High Oil Prices – an Assessment of the Possible Effects to Global Multinational Enterprises

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ABSTRACT

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This study focuses on the effects of high oil prices on multinational enterprises (MNEs). As the global climate change has made energy related issues popular, it has also stimulated the debate over the peaking of oil production and the future of oil based economy. There is a lot of speculation over these topics as nobody knows the exact situation of the remaining oil reserves. High oil price, which is usually a result from tight oil supply, can affect negatively to the whole global economy. Thus it is important and interesting to assess how the high oil prices can affect the globally acting multinational enterprises.

The modern and global MNE was first modeled by using a global strategy framework and the theory of global production network. The oil production peak predictions and their background were critically assessed and a picture from the oil supply and the price formation was consisted with the aid of related literature. The main insight from the literature was that as cheap conventional oil becomes more difficult to find, the oil supply remains tight in the future. The price formation of oil was revealed to be affected by multiple factors and its long term development is difficult to predict.

The possible effects of the high oil prices were then derived from the expert literature related to peaking of oil production and high oil prices and a data content analysis made by the author. The data consisted of annual reports or Form-10Ks of 50 major MNEs from fiscal years 2008 or 2009. The content of these documents were possibly affected by the record high oil prices of 2008. The companies were picked from The Global 2000 list by Forbes. The main results of the data content analysis were that although the companies mentioned oil and oil related effects, the linkages between business operations and oil were generally indirect. MNEs were found to pursue energy efficiency and lower emissions rather than reduce oil dependency. Finally, a framework was created which illustrates the high oil price effects on global strategy and global production network, with the aid of reviewed literature and results of data content analysis.

Key Words: Multinational enterprise, Oil, Energy, Global production network, Global Strategy

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Abbreviations

ASPO	Association for Peak Oil Studies
BAF	Bunker adjustment factor. Refers to floating part of sea freight charges which represents additions due to oil prices.
bbls:	billion barrels
BP	British Petroleum
BRIC	Brazil, Russia, India & China
CCS	carbon capture and storage
CERA	Cambridge Energy Research Associates
CIF	cost, insurance & freight
CTL	coal-to-liquids
EIA	Energy Information Administration. Section of the US Department of Energy
EU	European Union
FOB	free on board
GGDP	Global gross domestic product
GPN	Global production network
GTL	gas-to-liquids
IEA	International Energy Agency
IEA	International Energy Agency
IHS	a knowledge company named IHS
LDV:	Light Duty Vehicle
Mmbls/d	million barrels per day
MNE	Multinational enterprise
Mtoe:	million tons of oil equivalents
O&GJ	Oil and Gas Journal
ODAC	Oil Depletion Analysis Centre
OECD:	Organisation for Economic Co-operation and Development.: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the

	Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, South Korea, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States
OIES	Oxford Institute for Energy Studies
Oil	crude oil, condensates and natural gas liquids (NGL).
OPEC	Organisation of the Petroleum Exporting Countries
PWHC	PriceWaterHouseCoopers
R&C	Resources and capabilities
SEC	U.S. Securities and Exchange Commission
Tbls	trillion barrels
TOD	The Oil Drum, website
TOE	tonne of oil equivalent, a unit of energy: the amount of energy released by burning one tonne of crude oil
TPEC	total primary energy consumption
U.S.	Unites States
UN	United Nations

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1. Introduction

During the past few years the general discourses in science and mass media have begun to consider the global climate change as something to be averted. The future of oil as a fossil fuel has also been under diverse debate but not to the same extent. In the past the energy prices were considered to be relatively predictable and most importantly manageable as a cost and resource, but the recent price volatility, the global climate change and the geopolitical conflicts have challenged this assumption radically. Furthermore, in the end of 2009, the International Energy Agency announced that the world will meet the peaking of the oil production in around 2030. Some authors even predict that this "peak oil" will lead to oil prices that will ruin the whole global economy.

The oil prices breached the $150 barrel price on the 2nd quarter of 2008. At the time of writing, it has been since declined back to under $100 and now, during a global recession, floats at around 80$. In the price level of $150 the general economy begun to react but those companies that are pursuing international business generally felt the soaring oil prices in the operations. In the management barometer published by PriceWaterHouseCoopers (2005), North American multinational enterprises recognized energy prices as the number one hindrance for new investments in the 3rd quarter of 2005. At that time, the nominal price of an oil barrel was around $50. In the 2nd quarter of 2008—on the verge of the gloomiest chapter of the global credit crunch—oil prices were well beyond $100 (see Chart 1, below).

Chart 1. NYMEX Crude Oil Front Month 02.02.2005 - 02.02.2010

Source: Financial Times

Thus, despite the incoming financial crisis, MNEs still considered the energy prices as the major barrier to economic growth (PriceWaterHouseCoopers, 2008). This proves that energy prices are a highly relevant factor for MNEs. Companies possess more power than individuals when it comes to preparing the world to the era beyond the cheap oil, but there is still much confusion and different opinions about the tools, means and time period that the solutions require. A lot has been written about the effects of the oil shocks to the economy, but the scientific literature that discusses the same effects in the context of international business is almost nonexistent, especially when it comes to strategic and operational level. Still, many nations are already pursuing the quest out from the foreign oil and gas dependency with a planned energy strategy, and not least for the sake of national security, global climate change and economical self-sufficiency, but also because they seek to improve the national competitiveness. For companies the high energy price equals lower margins, fewer new jobs and investments and slower revenue growth. Considering these effects, not only the energy-vulnerable companies should reassess their take on oil/energy strategies on time tight oil supply.

When riffling through the annual reports of MNEs it can be seen that environmental matters such as proper treatment of effluents, office recycling, origins of raw material and emission control have been somewhat a must for multinationals for some time now, but these issues seldom derive from a direct attempt to make operations more economically competitive, although the environmental driven actions tend to often lead to similar results (Porter & van der Linde, 1995). It has been more about green washing the brand and the company image and of course also doing the right thing. Reducing the oil /energy vulnerability of operations has not been the main target although it is one of the simplest expedients to gain cost competitiveness. Small and medium sized enterprises can save in energy costs with simple practices, but in the scale of MNEs energy efficiency and self-sufficiency really starts to take effect on the company's economics. One example comes from an American retail giant, Wal-Mart, which is redesigning its large truck fleet to double the fuel efficiency before 2015. The new heavy duty truck it has modelled has improved aerodynamics, transmission and tires and an auxiliary power unit. Wal-Mart believes that it can double the fuel economy of its truck fleet before 2015.

