



GRADUATE SCHOOL OF BUSINESS (GSB)
UNIVERSITI SAINS MALAYSIA

DECLARATION

I hereby declare that the project is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at USM or any other institutions.

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DATE: 04-MAY-2011

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ABSTRAK

Tanggung jawab sosial korporat (CSR) bertujuan untuk lebih mengintegrasikan masalah sosial dan persekitaran ke dalam perniagaan dan menghuraikan secara sukarela. Pada masa ini, syarikat menghabiskan banyak usaha terhadap amalan CSR. Amalan CSR ini berkaitan dengan tanggung jawab dari syarikat kepada pihak kepentingan mereka. Kumpulan utama pihak kepentingan adalah pekerja, pelanggan dan masyarakat setempat. Kajian ini bertujuan mengetahui keberkesanan amalan CSR dalam organisasi, apakah organisasi memberikan sumbangan kepada persekitaran, komuniti, pasaran atau tempat kerja. Untuk mengukur keberkesanan amalan CSR dalam organisasi, kajian ini mengfokus kepada dimensi dalaman dan luaran perusahaan CSR yang berkaitan dengan amalan-amalan dalaman organisasi. Penyelidikan ini juga ingin menilai CSR samada amalan CSR ini menguntungkan atau tidak bagi organisasi. Selain itu kajian ini menekankan kesan dan pengaruh amalan CSR pencapaian pertumbuhan lestari. Kajian kes dijalankan, penemuan menunjukkan bahawa syarikat telah mengadaptasi beberapa amalan CSR di dari segi penglibatan sosial, persekitaran dan masyarakat. Syarikat juga didapati menggalakkan sukarelawan turut serta dalam amalan CSR ini. Pihak kepentingan yang terlibat dalam syarikat tentang amalan CSR ialah pekerja dan masyarakat.

ABSTRACT

Corporate Social Responsibility (CSR) aims to better integrate social and environmental concerns into business outlines on a voluntary basis. Currently, companies spend a great deal of effort on CSR practices. CSR practices relates to the responsibility from the firm to their stakeholders. The main stakeholder groups most often employees, customers and the local community. The purpose of this study is to investigate the effectiveness of CSR practices in the organization whether the organization contributes in the environmental, community, marketplace or workplace. To measure the effectiveness of CSR practices in the organization, this research focus on the internal dimension and external dimension of CSR that related to practices inside the organization. This research also attempts to evaluate the CSR practices whether it is beneficial or not to the organization. Beside that this research emphasizes the impact and effect of CSR practices towards attaining the sustainable growth. Qualitative case studies were conducted. Finding showed that the company has adopted a few CSR practices in term of social, environmental and community involvement. The company also encourage volunteer to participate in its CSR activities. The stakeholders involve in the company regarding the CSR practices are its employees and society.

CHAPTER 1

INTRODUCTION

This first chapter presents a brief background to the research topic of this study, followed by a problem statement leading to research question and research objective for the study.

1.0 INTRODUCTION

In order to begin this research, it is important to know the overview of the research itself. Therefore, in this chapter, the introduction of the research and the brief concept of corporate social responsibility (CSR) practices are discussed. Furthermore, this chapter also introduce the problem statement, aim and objectives. Besides that, this research also can review how CSR affected the business operation in an optical industry. There is also a brief description about the different area in business operation that could be affected by CSR practices.

Today in the modern are there have been changes in the business environment relationship between companies, the state and the society (Krishnan & Balachandran, 2005). These relationships related to CSR implementation. Actually, CSR we can describe CSR as a responsibility of the company in order to gain a positive impact on society and the environment. The positive impact will be gain through their management, operation and product. CSR also includes their relationship with stakeholders including customers, communities, employees and suppliers. Pohle and Hittner (2008) point out

that CSR is the way companies manage their businesses to produce an overall positive impact on society through economics, environmental and social actions.

Nowadays, CSR has become important in business activities. Most of the companies implement CSR as their competitive advantage in order to gain first mover advantage by establishing goodwill relationship with the state and the society. The principle of CSR may also helpful to the company to gain their own sustainability efforts. Some others company implement CSR to create or develop innovative and economically product, process and services. From CSR implementation it will improve environmental protection and social condition. Additionally, some of the business leader focusing on CSR activities to create new revenue streams (Crane & Matten, 2007).

