case study design and having various respondents from large lighting companies can increase the generalizability of the results from this study. When a multiple case study is used it comes with both

benefits and difficulties, which is important to take under consideration by the researcher. According to Baxter and Jack (2008), making a multiple case study can be an expensive and time-consuming process and Eisenhardt and Graebner (2007) suggest that multiple case studies allow a wider discovering of theoretical evolution and research questions. Therefore, in a multiple case study, the researcher can analyze the data within each situation and across different situations, but it is a tedious process (Gustafsson, 2012).

Second, the future research can examine the ways to arrive at a new business model that will be needed when connected lighting takes over the LED lighting industry. In the latter case, the lighting industry may switch to a subscription model and research can be carried out to study the existing business models and arrive at the most suitable one for connected lighting. Also, the research could suggest the key factors in developing a successful subscription model. Pricing is an important strategic factor in any subscription business and the research could further analyze this complex factor and help the LED lighting industry with its suggestions.

Third, this study shows that LEDs are fast replacing the conventional lighting sources and therefore, LED lighting would make a solid example for researchers that study how a new innovative technology cannibalizes the sales of existing technology. The research can analyze the willingness of the firms to cannibalize their own investments for a strong radical product innovation. The research can identify various factors that drive a firm's willingness to cannibalize. Finally, a framework can be developed to help firms manage the decision making and cannibalization processes when a new and an existing technology need to be kept in parallel in the product portfolio.

Fourth, the study analyses the dynamics of a transitioning industry from Porter's five forces model as the foundation. Other theories analyzing industrial transition due a technological innovation could be used to find the advantages and limitations of this study. That research can find various other factors that can help analyze the dynamics of an industry and increase the accuracy of the analysis. By doing so, a company can formulate its growth strategy clearly oriented towards those factors and eventually arrive at very successful strategies to increase market share. But one has to be cautious on not over analyzing the industry dynamics trying to be extremely accurate as it might create a blind side view.

Fifth, as discussed in the research, the LED lighting industry is lacking significant uniform testing standards. For the industry competition to remain healthy in the long run, a uniform testing standard is a must and that will also help the customer feel safer and more satisfied on his/her orders. So, a research in this direction interviewing key stakeholders of lighting industry and identifying the specifications for quality control and relevant testing standards will be a massive contribution for the future of LED industry. The results of the study could be further validated through expert interviews. Once there are uniform quality standards, the competition between key players will push the industry to strive for better product performance.

Finally, we advocate scholars to carry out additional studies on the need for collaborations in lighting industry as the future is connected lighting and the existing large lighting companies lack data capabilities and therefore, collaborations will be become an important part in the next generation of lighting industry. The study could explore with the main dimensions of the inter-firm collaborations and identify the necessary factors to build successful innovation partnerships. The study could choose the dependent, independent and moderator variables and study their relationships. Also, a follow-up research could be performed to support the generalizability of the findings by carrying out similar studies in different industries.

## **5.6 Conclusion**

The research dealt with how a lighting company can increase its market share in the European market as the industry is transitioning from conventional to LED based lighting. The current state of the lighting industry was analyzed and found to be favourable towards the transition. Also, the study suggested that, as the LED technology is rapidly being commoditized, the lighting companies can gain market share only through developing new value propositions for buyers like quality of light and exploring untapped potential of connected lighting. Finally, the limitations and future directions of the research was discussed.