The future of the oil aspect is important to be discussed because at least at the moment it has been underweighted due to global climate change—although it links strongly to the phenomenon and the mitigation of it—and the still ongoing financial recession. The future of oil defines also the future of our globalized economy and the effects will somehow affect all of us. The decade of 2010s is predicted to be the decade of scarcity when it comes to resources (Evans, Jones & Steven, 2010), and companies need to acknowledge this in their strategies. Companies must cope with higher resource prices and some of them must rethink the source of their competitiveness, especially companies with global value networks because the rising transportation and raw material costs linked to the oil price affect the whole value network in several ways. Global strategy allows MNEs to gain competitiveness in several ways throughout the world, but the uncertain future of oil economy can challenge certain logics behind the theory of modern multinational enterprise and global strategy.

Global climate change, EUs emission controls, unstable oil prices, international emission pacts and national energy policies all summon challenges and threats to companies, but as change always does, also opportunities. From these intertwined challenges, this study concentrates on oil, its price, future and what kind of effects it could have on MNEs. The paper will then look through related literature and company publications in order to find out what the experts and companies have done or suggested to counter oil price effects and other effects that the oil has to their operations. By examining these issues, the paper aims to depict how severe the high oil prices can be for global economy and create a framework that would serve as a road map to MNEs which have complex value networks and are practicing global strategy or some aspects of it.

1.1 Research Gap

Most of the contemporary oil and strategy related studies are done more in the context of holistic energy strategy and global climate change, where the direct linkage to the competitiveness and strategy of a single firm is secondary, weak or completely lacking. In various publications, the high oil price effects are a global and national level phenomena and there is not much detailed empirical information (few exceptions: Sakellaris, 1997; Lee, K. & Ni, S., 2001) to be found

from single company or industry performance and oil shocks. The reason behind this could be that these matters are very much strategic and companies don't want to reveal too much information about them. Other reason might be that the effects are considered to be out of company control and can be mirrored to be similar as exchange rate risk. The third explanation could be the sheer size of the topic and how it affects everything, which makes it hard to model precisely. The gap in research appears even more obvious when we look the context of international business discipline, multinational enterprise and oil. In the science of strategic management the global climate change has been discussed and oil links strongly to the phenomena (e.g. Levy & Kolk, 2002). Supply chain literature approaches the oil through fuel and material costs (e.g. Lapide, 2007; Deering & Forbes, 2009), but mainly it has been linked to the macro economics and international economics (e.g. Rogoff, 2006; Hamilton, 2003; Kilian, Rebucci and Spatafora, 2009). There are some publications that deal with oil future, geopolitics, society and business, (e.g. Mitchell, Morita, Selley & Stern, 2001; Lovins, Datta, Bustnes, Koomey & Glasgow, 2004). Scientific journals of international business studies touch oil indirectly through risk management, but the role of oil in international business is seldom the main topic, which is a little bit surprising because the exchange rate risk and the oil prices have similar effects to internationally active companies.

Economics are important in measuring the impact that oil price has to national and global economies. The supply chain studies again can answer how the oil prices affect individual firms. There is not yet a study or framework that has the whole value network of a MNE viewed through the oil question. Some institutions, for example Global Business Network (2007), have studied the possible scenarios of energy future and have created scenarios for companies in order to prepare their overall energy strategies. Peak oilists (who believe that the peaking of oil supply has already happened or will happen very soon) and their counterparts have also discussed the topic, but their approach doesn't derives from single firm needs and the competitiveness of the firm, and the effects to the value networks are not discussed.

The future of oil is discussed a lot in the various levels of media, but the academic debate concentrates on forecasting the peaking of oil (Kjärstad & Johnsson, 2009), which is difficult given that nobody knows for sure how much there is undiscovered oil reserves. Mostly the

parties are divided to those who believe that peaking of oil production is near or already happened and those who response the peaking has been predicted to happen every year since the oil crises of the 1970s and it has not occurred. This study tries to draw a picture of the contemporary situation from different sources such as oil experts, geologists, oil companies and peak oilists.

1.2 Research problem

In overall, the combination of MNEs' strategy, oil and value networks have not been mixed in order to assess the effects, threats and opportunities in a single firm context. But by bringing together the various topics and disciplines there lies an opportunity to make a synthesis that can serve the further research and offer a framework which can be used by companies to assess how oil will affect their strategies and value networks. Because of the chosen approach and the lack of similar previous research, the research problem has a wide scope and uses two folded research questions:

Main research questions:

1. *How high oil prices affect global MNEs?*
2. *How oil price is formed and how it will develop in the future?*

Sub-questions:

1. *How does this reflect in global production networks and strategies of global MNEs?*
2. *What tools are there to counter the effects?*

The paper focuses on world's leading MNEs which Rugman and D'Cruz (1997) call global flagship MNEs. This approach has been picked, because these global flagship MNEs have often global presence and have complex cross border production networks. Furthermore, they are important trailblazers to the global economy. These characteristics make them more vulnerable to the oil price fluctuations, but they also possess resources and capacities to solve direct and indirect problems related to the high oil prices. To answer the above questions is a complex task, but even an attempt will help individual companies to see the effects and the interdependence to the different global businesses operations and competitiveness. The effects will vary between the

industries, locations and companies, thus the exact impact assessment must be left to individual companies.

1.3 Limitations of the study

This research has three obvious limitations because of the broad scope it has. The most problematic limitation is the lack of direct empirical data from the actual strategies that the companies have developed in order to cope with the high oil price and the economical implications that derive from it. Qualitative approach cannot offer actual figures of how the oil affects the financial performance of an individual firm. This kind of analysis would require resources that the author does not possess. The second limitation is the highly theoretical nature of the framework and that it can't be generalised to all the MNEs. The third important limitation is the uncertainty that the future of the energy and oil holds and nobody can be sure about the magnitude, duration and the "beginning" of the phenomenon. The financial and environmental interests and emotions that the circa 1000 billion dollar oil industry withholds and hazes the picture very effectively when one tries to assess the future of the oil supply.