According to Werther and Chandler (2004), environmental and community issues are matters because it have become more important for companies in order to fulfil the customer requirements. Company need to be more aware and responsible in their operational and also they must focus on their ethical behaviour and prioritizing CSR. In this recent year, most of the company contribute to CSR practise not only to spend money but on how to make money. The company also can attain sustainable growth and market success through CSR practices (Carroll, 1999).

1.1 RESEARCH BACKGROUND

Under this research background subtopic, the investigation regarding implementation of CSR practices in a business operation of optical industry in Singapore name Carl Zeiss S.E.Asia. The main operational and it's headquarter is in Germany. This research is taking the headquarters in South East Asia, Singapore to be investigated. Carl

Zeiss S.E.Asia started in 1990 as an optical industry. Carl Zeiss S.E.Asia offer products and services for biomedical research and medical technology, system solutions for the semiconductor, automotive and mechanical engineering industries. At the headquarter South East Asia office in Singapore, the implementation of corporate social responsibility (CSR) practices is exist and this research may investigate to this research topic.

The overall idea is to investigate the effectiveness of CSR practices in the organization whether the organization contributes in the environmental, community, marketplace or workplace. To measure the effectiveness of CSR practices in the organization, this research focus on the internal dimension and external dimension of CSR that related to practices inside the organization. This research also attempt to evaluate the CSR practices whether it is beneficial or not to the organization. Beside that this research emphasizes the impact and effect of CSR practices towards attaining the sustainable growth. Therefore this research could identify comprehensive CSR practices to the improvement of the organisation to be more efficient and valuable to the organization.

1.2 PROBLEM STATEMENT

Companies are under pressure by increased public awareness, various interest groups, legal and governmental concerns and media coverage to act in a socially responsible and ethical way (Carroll & Gannon, 2007). Ethical concerns has become fairly of necessity in the business world of today (Meehan at el 2006). Ethical business behaviour can reflect positively on the corporate reputation and the long-term success of a company (Maigan & Ferrell, 2001).

The concept of CSR relates to the role of business in society (Lantos, 2002). A CSR motive may be to help achieve the company's performance objectives on profitability, return on investment or sales volume (Phatak, Bhagat & Kashlak, 2005). It may also be self-motivated the company might want to have a positive impact irrespective of social pressures. The company for this case study Carl Zeiss S.E.Asia is business operation of optical industry in Singapore. At the headquarter South East Asia office in Singapore, the implementation of CSR practices is exist and this research may investigate it tend to this research topic.

According to this topic, the problem statement is wants to measure the effectiveness of CSR practices in Carl Zeiss S.E.Asia. The effectiveness of CSR practices in the company can help attract better job applicants, retain them once hired and maintain employee morale, which benefits the company's productivity and saves costs for recruitment of new employees (Branco & Rodrigues, 2006). This study also wants to identify how the company can increase the competitive advantage through CSR practices. The impact of CSR practices on company performances also will be look in depth.

There are several local and foreign people who are not concern with the existence of CSR in Singapore. Around the year 2008, the government's approach to CSR is responsible in providing the Singapore community. Singapore compact has made several surveys on companies in Singapore and found that 60% of the company has yet to realize the importance of CSR. Only 27% of the practice and recognizes the importance of CSR

(<http://www.expatsingapore.com>)

Most companies in Singapore assume CSR is a contribution from the company to the public and the environment through charity and voluntary. There are also several companies that are aware of CSR but still not practicing. 13% of this company does not assume CSR as important in their business and their finances. These companies are showing lack of interest in CSR and the lack of knowledge on CSR (Thomas, 2009).

The Singapore government has successfully implemented several rules and set the quality standards of responsible business practices. With this there are a few facts and little emphasis is focused on CSR. This regulation is focused on three main sections, which are the rights of workers, the government and environmental protection. All of which is aim to protect the interests of different stakeholders in Singapore (Thomas, 2009).