## 6. References

- Afuah, A. (2009), "Strategic innovation - New game strategies for competitive advantage ", New York: Routledge.
- Aktouf, O. (2004). The false expectations of Michael Porter's strategic management framework. *Revista Universidad & Empresa*, 6(6), 9-41.
- Alexander, R.S., Cross, J.S., Cunningham, R.M. (1961), *Industrial Marketing*, re.ed. , Homewood Ill: Richard D, Irwin, Inc.
- Almeida, A. D., Santos, B., Paolo, B., & Quicheron, M. (2014). Solid state lighting review – Potential and challenges in Europe. *Renewable and Sustainable Energy Reviews*, 30-48.
- Alsem, K.J., *Strategische Marketingplanning: Theorie, technieken en toepassingen*. Culemborg: Stenfert Kroese, 1993.
- Andrews, K.R. (1987). *The concept of corporate strategy*. Homewood, IL: Irwin
- Ansoff, H.I. (1965). *Corporate Strategy*. New York: McGraw-Hill
- Bain, J. S. (1959). *Industrial Organization*. New York: Wiley.
- Bagozzi, R., "Marketing as Exchange", *Journal of Marketing*, Vol. 39, October 1975, pp. 32-9.
- Baker, S. & Bass, M. 2003. *New Consumer Marketing*. West Sussex: John Wiley & Sons Ltd.
- Barney, J. B. and Griffin R. W. (1992), "The management of organizations. Strategy, structure, behaviour", Boston: Houghton Mifflin Company.
- Baumgartner, T., Wunderlich, F., Wee, D., & Jaunich, A. (2012, August). McKinsey & Company. Retrieved from [https://www.mckinsey.com/~media/mckinsey/dotcom/client\\_service/automotive%20and%20assembly/lighting\\_the\\_way\\_perspectives\\_on\\_global\\_lighting\\_market\\_2012.ashx](https://www.mckinsey.com/~media/mckinsey/dotcom/client_service/automotive%20and%20assembly/lighting_the_way_perspectives_on_global_lighting_market_2012.ashx)
- Berry, L.L., "Relationship Marketing", in Berry, L.L., Shostack, G.L. and Upah, G.D. (Eds), *Emerging Perspectives of Services Marketing*, American Marketing Association, Chicago, IL, 1983, pp. 25-8.
- Blomqvist, R., Dahl, J. and Haeger, T., *Relationsmarknadsföring. Strategi och metod för servicekonkurrens (Relationship marketing. Strategy and methods for service competition)*, IHM Förlag, Göteborg, Sweden, 1993.
- Blythe, J., *Principles & Practice of Marketing*, London: Thomson Learning, 2006
- Boone, L.E. & Kurtz, D.L. 1992. *Contemporary Marketing*. New York: Harcourt Brace Jovanovich Publishers.
- Brandenburg, A. and Nalebuff, B. J. (1995). "The Right Game: Use Game Theory to Shape Strategy," *Harvard Business Review* 73, No. 4. Boston: Harvard Business School.
- Calonius, H., "A Buying Process Model", in Blois, K., and Parkinson, S. (Eds), *Innovative Marketing – A European Perspective*, proceedings from the XVIIth Annual Conference of the European Marketing Academy, University of Bradford, 1988, pp. 86-103
- Candelon, F., Creyghton, A., Hong, M., Rubel, H., & Smits, M. (2015, November 12). BCG. Retrieved from Boston Consulting Group: <https://www.bcg.com/en-nl/publications/2015/building-materials-accelerating-growth-wintransforming-lighting-industry.aspx>



Chamberlin, E.H., *The Theory of Monopolistic Competition*, Harvard University Press, Cambridge, MA, 1933

Chaney, D. (1996). *Lifestyles*. London: Routledge.

Christopher, M., Payne, A. and Ballantyne, D., *Relationship Marketing: Bringing Quality, Customer Service and Marketing Together*, Butterworth, London, 1991.

Clancy, K.J. and Shulman, R.S., *The Marketing Revolution. A Radical Manifesto for Dominating the Marketplace*, Harper Business, New York, NY, 1991.

Conklin, D. W., & Tapp, L. (2000). The creative web: A new model for managing innovation. *Ivey Business Journal*, 64(5), 60-69.

Coulter, M. (2008). *Strategic management in action*. New Jersey: Pearson Education.

Craninx, P. (2017). Retrieved from IMAP: [https://www.moorestephens.be/files/IMAP\\_Lighting-industry---NorthEuropean-MA-report-2017.pdf](https://www.moorestephens.be/files/IMAP_Lighting-industry---NorthEuropean-MA-report-2017.pdf)

Cunningham, M.T. and Roberts, D.A. (1974), "The role of customer service in industrial marketing", *European Journal of Marketing*, Vol. 8, Nr. 1, pp. 15 -- 28.