The data used in this study is picked from the company annual reports of 2008/2009 and in some cases, from Form-10Ks. Even though the companies must report their losses and troubles in the reports, they meant to assure investors and shareholders that the company is doing well and thrives to do even better, which must bias the tone of language used. Although the reviewed energy, oil and supply chain professionals are respected in their fields, all of the reviewed literature in Section 4 is not peer-reviewed scientific literature. I have tried to critically assess these texts.

1.4 Method of Research

This study has been made by using qualitative data that is acquired from various scientific disciplines, oil experts and annual reviews of the MNEs. The main method of research is qualitative modeling, which is used because of the scope of the research problem. More exactly put: by examining the different scientific disciplines of macroeconomics, logistics, management

and annual reports, the author gathers information from how the oil prices affect production network and different aspects of global strategy. My own contribution is the survey of 50 annual reports of 2008/2009 and in some cases, Form-10Ks.With a help of a theoretical framework, which resembles the global flagship MNE and its global strategy affecting the global production network, this information is then used to point the possible effects of high oil price.

1.5 Structure of the Research

The research project consists of seven sections. After the introduction, the next section goes through the global strategy literature and shows how the global production network has developed and finally forms a model of global MNE. In Section 3, I discuss the basics and importance of oil to humankind and review the various opinions and arguments that the debate around peak oil has evoked. Section 4 examines, with the help of literature, how the oil prices and tightening supply can affect the different levels of economy. Section 5 does the same, but in international operations context. In the Section 6, the data and method of the annual reports/Form-10Ks survey are presented, data is analyzed and the results discussed. The final conclusions and a roadmap framework are modelled in Section 7.

1.6 Key Concepts

Multinational

Multinational in this paper refers to multinational enterprise (MNE). The terms multinational company or corporation (MNC) and transnational company or corporation (TNC) are often used as synonyms. There are over 60000 MNEs in the world and the largest MNEs are the most influential players in world's trade with economies that exceed the GDPs of smaller countries. In 2002 a press release of the United Nations revealed that 29 out of 100 world's biggest economies were multinational businesses. These figures state the reason why multinationals are on focus in this study. Schetting (1980, p.76) argues that the widely accepted characteristics of the MNEs are transnationality, global business strategy, central-decision making and economic power. One international business text book defines multinational enterprise as "any business that has productive activities in two or more countries" (Hill, 2007, p.20).

Oil

The English word “oil” can refer to a variety of meanings and usages, but today it is mainly considered as a synonym for petroleum. The Oxford Dictionary of Economics: “Oil is used mainly for fuel, but also in the manufacture of lubricants and chemicals. It is the most important single fuel source in the world at present. While stocks are finite, so that it is a depletable resource, the world's oil reserves are far from fully explored, and exhaustion of the stock is not imminent.” From here on the word oil refers to crude oil and its condensates. For companies, oil price linkages directly to fuel costs and electricity consumed by production, offices, warehouses and outlets. In the study oil is approached from this cost perspective but the more indirect effects of (especially high) oil price are also examined.

Energy

Oxford English dictionary defines energy in several ways, but the following definition is best suited for this cause: “power derived from physical or chemical resources to provide light and heat or to work machines”. In economical energy studies often treat energy as oil, gas, fuel and electricity. In more general academic working papers energy supply however is commonly divided to three sources: fossil fuels, nuclear energy and renewable energy. Fossil fuels, which derive their name from the fact that they are formed from organic remains of prehistoric animals and plants, consist of oil, coal and natural gas. According to Massachusetts Institute of Technology (2007) fossil fuels account 80% of world energy demand with following percentages: coal 25%, natural gas 21% and oil 34%. Nuclear energy satisfies 6.5% of global energy demand and renewable—which, as their name hints cannot be depleted—the rest: hydropower 2.2%, biomass and waste 11.1% and geothermal, solar and wind 0.4%.

2. Literature Review for Theoretical Framework

There must first be a theoretical model of modern large MNE, in order to answer how the high oil prices could affect globally operating companies. The model should depict what is a global strategy and a global production network and the role of MNE in these concepts. This section depicts how the MNEs have developed to the point where they are today and the brief history of the two concepts under research. I chose these two concepts because they represent well the ideas behind the sources of competitiveness, when it comes to production, supply and distribution chains and general strategies that company with a global presence can execute. The literature review will first depict how the two concepts have born and developed. The concept of global strategy is widely discussed and there are various interpretations of it. The global production network is the younger of the two concepts, but it includes ideas and concepts from resource-based view of the firm, value chain and geographical dispersion of production theories. In order to understand the framework that is developed from the two theories, these building block theories must be also discussed briefly. First, I will go through the global strategy and then the development of global production network and its characteristics.

2.1 Global Strategy Concept

In a search of competitiveness and efficiency, companies have long since crossed the national borders. As Adam Smith stated, single nations have their own competencies. Companies can use international trade to gain more competitiveness by acquiring national competencies outside their home nation. Institutions like "Michael Porter" and World Economic Forum have further developed these ideas and depicted how the characteristics, resources and the capabilities of single nation relates to the competitiveness and performance of industries operating inside its borders. Historical trading companies like East India Company have developed to large MNEs. It operates in multiple locations across different countries and is always searching sources of competitiveness around the globalization shrunk world. The high level of competitiveness usually translates to a high number of customers (Porter, 1985). However, there are hundreds and hundreds of other MNEs that are searching or already using the same sources and these companies operate in the same markets. What can differentiate one company from another in

global market place is a strategy. The concept of global strategy is then a natural starting point to examine why MNEs flourish better than single location companies, but first we should understand how the concept has developed and been discussed in scientific literature.

The now household research by Perlmutter (1969) showed how MNE organizations evolve from ethnocentric to polycentric and finally to geocentric organizations. Even though the research focused on employees, it was one of the first papers that divided the organization according to their level of internationalization. Contemporary global organization can be considered as a modern interpretation of geocentric company. Quickly thought, it would seem natural that this kind of geocentric organization of Perlmutter would also have a global or geocentric strategy. This is seldom the case and strategies and their academic names vary vividly from company to company, industry to industry and region to region.