1.3 SIGNIFICANCE OF THE RESEARCH

CSR remains a key business concepts and the increasing globalization of the world must be found among large companies in most countries around the world (Welford, 2005). This study is important in order to understand CSR in depth. Upon completion of this study, it can improve the understanding of CSR to the both internal and external aspect of the company. It will motivate the company to emphasize the values of CSR in the company.

This study is also able to help companies to assess the activities of its CSR and also to give them more understanding about CSR practices. Company can determine which aspect of CSR should be emphasized and which should be developed.

In addition, this study is to assess the level of internal stakeholder perception related to CSR practices in the organization. This study can also help this company to determine the factors that influences the Carl Zeiss S.E.Asia in implementing the CSR practices. The company will understand more about CSR and its requirements.

It is hoped that the findings from this study can give the positively impact to the company and at the same time to improve the standard of their CSR. This study will also provide knowledge about the CSR in more detail and clearness. With this study it can facilitate the practice of CSR carry out without any difficulty.

1.4 RESEARCH QUESTION

Here are some of the research questions that involved in this research:

- Why the company need to implement the CSR practices?
- What is the level of internal stakeholder perception related to CSR practices in the organization?
- What are the effects of CSR practices on the company operation?

1.5 CASE ISSUES

- What are the factors that influence implementation of the CSR practices?
- What kind of CSR practices in the Carl Zeiss S.E.Asia?
- How the CSR practices effect the stakeholders' performance?
- What type of stakeholders involve in CSR practices in Carl Zeiss S.E.Asia?

- What is the impact of company performance after implementing CSR practices?
- How the company gain competitive advantages through CSR practices?

1.6 OBJECTIVE

Based on the research problems, the main objective of this study is to:

- To identify how the company can increase their competitive advantage through CSR practices
- Besides that, this research is also aimed to measure how the CSR issue had penetrated the core of the corporation.
- It is also proposed to look in depth what is the impact of CSR on company performance.
- This research analyzes the potential factor in order to achieve sustainable growth through CSR.

At the end of this project it is expected that the objective will be achieved and the organization can look at the pros and cons of CSR issue in the company. In a nut shell, this research aimed to help the organization to identify effectiveness and sustainable growth of CSR implementation in the company.

1.7 CONCLUSIONS

This study investigates the implementation of CSR practices in optical industry in Singapore name Carl Zeiss S.E.Asia. Business world today is creating higher demands on

managers to take a positive stance on issues regarding social responsibility and ethical behaviour. In this study also seek how the CSR issue penetrated the business operation. Companies today need to increase public awareness, legal and governmental concerns and media to behave in a socially responsible and ethical way. It also looks what the impact of CSR on company performances. Furthermore, this study also determines the benefit and challenges faced by the company during the implement action of the CSR practices. CSR is not a new idea. More and more companies are adopting CSR, though the motive for engaging in CSR may vary.

CHAPTER 2

COUNTRY PROFILE

This section will provide the detail description and analysis of Singapore in terms of geography, demographic, political, economy, environmental education and policy.

2.1 GEOGRAPHY AND CLIMATE

Singapore is an island nation in Southeast Asia, situated at the tip of Peninsular Malaysia between Malaysia and Indonesia. Singapore is the island of 692.7 km². Singapore separated from Malaysia in the Straits of Johor to the north, and the Riau Islands of Indonesia in the Straits of Singapore to the south. Singapore is in relation to Johor, Malaysia via a causeway at the Woodlands. Singapore also has a bridge Malaysia-Singapore Second Line which connects to the Gelang Patah in Johor. Figure 1 below shows the Singapore geography map.

Figure 1: Singapore geography



Source: <http://www.globaltrade.net>

Table 1 below shows the Singapore geography. Singapore is a country of huge waves and also has lower hills as high as 540-ft/166-m pointing to the northwest city. The highest hill is Bukit Timah Hill. Singapore consists of 63 islands, including all of mainland Singapore. There are several small islands owned by Singapore's largest, such as Pulau Tekong, Pulau Ubin and Sentosa Island. Singapore has a tropical rainforest climate with no distinct season's transition, high humidity, pressure and temperature are equivalent, and heavy rainfall. Temperatures are between 22 to 34 ° C (71.6 to 93.2 ° F). The lowest and highest temperature recorded in history was 19.4 ° C (66.9 ° F) and 35.8 ° C (96.4 ° F). The average humidity is around 90% in the morning and 60% in the afternoon. During prolonged heavy rain, relative humidity often reaches 100%.