Dare, C. (2006). The UK tour-operating industry: A competitive analysis. *Journal of Vacation Marketing*, 6(4), 357-367.

Day, G.S. (1990), *Market Driven Strategy: Processes for Creating Value*, The Free Press/Macmillan Inc., New York, NY.

Dealtry, T. R., *Dynamic SWOT Analysis': Developer's Guide: Intellectual Partnerships*, 1992.

Dess, G. G., Lumpkin, G. T. and Eisher, A. B (2006). *Strategic Management. Text and cases. International edition*. London: McGraw-Hill.

Downes, L. (1997). *Beyond Porter*. Context Magazine.

Dorussen, H., Lenz, H., Blavoukos S. (2005). Assessing the Reliability and Validity of Expert Interviews. *European Union Politics*, 6(3), 315-337.

Drucker, P. (1964). *Managing for Results*. London: Harper and Row.

Dulčić, Ž., Gnjidić, V., & Alfirević, N. (2012). From Five Competitive Forces to Five Collaborative Forces: Revised View on Industry Structure-firm Interrelationship. *ProcediaSocial and Behavioral Sciences*, 58, 1077-1084.

Fern, E.F. and Brown, J.R. (1984), "The industrial/consumer marketing dichotomy: a case of insufficient justification", *Journal of Marketing*, 48, Spring, 68-77.

Fisk, G., *Marketing Systems*, Harper & Row, New York, NY, 1967

Flint, D., Woodruff, R. and Gardial, S.F. (1997), "Customer Value Change in Industrial Marketing Relationships. A Call for New Strategies and Research", *Industrial Marketing Management*, Vol. 26 pp. 163 –175.

Flower, E. (2004). "Competition, Technology, and Planning: Preparing for Tomorrow's Library Environment." *Information Technology & Libraries* 23(2): 67-69.

- Ford, D., (Ed.), *Understanding Business Markets: Interactions, Relationships and Networks*, Academic Press, London, 1990.
- Friend, G. and Zehle, S. (2009). *Guide to business planning*. United States: Bloomberg Press Published, New York.
- Gay, G. (2002), "Audit risk reduction", *Australian CPA*, March, pp. 68-70
- Gemunden, H., & Ritter, T. (1997). *Managing Technological Networks: The Concept of Network Competence*. Elsevier Science, 294-304
- Grönroos, C., "Designing a Long-range Marketing Strategy for Services", *Long Range Planning*, Vol. 13, April 1980, pp. 36-42.
- Grönroos, C. (1990), *Service Management and Marketing – Managing the Moments of Truth in Service Competition*, Lexington Books, Lexington, MA.
- Grönroos, C. (1994), "Quo Vadis, Marketing? Toward a Relationship Marketing Paradigm", *Journal of Marketing Management*, Vol. 10 pp 347 - 360.
- Grönroos, C. (1994), "From Marketing Mix to Relationship Marketing – Towards a Paradigm Shift in Marketing", *Management Decision* 32/2, MCB University Press.
- Grundy, T. (2006). "Rethinking and reinventing Michael Porter's five forces model." *Strategic Change* 15(5): 213-229.
- Gulati, R. (1998). *Alliances and Networks*. *Strategic Management Journal*, 293-317.
- Gummesson, E., "The New Marketing – Developing Long-term Interactive Relationships", *Long Range Planning*, Vol. 20 No. 4, 1987, pp. 10-20.
- Haberberg, A., *Swatting SWOT: Strategic Planning Society*, 2000.
- Håkansson, H., (Ed.) *International Marketing and Purchasing of Industrial Goods*, Wiley, New York, NY, 1982
- HARRISON, J. S. & St. JOHN, C. H. (2004). *Foundations in Strategic Management*, (3.Baskı), USA: South Western.
- Hawkins, D. I., Best, R. & Coney, (2004), "Consumer behavior: Building validity project", *Journal of Advertising Research*, vol. 40(6), pp. 114-135.
- Heide, J., & Miner, A. (1992). *The Shadow of the Future: Effects of Anticipated Interaction and Frequency of Contact on Buyer-Seller Cooperation*. *Academy of Management Journal*, 265-291.
- Hertz, S., & Mattsson, L. (2001). *Dynamics of Contemporary International Markets-Strategic Alliances and*. European Marketing Academy (EMAC) Conference. Bergen.
- Heskett, J.L., "Lessons in the Service Sector", *Harvard Business Review*, Vol. 65, March-April 1987, pp. 118-26.
- Hitt, M. A., Keats, B. W., & Samuel, D. M. (1998). *Navigating in the new competitive landscape: Building strategic flexibility and competitive advantage in the 21st century*. *Academy of Management Executive*, 22-42.
- Hill, C. & Jones G. (2009). *Strategic Management Theory: An Integrated Approach*, Cengage Learning.