Globalization has made company management more complex and strategies needed to adapt to this increased complexity. The global strategy concept developed by scholar refers to characteristics that globalization of business has brought to company management. Globalization is nowadays a household and even inflated concept in international business and management literature, but the actual research of the concept among management science did not start to evolve before the early 1980s. The rise of Japanese firms—that challenged the hegemony of western MNEs—particularly led to the overuse of the term *global* by academics and consultants (Hout, Porter and Rudden, 1982; Porter, 1986; Bartlett & Ghoshal, 1991). This dialogue on global industries and global companies by Porter et al. gave also birth to the concept of global strategy.

Porter (1986) discussed that certain MNEs operate inside a global industry, compared to multidomestic industry, where competition position in one country market affects also to the competition in a market of another country. Morrison (1990) further defined that a global industry incorporates high intensity of competition in an international level, the product is standardized, competitors have presence in all the important international markets and the amount of international trade is at a high level. Bartlett and Ghoshal (1991) emphasized that global industry, or “transnational industry” as they put it, demands a company strategy to have

global efficiency, worldwide learning and national responsiveness. The main idea in these definitions is that some industries are global in their nature and this demands that the MNEs need to have a global strategy rather than compete with domestic-market-by-domestic-market strategies.

As with any new complex concept, different researchers contributed their own view to global strategy discussion. Hout, Porter and Rodden (1982) saw that when a company has a global strategy it thinks of the world as one market and it is ready to accept investment projects with low ROI in order to gain competitive edge in the location or through it. A pioneer of marketing, Levitt (1983) argued that global strategy is simply about product standardization across the countries and regions, when a multinational strategy localizes its product. A different and more holistic interpretation is by Ghoshal (1987), who studied the variations of the concept between different authors and synthesized these ideas to an organized framework for the global strategy. Ghoshal (1987, p. 427) stated that MNE can have three tools to develop competitive advantage via global strategy: differences in input and output markets throughout the different nations where it operates, scale economies and exploiting of synergies and economies of scope which its different global operations can make available. Table 2 below shows the Ghoshal's framework.

Table 1. Sources of Competitive Advantage from a Global Strategy

	Sources of competitive advantage		
Strategic objectives	National differences	Scale economies	Scope economies
Achieving efficiency in current operations	Benefiting from differences in factor costs—wages and cost of capital	Expanding and exploiting potential scale economies in each activity	Sharing of investments and costs across products, markets and businesses
Managing risks	Managing different kinds of risks arising from market or policy-induced changes in comparative advantages of different countries	Balancing scale with strategic and operational flexibility	Portfolio diversification of risks and creation of options and side-bets
Innovation learning and adaptation	Learning from societal differences in organizational and managerial processes and systems	Benefiting from experience—cost reduction and innovation	Shared learning across organizational components in different products, markets or businesses

Source: Ghoshal 1987

As the reader can see, the ideas of framework have endured time, mainly because it moves in a very general level and is not industry or location bound.

Prahalad and Doz (1987) observed that companies seem to adopt a global strategy that suits to the cost pressures and to the degree of responsiveness that local markets requires from the company. Next groundbreaking contribution, which echoes the ideas of Levitt (1983) and Prahalad and Doz (1987) to the evolution of the concept was by Yip (1992), who proposed that a strategy is formed by five dimensions and depending on the choices that the company has made, its strategy is either multidomestic, global or somewhere between the continuum. The five dimensions were market participation, products/services, location of value-adding activities, marketing and competitive moves. A multilocal strategy seeks to maximize the performance by maximizing the local competitive advantage within each country/region, when a global strategy pursuits for maximizing the performance via worldwide sharing and integration. See Table 2 for illustration of the Yip's ideas.

Table 2.Global Strategy Levers: Multidomestic and Global Strategy

	Globalization Dimensions / Global Strategy Levers	
Dimension	Multidomestic Strategy	Setting for pure Global Strategy
Market Participation	No particular pattern	Significicant share in major markets
Product Offering	Fully customized in each country	Fully standardized worldwide
Location of Value-Added-activities	All activities in one country	Concentrated, one activity in each (different) country
Marketing Approach	Local	Uniform worlwide
Competitive Moves	Stand-alone by country	Integrated across countries

Source: Yip (1992)

A whole decade later, Svensson (2001) argued that a global strategy concept is still very much under debate and that a more coherent definition is needed in order to avoid confusion between scholars themselves and especially between the authors and readers. This is a notable perception

given that at the time global strategy was already a 20 years old concept among scholars. Svensson found that terms differed significantly and misusage of the term was widely spread amid the academia and companies. His proposed solution was to introduce a completely new term called *glocal strategy*. The glocal strategy shares many similar characteristics with global strategy, but it acknowledges the necessity for local adaptations and accommodation of business operations and marketplace activities. In addition, it comprises local, international, multinational and global strategy issues (Svensson, 2001, p. 15). Glocal concept was a step towards a more holistic and realistic view and it underlined that companies can seldom be placed under a simple academically constructed strategy. When it comes to my study, the concept is problematic because it does not give any clear answers and continues the tradition of continuum of international-multinational-global using theories, which makes the research problem very complex.

On their article published on the Harvard Business Review, Doz, Santos and Williamson (2001) introduced the concept of metanational enterprise, which they argued to be the next form of global company—after it has established a working global strategy. The main idea of the metanational enterprise concept is the usage of knowledge gathered from all around the world. For example, an IT company having a presence in a traditional IT cluster of Silicon Valley is not enough, but the company should attain knowledge also from Cambridge, Tokyo, Bangalore, London and Helsinki. This knowledge would then be melted in the "magnet units" of organization and developed into new products, global platforms and global activities.

I see the main ideas of a metanational enterprise a little over enthusiastic, knowing how much there is excess data and knowledge in the companies. Today, it seems to be more important how you use and analyze the knowledge you have. The concept is still worth mentioning, because it holds that global strategy and presence is step in a road to being a corporate information power house. Then, it holds information as the main source of competitiveness, when every company can easily source the same physical R&C around the world. This offers an insight that even if the high oil prices would shrink the global production networks and commodity chains to local ones, information can still be sourced globally. In the future, it could be that the only truly global operation for companies is the information sourcing.