Table 1: Singapore geography

Location:	Southeastern Asia, islands between Malaysia and Indonesia
Map references:	Southeast Asia
Geographic coordinates:	1 22 N, 103 48 E
Area:	total: 647.5 sq km
Land:	637.5 sq km
Water:	10 sq km
Land boundaries:	0 km
Coastline:	193 km
Elevation extremes:	Lowest point: Singapore Strait 0 m Highest point: Bukit Timah 166 m
Area – comparative:	slightly more than 3.5 times the size of Washington, DC

Source: <http://www.singapore.alloexpat.com>

encourages foreigners to migrate to Singapore. Buddhist devotees in Singapore have the highest percentage of 42.5%. The structure of population aging in Singapore, is 14.4% of the population under 14 years, 76.7% consist of people aged 15-64 at 8.9% of the population aged 65 years and over.

2.3 POLITICAL ISSUES

Table 3 below shows Singapore Political Issues. Singapore is a parliamentary republic democracy based on the Westminster system of parliamentary government unicarmel representing various constituencies. Singapore becomes independence in 9 August 1965. They are a total of 84 members who joined the Nonconstituency unicarmel Parliament. Nine of the election Members of Parliament (MP) is the sole member and the remainder coming from group representation constituencies. Much executive power lies in the cabinet led by Prime Minister and the leader of the ruling party. This post has been occupied by Lee Hsien Loong, son of the first Prime Minister of Singapore Lee Kuan Yew in 2004.

Apart from the Prime Minister, Singapore also has a president elected by popular vote. MP is composed of members elected without the vote and nominated. The majority of the MP is elected through general election based on winning a majority vote system, and represents the area of the Single (Single Member Constituencies, SMC) or Group Representation (Group Representation Constituencies, GRC). The legal system in Singapore is based on the British system. There are some differences between Singapore and British system including the absence of constitutional court judges in the Singapore system.

Table 3: Singapore Political Issues

Country name:	conventional long form: Republic of Singapore conventional short form: Singapore
Government type:	parliamentary republic
Capital:	Singapore
Independence:	9 August 1965 (from Malaysian Federation)
National holiday:	Independence Day, 9 August (1965)
Constitution:	3 June 1959, amended 1965 (based on pre-independence State of Singapore Constitution)
Legal system:	based on British system; has not accepted compulsory ICJ jurisdiction
Suffrage:	21 years of age; universal and compulsory

Source: <http://www.singapore.alloexpat.com>

2.4 ECONOMY FACTOR

Singapore adopts a free market economy. It is quite developed and managed, which have ranged widely in the Interpol trade. Singapore has a very spacious environment free of corruption, favourable price stability and also has a higher GDP per capita than other developed countries. Economy is highly dependent on exports such as pharmaceuticals, electronics customers, information technology products and financial services sectors. Singapore also depends on imported goods, particularly in manufacturing.

In 2006, Singapore managed to produce about 10% of foundry wafer output. Singapore is also one of the world's busiest port and a foreign exchange trading centre in

the world's fourth largest, behind London, New York and Tokyo. World Bank assesses Singapore's premier logistics centre and a business-friendly economy in the world's highest. Singapore is also listed among the ten most open economies, innovative and exciting competitors. Singapore has major investment in the production of medical technology and drugs. This is because to strengthen Singapore as a financial city and Southeast Asia as a high-tech country. Table 4 below shows the Singapore economy factor. Singapore GDP was \$235.7 billion and Singapore has a higher GDP per capita \$50,300. GDP in services was the highest 73.2% followed by industry 26.8% and agriculture: 0%. The lowest household income was 10% and highest 10%. The inflation rate was 0.2%.

Table 4: Singapore Economy factor

GDP (purchasing power parity):	\$235.7 billion (2009 est.)
GDP - real growth rate:	-2.1% (2009 est.)
GDP - per capita:	\$50,300 (2009 est.)
GDP - composition by sector:	Agriculture: 0% industry: 26.8% services: 73.2% (2009 est.)
Household income or consumption by percentage share:	lowest 10%: NA% highest 10%: NA%
Inflation rate (consumer prices):	0.2% (2009 est.)