- Hofer, C.W. & Schendel, D. (1978). *Strategy formulation: Analytical concepts*. St. Paul, MN: West Publishing Company.
- Hollensen S (2003). *Marketing Management-A Relationship Approach*, Pearson Education Ltd, Essex, England.
- Holm, D. B., Eriksson, K., & Johanson, J. (1996). Business networks and cooperation in international business relationships. *Journal of International Business Studies*, 1033- 1053.
- Homburg, C., & Workman, J. (2000). Fundamental changes in marketing organization: the movement toward a customer-focused organizational structure. *Academy of Marketing Science Journal*, 78-459.
- Honkanen, P. and Olsen, S., O. (2004), 'Preference-based segmentation: a study of meal preferences among Norwegian teenagers', *Journal of Consumer Behavior*, Volume 3, Issue 3, pages 235–250.
- Hopkinson, J. (1993), "Towards the year 2000 – a personal view of future changes", *Management Services*, May, pp. 18-22.
- Hubbard, G. & P. Beamish (2011). *Strategic management: thinking, analysis, action*, Pearson Education Australia.
- Hussey, D. (1979). *Introducing Corporate Planning*. Oxford: Pergamon Press.
- Jackson, B.B., *Winning and Keeping Industrial Customers. The Dynamics of Customer Relationships*, Lexington Books, Lexington, MA, 1985
- Jain, S.C. 1997. *Marketing Planning and Strategy*. Ohio: South Western College Publishers.
- Johnson, G., Scholes, K. and Whittington, R. (2005). *Exploring Corporate Strategy*, 7th edition. Harlow, US: Financial Times Prentice Hall
- Karagiannopoulos, G. D., Georgopoulos, N., & Nikolopoulos, K. (2005). Fathoming Porter's five forces model in the internet era. *info*, 7(6), 66-76.
- Katko, T. S. (2006). Road Safety Fatalities, Management, and Policy in Finland, 1970-2003. *Public Works Management & Policy*, 11(2), 126-138. <http://dx.doi.org/10.1177/1087724X06294066>
- King, R. K., Enhancing SWOT analysis using TRIZ and the bipolar conflict graph: A case study on the Microsoft Corporation. Paper presented at the Proceedings of TRIZCON2004, 6th Annual Altshuller Institute, 2004.
- Klemperer, P. (1995). Competition when consumers have switching costs: An overview with applications to industrial organization, macroeconomics, and international trade. *The Review of Economic Studies*, 62(4), 515-539.
- Koch, A. J. SWOT does not need to be recalled: It needs to be enhanced, Available at: <http://www.westga.edu/~bquest/2000/swot1.html>, 2000.
- Kotler, P. (1967), *Marketing Management*, Englewood Cliffs, New Jersey; Prentice-Hall, 1st edition.
- Kotler, P. (1984), *Marketing Management: Analysis, planning and Control*, Fifth edition, Prentice-Hall, Englewood Cliffs, New Jersey.
- Kotler, P., "It's Time for Total Marketing", *Business Week ADVANCE Executive Brief*, Vol. 2, 1992.