2.1.1 Critic towards Global Strategy Concept

The 2000s saw also direct critic towards the global strategy concept. Rugman (2001) argued directly that global strategy is a myth. His argument is based on the fact that globalization itself is a myth to some extent and the world trade is highly intraregional and the rest of the trade is triadic in nature. NAFTA, Asia and EU are the three regions forming a triad and these entities also represent the regions. The implication of this is that the company strategies should also be regional. In his book Regional Multinationals (2005), Rugman further justifies his claim by investigating different industries in global scale and founding that in most of the cases, the very few of the 500 biggest MNEs sell the same products and services globally. Svensson (2001) commented that in an empirical context, the global strategy concept resembles a managerial utopia, because any kind of a global strategy needs local adaptation to some point. Peng (2006, p. 18) points out that global is many times just a word without meaning because firms (especially U.S. based) seem to use it to describe whatever operation as global, if it takes place outside US borders. Or it simply refers to competing situation where companies offer standardized products and services on worldwide basis.

Gupta, Govindarajan and Wang (2008, p. 20) offer a different kind of solution to the diverse definitions by stating that the concept of global strategy can answer the following questions: what must be (versus what is) the extent of market presence in the world's major markets? How to build the necessary global presence? What must be (versus what is) the optimal locations around the world for the various value chain activities and how to run global presence into global competitive advantage? Despite these are great questions and they reflect the main themes of the two decade old debate, they do not offer a proper framework for the study.

Thus, among scholars the global strategy concept is still hazy and diverse. As said, there is a debate if the global strategy even exists. It should be kept in mind that the definition of the concept is highly dependent on the context where and who uses it. Clearly the global strategy discussion and concept can't give a one clear framework and tools to research all the effects that high oil prices have in global MNEs or depict the structuring of global production networks because of the abstract concepts it embodies.

The organizing framework of Ghoshal (1987) what was shown above is promising for this study, because it is flexible and does not divide MNE strategies to multidomestic or global. Although realistic, this kind of continuum would have made the wide scope of the study even wider and more complex. Ghoshal's framework does not take a stance on localization vs. globalization. It simply states that company can use scope economies of brand, in order to source competitiveness globally. Still, the Ghoshal's framework needs to be adapted to more modern and "physical" theory of MNE, which shows how resources and capabilities move across the supply chain and production networks. The reason behind this is the transportation, energy and production costs perspective of oil and how it links to competitiveness that MNEs source from diverse locations.

2.2 Global Production Network Theory

The development of the modern theory of MNE has gone through several theories and concepts that are developed to explain why MNEs exist and why they flourish so well that some of them are larger economies than some nation countries. This section will go through the relevant theories that have a pronounced role behind the more modern theory of the so-called flagship MNE and global production network. First we will go through the resource based view and then value chain concept and its broader version; global value chain.

The reader should be warned about the robustness of different versions of concepts such as supply chain/value chain, global value chain/global commodity chain, flagship network/global production network. I decided to keep them as they originally exist in the texts of other authors and I do not go to details how these concepts may differ. In the theoretical framework part one version from these concepts is used and defined and used in the rest of the paper.

2.2.1 Resource-based view

If the global strategy concept did not provide a picture of more physical side of the international and global operations, there must be searched for theories that can underline the rationale that create and transfer competitiveness and efficiency both from and for the MNE operations. A global strategy, like any other strategy, is made of shorter plans and projects which are

implemented with the resources and capabilities of an organization. This is why I started the search for a fitting theory from the resource-based view of a firm.

Resource-based view initially by Wernerfelt (1984), has been around a good while in the strategic management science and its main question: *why do some companies among the same industry vary in their performances over time?,* has been tested, challenged and reinforced numerous times, and it still holds its place in the field of firm strategy theories (Hoopes et al., 2003). The closest "theory of all" to the resource-based view is the eclectic paradigm (a.k.a. OLI-Model) by Dunning (1980), which is based on transaction theory and aims to explain why and how companies internationalize. However, since I am more interested what happens to resources and capabilities of a company when the oil price increases, the resource-based view is better to examine the research problem.

As said, resource-based view consists of two basic concepts: resources and capabilities (Peng, 2006, pp. 77-78). Resources are defined to be tangible and intangible assets that firm uses in its strategy. Capabilities are company's capacity to effectively utilize resources. Ever since the introduction of these concepts, academics have debated over the definition of capabilities and lines are drawn to running water. For example, is organizational transparency a resource or capability? Peng argues further that in order to avoid this hurdle, these two concepts should be used interchangeably and in parallel. Thus, from this point on, I will refer to them simply as R&Cs. Table 3 in the next page shows examples of R&C, both tangible and intangible.

The other main idea of resource-based view is the VRIO framework (Peng, 2006), which states that companies can gain competitive advantage if their R&Cs are *valuable, rare, hard to imitate* and *organizational*. R&Cs are *valuable* if a company can improve its market position relative to competitors. For example, if raw materials are acquired at a price below competitors, company will most probably be able to drop the price level of final product and—ceteris paribus—seize some markets from competitors. *Rarity* refers to assumption that in order for R&Cs to be valuable they must be available in short supply relative to demand. In order to be rare, R&C need to be isolated from imitation or replication and be immobile (Hoopes et al. 2003, p. 890). In my opinion, companies do not thrive just by searching resources and capabilities that fit the

VRIO framework, but they need to consider how the tangible and intangible resources fit to the value chain of the company.