Source: <http://www.singapore.alloexpat.com>

2.5 ENVIRONMENTAL EDUCATION

Singapore's school system consists of six primary schools, five secondary schools and tertiary education. In Singapore, English is the medium of instruction in each school. Each student must attend primary school from age seven for six years. Every primary

school should end with the Primary School Leaving Examination (PSLE). Public primary school fees are not charged, but have a nominal extra fee for school facilities (www.singapore.alloexpat.com).

Singapore students take the exam-Cambridge GCE 'O' Level after finishing secondary school. These results will determine the type of post secondary education. School fees at most public schools are nominal, S\$ 5 after subsidies.

There are many students enrolled in vocational education institutions such as Institute of Technical Education (ITE), Singapore Sports School or school on the "Integrated Programme". There are five public universities in Singapore: National University of Singapore, Nanyang Technological University, Singapore Management University, University Technology and Design Technology Institute of Singapore and Singapore. (www.singapore.alloexpat.com).

The government has to build more public universities in the past decades with the hope of providing higher education opportunities. Polytechnics and universities run courses in English. There are many foreign universities open campuses in Singapore. Among them are INSEAD, Chicago Graduate School of Business, University of New York, University of Las Vegas, Technische Universität München, ESSEC, and others (www.singapore.alloexpat.com).

2.6 LEGAL ENVIRONMENT, INTELLECTUAL PROPERTY RIGHTS

Singapore has the reputation of providing a legal framework very conducive to economic development. In terms of intellectual property in which inventors are particularly interested, Singapore has a complete set of laws covering copyright,

trademarks and patents, making it particularly attractive to inventors. Thus, Singapore patents appear to be well protected, particularly through laws inherited from the English system which were in force until 1995 (www.singapore.alloexpat.com).

The country is a member of the PCT (Patent Cooperation Treaty) and a signatory of the Paris convention, which facilitates extension approaches. Furthermore, creation of the "patent agent" profession in 2002 provides a means of helping the applicant with writing and anteriority searches; it remains to be seen how the presence of patent agents with sufficient scientific knowledge will develop (www.singapore.alloexpat.com).

2.7 MORE COMPANIES EMBRACE CORPORATE SOCIAL RESPONSIBILITY (CSR) IN SINGAPORE

CSR is starting to get the attention from companies in Singapore. It is evident from the significant increase in companies participating in the Singapore Compact for CSR. Membership increased 42% from September and 239 to 341 this year. There was also increased from zero o 20 in 2007 via the Global Reporting Initiative (GRI) (Global Reporting Initiative, 2002).

According to the Singapore Compact, people in Singapore have perceived its responsibilities regarding the environment and social. Customers expect companies to be more ethical. Many companies in Singapore have started to understand CSR with good business practice to dispelling their credibility. In addition, CSR can also increase their employees retention and at the same time to attract global talent (Carroll, 2006). With the CSR program in their company, it can help them solve the environmental problem with better and more effective (Thomas, 2009).

Singapore Compact provides awards to companies that contribute to CSR. With this award they can push companies to adopt CSR. The appointment of an award will be presented to companies that contributed significantly to the corporate social responsibility (CSR) in the category: Green Award Winner, Community, Best Workplace Award, Accountable Marketer Award, and Care Work Award.

"The response to initial recognition is very strong. This shows that the organization take their CSR journey into and consider this a high priority item. Not surprisingly, the judges had a challenging task in selecting winners' awards. We feel that this award is a great way to motivate people to improve their CSR performance. We need a leader and innovator to lead the way in CSR and to improve what has been done."