- Kotler, P. (2000). Marketing management. Upper Saddle River, NJ: Prentice Hall
- Kotler, P. & Keller, K.L. 2006. Marketing Management. New Jersey: Pearson Education.
- Levitt, T. (1983), The Marketing Imagination, Free Press, New York, NY.
- Louw, L. & Venter, P. 2010. Strategic Management: Developing Sustainability in Southern Africa. Cape Town: Oxford University Press.
- Lynch, R. (2009). Strategic management. England: Pearson Education Limited.
- Malcolm, M. And Martin, C. 2003. Marketing: A Complete Guide. New York: Palgrave Macmillan Ltd.
- Mason, E. (1949). The current state of the monopoly problem in the U.S. Harvard Law Review, 1265-1285.
- Mayer-Wittman, K.M. (1989), "Economic analysis and corporate strategic planning", Business Economics, April, pp. 2731.
- McCarthy, E.J., Basic Marketing, Irwin, Homewood, IL, 1960.
- McDonald, M. (1982). The theory and practice of marketing planning for industrial goods in international markets. Cranfield: Cranfield University.
- McDonald, M. (1996). Strategic marketing planning: theory, practice and research agendas. Journal of Marketing Management, 5-28.
- McGarry, E.D., "Some Functions of Marketing Reconsidered", in Cox, R. and Alderson, W. (Eds), Theory in Marketing, Richard D. Irwin, Homewood, IL, 1950, pp. 263-79
- McKenna, R., Relationship Marketing. Successful Strategies for the Age of the Customer, Addison-Wesley, Reading, MA, 1991.
- Michael E. Dobbs, (2014) "Guidelines for applying Porter's five forces framework: a set of industry analysis templates", Competitiveness Review, Vol. 24 Issue: 1, pp.32-45, <https://doi.org/10.1108/CR-06-2013-0059>
- Mintzberg, H., Ahlstrand, B. & Lampel, J. (1998). Strategy Safari: A guide through the wilds of strategic management. New York: Free Press.
- Moorman, C., & Rust, R. (1999). The role of marketing. Journal of Marketing, 97-180.
- Moorman, C., Deshpandé, R. and Zaltman, G., "Relationships between Providers and Users of Market Research: The Role of Personal Trust", Working Paper No. 93-111, Marketing Science Institute, Cambridge, MA, 1993
- Moriarty, R. T. (1983). Industrial Buying Behaviour: Concepts, issues and applications. Canada: Lexington Books.
- O'Connor, D. (2000). Business planning. Broadstairs, UK: Scitech Educational., available at <http://site.ebrary.com/lib/jonhh/Doc?id=10040407> , 05.04.07.
- O'shaughnessy, J. (1984). Competitive marketing: a strategic approach. Boston: Allen & Unwin.