Table 3 . Examples of tangible and intangible R&C

TANGIBLE RESOURCES AND CAPABILITIES	EXAMPLES
Financial	▪ Ability to generate internal funds ▪ Ability to raise external capital
Physical	▪ Location of plants, offices, and equipment ▪ Access to raw materials and distribution channels
Technological	▪ Possession of patents, trademarks, and copyrights
Organizational	▪ Formal planning, command, and control systems ▪ Integrated management information systems
INTANGIBLE RESOURCES AND CAPABILITIES	**EXAMPLES**
Human	▪ Knowledge ▪ Trust ▪ Managerial talents ▪ Organizational culture
Innovation	▪ A supportive atmosphere for new ideas ▪ Research and development capabilities ▪ Capacities for organizational innovation and change
Reputational	▪ Perceptions of product quality, durability, and reliability among customers ▪ Reputation as a good employer ▪ Reputation as a socially responsible corporate citizen

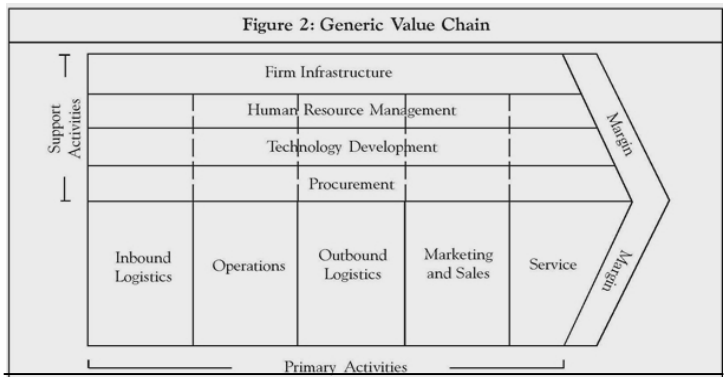
Source: Peng 2006

2.2.2 Value Chain

The idea of value chain concept, which is described first time by Porter (1985), is one of the most used concepts in the management science. Concept is used widely and with different interpretations, also in everyday business jargon. The basic idea is that it gathers all the resources and capabilities of the firm together and forms a company specific value chain. The most basic form of a value added chain is technology integrated to labor and material inputs which are further processed to products and then marketed and distributed (Kogut, 1985, p. 15). Value chain can be divided further to primary and support activities and for MNEs this chain is most often scattered regionally or globally. Supportive activities (such as infrastructure and

logistics)support primary activities (e.g. R&D and final assembly) and both activities need resources and capabilities of the firm. Table 4 depicts a generic value chain.

Table 4. Generic Value Chain



Source: Porter (1985)

Peng (2006, p. 81) points out that it is important to understand R&Cs are not always automatically found inside the firm, but they can be scattered around the globe to numerous partners and suppliers. This is especially the case of MNEs which try to take advantage of the best global locations for particular activities Thus, it could be stated these particular MNEs have global value chains.

2.2.3 Industrial Organization and Global Value Chain

Every company does not go after the R&C around the globe. There are many reasons behind this, for example, company's core competence should be in-the-house, search for R&Cs require resources that many companies do not possess and it is risky because of the lack of information and knowhow. Another reason is the organization of certain industry. It is important because the high oil prices is said to have effect on how the global production will be organized in the future (e.g. Rubin, 2009). Also, it explains more the rationale how and why the certain industries have build their value chains to be globally dispersed.

The basic and most simple view of organization of industry can be one company which is a highly vertically integrated organization and it owns and operates most of the steps —if not all—

in the value chain of product. Ever since Standard Oil was divided to separate companies by the US government (Giddens, 1976), this kind of model is highly theoretical in every industry because of the transaction costs.

The transaction cost concept is the main explaining factor of why industry has organized its value chain as it is. Williamson (1975) argued that the complexity of inter-firm relationship and asset-specified transaction cost dictates the abstract amount of investment to transaction cost. When the product of a company is highly customized and bought by niche of customers, it accompanies with high transaction-specific investment which raises the risk of opportunism and the level of coordination needed between the outsourcer and subcontractor. This scenario often leads to vertical integration of the company. Standardized product with wide variety of end users more often lead to more networked value chain. However, some more contemporary network theorists, such as already mentioned Gereffi Humphrey and Sturgeon (2005), argued that mutual dependence, trust and value of reputation can lower the obstacles of more complex inter-firm relations and vertical integration of firms can stay lower inside a highly customized industry.

Next we should ask what drives the industry organization to go across national borders. Gereffi. (1994) constructed a global commodity chain framework, which stressed the importance of global buyers and coordination across the firm boundaries as key drivers in the formation of globally dispersed and organizationally fragmented production and distribution networks. For example, electronics and contract manufacturing industries are highly networked when production is considered.

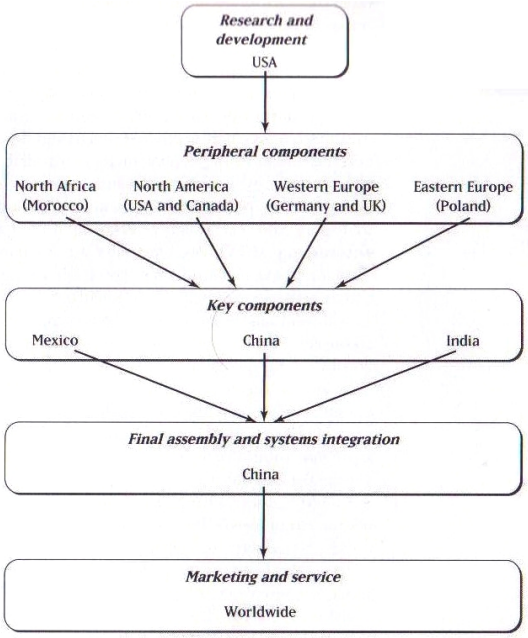
Thus, according to organization of the industry authors, R&Cs do not have to be owned by the firm, but they can be also produced by another company. This is known as outsourcing. The rise of offshoring has been one of the major trends given birth by globalization. One popular example from this is the apparel industry which holds vast resources and capabilities in upstream and downstream resources, but they outsource manufacturing to low-cost countries (Peng, 2006, p. 83). China and Eastern Europe are prime examples of textile industry outsourcing, whereas India is the main outsourcing location for IT related operations.

When the resources and capabilities activities are scattered around the globe, a value chain can be stated to be global. Global value chain is the result of globalization of trade and more and more efficient IT supported coordination of operations inside a company (Gereffi 2005). Contemporary international competition is so fierce and complex that almost all the major product companies have to consider the establishing of a value chain that goes beyond the home country borders. The latter half of 20th century saw deregulation and liberalization of trade and foreign investments and MNEs as phenomenon started to emerge more rapidly because both governments and companies saw the advantages and temptations of lower production costs, raw materials and new markets.