Mr Seah Kian Peng, Vice-President of Singapore Compact

In addition, other initiatives such as Singapore launch ASEAN CSR network. It consists of a network between Indonesia, Malaysia, Thailand and the Philippines. This network will be based in Singapore to facilitate the people of Singapore in inculcating CSR awareness, capacity building, knowledge exchange and advocacy. To encourage more companies to practice CSR, the Singapore Compact launched a book called *"Social Responsibility and Sustainable - Company Perspectives and Experiences."* This book shows the journey of a successful CSR of 10 companies which are CapitaLand, ComfortDelGro Corporation, Fairmont Singapore, Keppel Land, ORIGIN Exterminators, Philips Electronics, Senoko Power, Industrial Sin Hwa Dee Food, SMRT Corporation Limited and Wilmar International. Mr Thomas Thomas, Executive Director of the Singapore Compact says that they will continue to spread the message of CSR for the

Singapore business, promoting the new ISO 26000 standard, and help more companies embrace CSR in Singapore.

2.8 CORPORATE SOCIAL RESPONSIBILITY (CSR) IN SINGAPORE: AWARENESS AND IMPLEMENTATION

Awareness and implementation of Corporate Social Responsibility (CSR) in Singapore has increased over the last four years since the establishment of the Singapore Compact to promote CSR in Singapore (www.singaporecompact.com). Some companies implement CSR activities with the charity and philanthropy, but CSR is actually more than that. According to the Singapore Compact:

“CSR is basically about good business and doing well at the same time. CSR is about long-term strategy and operations align business strategy with universal values to achieve positive results and continued to customers, suppliers, employees, shareholders, communities, other stakeholders and the environment.”

Through CSR, companies can gain benefit and improve profitability. In addition CSR can also increase the reputation and goodwill among dealers and customers. Workers who apply social values are likely to be motivated, committed and more prepare to make sacrifices as a team member. Mr Koh Juan Kiat, Vice President of Singapore Compact and Executive Director of Singapore Entrepreneurs' Federation explain:

“Adopting CSR brings intangible benefits such as a reputation for the company, high spirit among employees and improves performance and attracts investors. Employees also take pride of their companies and this will affect productivity.”

In 2008, findings by the Department of Trade and Industry (DTI) showed that 40% of respondents aware of the term CSR. Currently, 240 organizations have joined forces with Singapore Compact and CSR practices. These organizations include large companies, SMEs, cooperatives, unions, federal and NGO. In addition, 70 companies have registered as a signatory to the UN Global Compact networks (UNGC) in Singapore.

The Singapore Compact has entered the International Council of Singapore Compact CSR Conference. In this conference, many topics were discussed on the CSR. It covers topics such as CSR and Community: Foundation of Great Companies, Global CSR Trends, and CSR Success Strategies for Agribusiness and CSR) Investor Perspective, CSR and Sustainable Development - Environment and Beyond and lastly the cover on CSR - what can be done. This is a good opportunity for the company to understand more about CSR and learn how to implement CSR in the organization.

2.10 CONCLUSION

As a conclusion we can see that Singapore is not left behind in carrying out its CSR. In line with the government, many companies in Singapore have come to realize the importance of the practice of CSR in the community. With the government's efforts to Singapore, the development of companies in Singapore on the activities of CSR can be expected to increase from time to time.

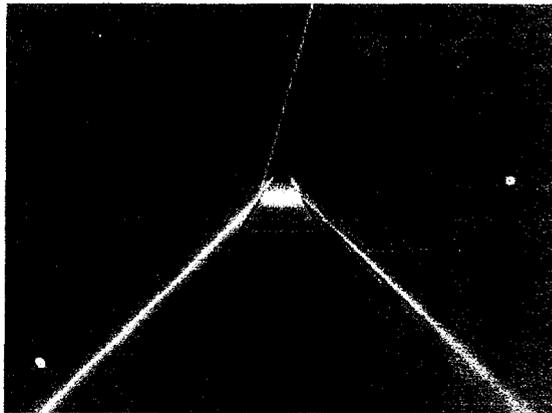
CHAPTER 3

OPTICS INDUSTRY

3.1 OPTICS INDUSTRY

Optics is the branch of physics that involve the activities and properties of light. Optics deal with the issue and the enlargement of instruments to use or to detect it. Optics generally describes the performance of visible, ultraviolet, and infrared light (www.viewoptic.com.my) because light is an electromagnetic wave. Other forms of electromagnetic waves such as X-rays, microwaves and radio waves showed the same features. Many optical phenomena can be accounted for using traditional electromagnetic explanation of light. (www.wikinvest.com/industry)