- Panagiotou, G. (2003). Bringing SWOT into focus. *Business Strategy Review*, 14(2), 8-10.
- Parvatiyar, A. and Sheth, J.N. (1997), "Paradigm Shift in Interfirm Marketing Relationships, Emerging Research Issues", *Research in Marketing*, Vol. 13, 233-256.
- Penrose, E. (1959). *The Theory of the Growth of the firm*. London: Basil Blackwell.
- Pfeffer, J., Veiga, J.F. Putting people first for an organizational success. *The Academy of Management EXECUTIVE*; May 1999; 13, 2; ABI/INFORM Global pg.37
- Piirto, R. (1990), "Global psychographics", *American Demographics*, December, No. 12, pp. 30-36.
- Porter, M. E. (1980). *Competitive Strategy*. New York: Free press.
- Porter M. 1991. Towards a dynamic theory of strategy. *Strategic Management Journal*, 12, 95-117
- Porter. (1996). What Is Strategy. *Harvard Business Review*, 61-78.
- Porter, M.E. 2001. Strategy and the Internet. *Harvard Business Review*, 79(3), 63-78.
- Porter, M. E. (1998). *Competitive strategy: techniques for analyzing industries and competitors: with a new introduction*, New York: Free Press.
- Pust, P., Schmidt, P. J., & Schnick, W. (2015). A revolution in lighting. *Nature Materials*, 454-458.
- Rapp, S. and Collins, T., *The Great Marketing Turnaround*, Prentice-Hall, Englewood Cliffs, NJ, 1990.
- Reichheld, F.E. and Sasser, Jr, W.E., "Zero Defections: Quality Comes to Service", *Harvard Business Review*, Vol. 68, September-October, 1990 pp. 105-111.
- Richardson, Jr. J. V. (2006). The library and information economy in Turkmenistan. *IFLA Journal*, 32(2), 131-139.  
<http://dx.doi.org/10.1177/0340035206066410>
- Rivard, S. Raymond L., Verreault D. (2006). "Resource-based view and competitive strategy: An integrated model of the contribution of information technology to firm performance." *Journal of Strategic Information Systems* 15(1): 2950.
- Root, R. (1998). *Entry Strategies for International Markets – revised and expanded*, San Francisco, US: Jossey-Bass.
- Rumelt, R. P. (1984). Towards a strategic theory of the firm. *Competitive Strategic Management*, 556-570.
- Sanchez, R. and Heene, A. (1997), "Managing for an uncertain future: a systems view of strategic organizational change", *International Studies of Management & Organization*, Vol. 27 No. 2, pp. 21-42
- Sanderson, S. W., Simons, K. L., Walls, J. L., & Lai, Y.-Y. (2008). *Lighting Industry: Structure and Technology in the Transition to Solid State*. Industry studies (pp. 1-64). Boston: Alfred P. Sloan Foundation.
- Schnaars, S.P. (1998). *Marketing strategy*. New York: Free Press.
- Shapiro, C. (1989). The theory of business strategy. *Journal of Economics*, 125-137.
- Shaw, V. (1995), "Successful Marketing Strategies, A Study of British and German Companies in the Machine Tool Industry", *Industrial Marketing Management*, Vol. 21, Issue 4 pp 329-339.

- Sheth, J.N., Gardner, D.M., Garrett, D.M. (1988). *Marketing Theory: Evolution and Evaluation*, New York: John Wiley & Sons, Inc.
- Shilei, L., & Yong, W. (2009). Target-oriented obstacle analysis by PESTEL modelling of energy efficiency retrofit for existing residential buildings in China's northern heating region. *Energy Policy*, 37, 2098-2101.  
<http://dx.doi.org/10.1016/j.enpol.2008.11.039>
- Senauer, B. n., Kinsey, J. n., & Asp, E. e. (1991), 'Food trends and the changing consumer', In St. Paul, Minn., U.S.A.: Eagan Press, c1991.
- Slater, S. F., & Olson, E. M. (2002). A fresh look at industry and market analysis. *Business Horizons*, 45(1), 15-22.
- Srivastava R.M., Verma, S. *Strategic Management: Concepts, Skills and Practices*
- Teece, D. J. (1984). Economic analysis and strategic management. *California Management Review*, 87-110.
- Teece, D. J., Gary, P., & Shuen, A. (1997). DYNAMIC CAPABILITIES AND STRATEGIC MANAGEMENT. *Strategic Management Journal*, 509-533.
- Thurlby, B. (1998). Competitive forces are also subject to change. *Management decision*, 36(1), 19-24.
- Todd, S., Lawson, R. and Faris, F. (1996), "A Lifestyle Analysis of New Zealand Consumers", *Asia Pacific journal of Marketing and Logistics*, pp. 30- 47.
- Turnbull, P.W., and Valla, J-P. (Ed.), *Strategies for International Industrial Marketing*, Groom Helm, London, 1986.
- Turner, S., *Tools for Success: A Manager's Guide*, London: McGraw-Hill, 2002.
- Urban, G., & Star, S. (. (1991). *Advanced Marketing Strategy: Phenomena, Analysis and Decisions*. Englewood Cliffs: Prentice-Hall.
- Valentin, E.K. (2001). SWOT analysis from a resource-based view. *Journal of Marketing Theory and Practice*, 9, 54-68.
- Van Waterschoot, W. and Van den Bulte, C., "The 4P Classification of the Marketing Mix Revisited", *Journal of Marketing*, Vol. 56, October 1992, pp. 83-93.
- Vorthman. R.G. Jr (2008). *Toward best-practices program management*. Sigma 8. Noblis. Falls Church.
- Wang, W., Chang, P. (2009). "Entrepreneurship and strategy in China: why 'Porter's five forces' may not be", *Journal of Chinese Entrepreneurship*, ISBN: 1756-1396, Vol. 1 No.1, pp.53-64.
- Wells, W. and Tigert, D. (1971), "Activities, interests, and opinions", *Journal of Advertising Research*, Vol. 11 No. 4, pp. 27-35.
- Webster, Jr, F.E., "The Changing Role of Marketing in the Corporations", *Journal of Marketing*, Vol. 56, October 1992, pp. 1-17.
- Wehrich, H., "The TOWS matrix—A tool for situational analysis", *Long Range Planning*, Vol. 15(2): 54- 66, 1982.

- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 171-180.
- Wheelen, T. L., & Hunger, J. D., *Strategic Management and Business Policy* (5th ed.), Reading, MA: Addison-Wesley, 1998.
- Williams, G. (1994). The airline industry and the impact of deregulation.
- Wind, Y. and Webster, F. (1972), "On the Study of Industrial Buying Behavior: Current Practices and Future Trends", *Industrial Marketing Management*, Vol. 1, nr 4, pp 411 –416.
- Yuksel, I. (2012). Developing a Multi-Criteria Decision-Making Model for PESTEL Analysis. *International Journal of Business & Management*, 7 (24).
- Zaltman, G. and Moorman, C., "The Role of Personal Trust in the Use of Research", *Journal of Advertising Research*, Vol. 28, October-November 1988, pp. 16-24.
- Zikmund, W.G., & d'Amico, M., *Effective Marketing: Creating and Keeping Customers*, St. Paul, MN: West Publishing Company, 1995.
- Zhu, D., & Humphreys, C. J. (2016). Solid-State Lighting Based on Light Emitting Diode Technology. In M. D, A.-A. ElGomati, & M. S. Zubairy, *Optics in our time* (pp. 87-118). Springer, Cham.

## Appendix 1

### Interview protocol

This protocol is used as a guide by the researcher when conducting interviews. The protocol provides continuity of questions asked across several interviews. The proposed interview scheme is used to define the data collection procedure of this thesis research project. Data collection is focused on gathering insights for PESTEL analysis, SWOT analysis and Expert interviews. Due to the semi-structured nature of the interview, the questions are meant as a guidance and are not supposed to be articulated to their full extend. Prior to the interview the interviewee was identified by searching for essential background information. An email was sent with a short explanation of the research project and the contact details of the interviewer. The time and date of interview were arranged, and interview questions was sent up front. Additionally, introductory and closing questions have been incorporated in the interview protocol in order to contextualize the study case, identify background conditions and collect overall conclusions and opinions from the interviewees.

### Interview's structure and questions

Opening

*Introduction of myself and of the thesis project*

*Methodology*

*Interview objectives*

*Confidentiality*

The researcher writes contextual interview notes. Only the researcher will access the notes. The researcher will keep the names of participants anonymous in the report. Notes will not be archived after this project. Letter of confidentiality can be signed upon request.

PESTEL analysis: Questions

*Political environment*

What are the governmental policies aiding the transition towards LED based lighting?

What are the sovereign risks (changes in tax laws and regulations on foreign trade) in EU that can affect the lighting industry?

What are the security risks (diplomatic relations, trade treaties and economic sanctions) in EU that can affect the lighting industry?