However, the acquiring of raw materials, components and products with lower price is only a one side of a current global value chain concept. The main idea of the concept proposes that every location of global value chain adds value in the operation that it excels (Peng, 2006). This differs much from simple international trade of commodities, because the streams of R&C that MNEs use can go through numerous countries and seaports before the component or end-product is distributed to an end-user. This is time consuming and costly though and the coordination of different R&C requires vast organizational resources. Still, the location bound R&Cs can offer substantial value to whole chain in order to be justified. Table 5 shows how General Electric Medical Systems produce their Proteus Radiographic System (Peng, 2006, p.84) by using global value chain.

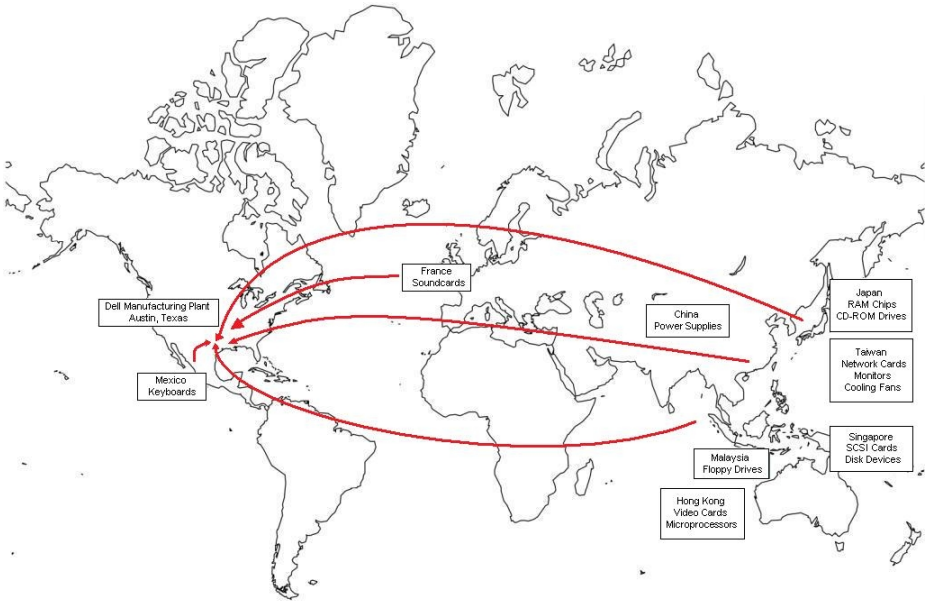
To highlight the distances that components can travel before reaching the final assembly, I take another example with a map picture depicting flow of components in a global value chain. Dell is a well-known manufacturer of PCs and Table 6 illustrates a simplified version of Dell's global value chain. The company is a prime example of a MNE that has organized its global value chain that relies heavily on outsourcing and highly specialized clusters. Dell's role in the global value chain is the final assembly, coordinating of marketing and distribution, and giving the final product a brand name.

Table 5. Example of a Global Value Chain



Source: Peng (2006)

Table 6. Global Value Chain of Dell



Source: adapted from Planning and Markets: An Electronic Journal . http://www-pam.usc.edu/images/world.gif

When speaking of geographical dispersion of resources and capabilities, concept of clusters (by Porter, 1998) also play their own role in the outsourcing and global value chain, because they provide excellence and/or low-cost R&C based on competition that hones and spars the actors inside it. Clusters are important locations to any company that considers establish a global value chain for products which demand special know-how, high-technology and/or skilled labor. Personal computers and Dell is good example from this kind of a product.

The key idea from these observations from global value chains is that the companies can have global level production systems without direct ownership, but we still do not know how the value and performance creation is divided in the value chain of large MNEs. Depending on the industry organization, the nature and governance of the value chains (who wields the power and where does it come from in the value chain) varies from industry to industry but are never static (Gereffi et al., 2005). The trend of rising interdependence and leveling of power levels with suppliers and lead firms has created value chains where suppliers are as important, or even more important, value adders in the value chain than the MNE. This can happen because suppliers have increased their capabilities through value bundling, where supplier offers more thorough solutions, and the result is that many industries have seen the rise of global suppliers. It goes without saying that this kind of interdependence also ties MNEs more to the supply chain and it becomes much more difficult to change the supplier to another. The ongoing trend has been described as the emergence of global production networks.

2.3 Global Flagship Network Concept

The global production network concept, initially by Henderson, Dicken, Hess, Coe, and Wai-Chung Yeung (2002), has evolved from global commodity chain, managerial value chain perspective, organizational sociology studies and network-actor research (Hess and Young, 2006). GNP owes much to Gereffi, who first developed global commodity chain theory and distanced it from the Porter's value chain by adding international dimension (Sturgeon, 2000).

It is unclear how much the above discussed global production network has been influenced by the Rugman and D´Cruz developed theory of the flagship (1997) firm because it has striking

similarities that GPN concept bears, but when GPN is developed to learn more about international economical development, the flagship theory seeks to describe a modern large MNE that is in the centre of GPN. Clearly the authors saw the same international trend emerging but in slightly different context and scale.

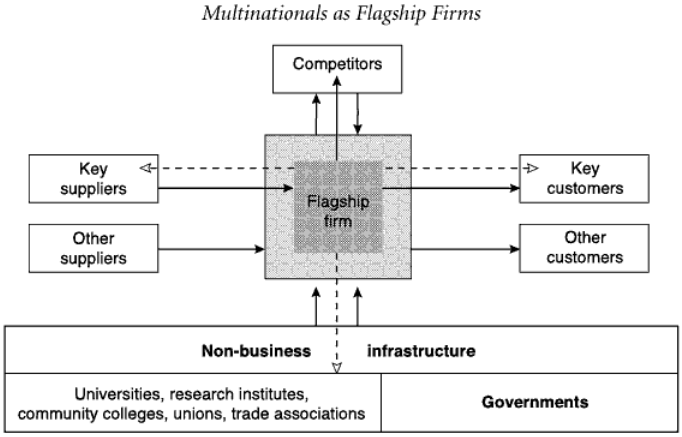
Ernst and Kim (2002) saw also that the industrial organization of MNEs is moving toward "global network flagships" which connect the various suppliers, information and knowledge and customers to GNP. They see three drivers behind the trend: liberalization, development and diffusion of IT technology and competition. Liberalization of trade, capital flows, FDI policies and privatization all benefit MNEs through risk distribution, cost reduction and overwhelming amount of liquidity. On top of that they have enjoyed the increasing freedom of choosing entry and operational modes in foreign markets and globalization and IT have offered the option of outsourcing the resources and capabilities that fit the VRIO framework but were difficult to exploit and find. All this made the globe smaller in the sense that value chain can be constructed to be truly global. Rapid development of IT has made it possible to coordinate and communicate the value chain and organization's resources and capabilities with lower friction and increased swiftness across national borders, but the huge investment to corporate wide IT systems has meant also that the spending must be covered with growing sales expansion internationally. The two former drivers together have both accelerated and broadened the international competition in business. This has made it necessary for MNEs to be active in all the major growth markets and connect these activities to enhance competitiveness. All this has made the competition so complex that very few firms can possess all the resources and capabilities that are required to compete in global level. (Ernst and Kim, 2002).