Figure 2: Optics



Optics includes study of dispersion of light

Source: www.viewoptic.com.my

Figure 2 above shows the objects of Optics. Optical practice is regularly done using a straightforward model. The most familiar models are geometry, optics, treating light as the power that runs in a straight line and turn around when they pass throughout or reflected from the surface. Physical optics is a more comprehensive model of light, which includes the cause of waves, such as diffraction and intervention is be taken into account in the geometrical optics. Historically, the central light ray model is developed first, followed by a wave model of light. Advances in electromagnetic theory in the 19th century led to the finding that light waves in the electromagnetic energy (www.wikinvest.com).

Some of the incident depends on the actuality that light has a good nature, as well as wave and particle-like. Explanations of these effects necessitate quantum mechanics. When taking into consideration the character of light's particles, modelled as a collection of particles of light called "photons." Quantum optics allied with the application of quantum mechanics to optical systems (www.viewoptic.com.my).

Optical science is significant in several of disciplines, including astronomy, field techniques, photography, and medications. Medications look into ophthalmology and optometry. Practical application of optical technologies are found in many everyday objects, including mirrors, lenses, telescopes, microscopes, lasers, and fiber optics (www.viewoptic.com.my).

3.2 OPTICAL HISTORY

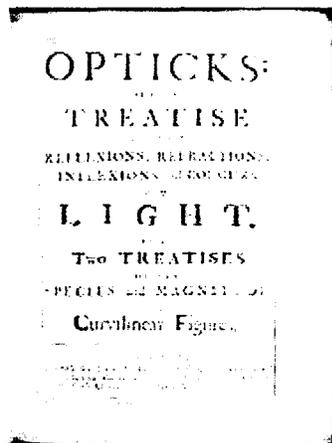
Early lens made of crystal polished known, often quartz, has the date as early as 700 BC to Assyria lens as the lens name Layard Nimrud. Ancient Romans and Greeks filled the field with a water glass to make lenses.

These practical developments were followed by the development of theories of light and vision by ancient Greek and Indian philosophers, and the development of geometrical optics in the Greco-Roman world (<http://www.viewoptic.com>). The word optics comes from the ancient Greek word ὀπτική, meaning appearance or look. Plato first articulated emission theory, the idea that visual perception is accomplished by rays emitted by the eyes. He also commented on the parity reversal of mirrors in Timaeus. Some hundred years later, Euclid wrote a treatise entitled Optics wherein he described the mathematical rules of perspective and describes the effects of refraction qualitatively. Ptolemy, in his treatise Optics, summarizes much of Euclid and goes on to describe a way to measure the angle of refraction, though he failed to notice the empirical relationship between it and the angle of incidence.

During the Middle Ages, Greek ideas about optics were resurrected and extended by writers in the Muslim world. One of the earliest of these was Al-Kindi. In 984 BC, the Persian mathematician Ibn Sahl wrote the treatise "On burning mirrors and lenses", correctly describing a law of refraction equivalent to Snell's law. He used this law to compute optimum shapes for lenses and curved mirrors. In the early 11th century, Alhazen (Ibn al-Haytham) wrote his Book of Optics, which documented the then-current

The first microscope was made around 1595, also in Middelburg. Three different eyeglass makers have been given credit for the invention: Lippershey, Janssen, and his father, Hans. The coining of the name "microscope" has been credited to Giovanni Faber, who gave that name to Galileo's compound microscope in 1625. Optical theory progressed in the mid-17th century with treatises written by philosopher René Descartes, which explained a variety of optical phenomena including reflection and refraction by assuming that light was emitted by objects which produced it. Figure 4 below shows a cover of the first edition of Newton's Opticks.

Figure 4: A cover of the first edition of Newton's Opticks



Source: www.viewoptic.com.my

In the late 1660s and early 1670s, Newton expanded Descartes' ideas into a corpuscle theory of light, famously showing that white light, instead of being a unique colour, was really a composite of different colours that can be separated into a spectrum with a prism. In 1690, Christian Huygens proposed a wave theory for light based on suggestions that had been made by Robert Hooke in 1664. Hooke himself publicly