What regulations must a lighting company follow in EU, and have they changed in the last 5,10, 20 years?

What are the incentives for foreign investments or on the other hand, disincentives to engage in foreign production in EU?

Are the political governments stable across EU and how does this affect attractiveness of a market?

*Economic environment*

What taxations must a lighting company follow in EU?

How do the following economic forces affect a lighting company's activities in the market place? Currency rates

Raw material prices

Interest rates

Inflation rates

How do variations in Gross Domestic Product (GDP) of EU affect the lighting industry?

*Social environment*

How do growing or slowing down population demographic affect the business of lighting companies?



How do consumer attitudes and beliefs in EU regarding LED based lighting impact the lighting industry?

What role do cultural trends in EU play in the business of a lighting company?

How important is the brand image and advertisements of a company in lighting industry? What

role do lifestyle trends in EU play in the business of a lighting company?

#### *Technological environment*

What are the emerging technologies in lighting industry with regards to LED?

How is the R&D spending of companies in the lighting industry?

What are the technological advancements needed in LED based lighting to further increase its usage?

What is the role of production efficiency in the lighting industry?

How do patents and licenses play a role in the lighting industry? What

is the role of quality and pricing in the lighting industry?

#### *Environmental environment*

What are the environmental regulations in EU with respect to LED based lighting?

What are the ecological regulations in EU with respect to LED based lighting? How

does LED based lighting contribute to sustainability?

#### *Legal environment*

What is the current and future legislations in EU with regards to LED based lighting?

What are the governmental regulations and policies in EU that affect the entry of foreign companies? What

are the health and safety restrictions when it comes to LED lighting?

#### SWOT analysis: Questions

##### *Strengths*

What is Signify's unique selling proposition?

What are the advantages Signify has over its rivals?

What are Signify's assets and which of those are the strongest?

Does Signify have a strong customer base?

What resources does Signify have readily available?

What do customers love about Signify's product(s)?

##### *Weaknesses*

What do customers dislike about Signify's product(s)?

What is the competition doing better than Signify?

What resources does Signify lack?

What's the main area that Signify needs to improve on immediately? What

factors are making Signify lose sales?

##### *Opportunities*

What changes in government policy related to LED lighting will bring in new opportunities for Signify?

What advancements in LED technology will bring in new opportunities for Signify?

What is the lighting industry market missing and can Signify provide that missing link for the customers? Will natural causes like weather and climatic changes give you the competitive edge?

How is the lighting market changing?

Will changes in social patterns, population profiles, lifestyle changes etc. bring in new opportunities for Signify? What would be the ideal opportunity for Signify?

##### *Threats*

Will changes in government regulations negatively impact Signify's business?

Has there been an increase in competition lately? Where and why?

What are the costs of Signify's resources? Is it affecting the bottom line?

Are there potential competitors who can steal market share from Signify? If so, why?

Are Signify's key staff members satisfied with their wages and other benefits? Are they poached by rival companies?

Are Signify's suppliers reliable and how crucial is their role?

Are quality standards for Signify's products or services changing? Could any of Signify's weakness seriously threaten its business?

Expert interviews: Questions

1. Is the LED lighting industry moving towards the value proposition of quality of light from only
2. Is quality performance the primary differentiating factor in LED lighting?
3. Who are the key competitors to Signify and what is their current strategy and market share?
4. What are the key success factors for Signify?
5. Do any of Signify's product features have unique selling propositions?
6. Who holds the major market share in the low-end solutions of LED lighting?
7. Is it better to have broad or narrow portfolio of products when it comes to Signify?
8. Has the ban on incandescent lamps helped Signify grow its business?
9. How are Signify's customers classified and what are each of their requirements?
10. What are the application segments in LED lighting that Signify is strong footed and weak footed?
11. How important is strategic partnerships when it comes to LED lighting?
12. What is Signify's vision for 2021 and how does it plan to increase its market share?
13. What are the strategies of Signify for each of its application segments?

Ending

Did I miss something important, could you elaborate on that? What did you think of the interview?