As the global strategic management authors seldom stress the important role of suppliers and outsourcing networks, Ernst and Kim (2002) state that it is the global production networks and location-specific resources and capabilities that are critical to competitive success of the MNEs and most often these resources and capabilities are operated by contract manufacturers, original equipment manufacturers subcontractors, suppliers and outsourcing companies.

The global flagship network concept is developed by Rugman and D'Cruz (1997) and it is only global network framework that has a global MNE in the middle of it (Verbeke & Busche, 2006). This framework is fitting to explore the consequences of oil, competitiveness and multinationals in network level because it synthesizes the features of resource based view, value chain and networks. Furthermore it depicts a new kind of MNE that is dependent on its network and which must plan its strategy according to overall efficiency of the flagship network that it has build (Ernst & Kim, 2002). It also considers competitors and non–business institutions and divides suppliers to key and regular suppliers. Table 7 below shows the basic composition of MNE as flagship network.

Characteristic for flagship network is that contains the both intra-firm and inter-firm transactions and coordination. The flagship MNE establishes long-term partnerships or strategic alliances with four entities that facilitate its international expansion (Verbeke & Bussche 2006).

Table 7. Multinationals as flagship firms



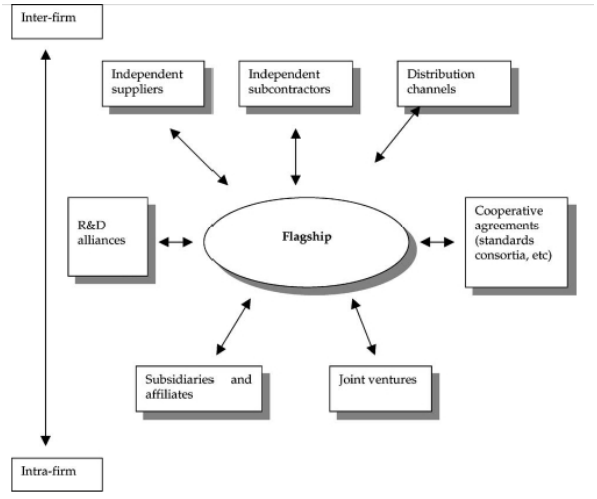
Source: Rugman and D'Cruz (2000)

Ernst & Kim (2002, p. 1420) recognize IBM or Intel a typical network flagships, which have the value chains divided to separate functions which are located wherever they improve the efficiency, access to resources and capabilities and penetration to important growth markets. The *raison d'être* of the network is thus to provide the flagship with quick and low-cost admittance to resources, capabilities and knowledge that complement the core competencies, but the real benefits derive from dissemination, exchange and outsourcing of knowledge and complementary

capabilities. Ernst & Kim (2002, p. 1420) Why Ernst & Kim see the knowledge sharing the most important benefit of the flagship network, they don't explain thoroughly. They argue that knowledge sharing helps local suppliers to upgrade their managerial and technical skill to meet the MNE specifications, but I think that then the knowledge sharing is more of a prerequisite—than a direct benefit—that must be done in order to establish a production network at all. When the time goes by, the flagship network comes more efficient because of continued knowledge sharing, but it seems that the initial move to choose a supplier to network must be other than plan to train and educate the supplier to be better. However, this "training" requires time and makes it difficult to break a partnership or move to another supplier, because two companies have been interlaced through deep symbiosis. Effects of high oil prices should be severe in order to MNE switch the supplier or subcontractor.

Ernst & Kim modified the model of Rugman and D'Cruz (1997) slightly and renamed it to show the nodes of global production network. Table 8 on the next page shows their interpretation.

Table 8. The nodes of a global production network



Source: Ernst & Kim (2002)

The addition of distribution networks has replaced the "key customers" of Rugman & D'Cruz model. I see this as more convenient concept when trying to assess high oil price effects, because it grabs more efficiently the fact that final products must be transported and distributed to

markets and this adds transportation costs. It is clear that all the flagships do not possess all the nodes and the nature of the network changes according to industry and company.

Sturgeon (2000) recognizes various forms of global production networks depending on the relations of suppliers and flagships but the division to "brand leaders" and "contract manufacturers" by Ernst and Kim (2002, p. 1421) is more manageable for this paper. They give Cisco as an example of brand leader: "its GPN connects the flagship to 32 manufacturing plants worldwide. These suppliers are formally independent, but they go through a lengthy process of certification to ensure that they meet Cisco's demanding requirements." This helps company to get rid of low-margin manufacturing, combine cost reduction, product differentiation and enhance time-to-market. Contract manufacturer, e.g. Flextronics, again are products of outsourcing trend based on contract manufacturing where companies like Nokia and Sony sold and outsourced large pieces of their GPN and these pieces have now established their own GPNs in order to supply brand leader (Ernst and Kim, 2002, pp. 1421 - 1422).

Finally, an important aspect of the global flagship network that Ernst & Kim (2002) point out is that local suppliers can thrive and act in the network only by constant upgrading. Flagship places business orders and shares knowledge to local suppliers in order to improve the efficiency of its network. This leads to situation where suppliers are expected to respond inside hours with a price, a delivery time and with the same product quality that their recent performance record shows. Thus, the MNE flagship possesses the majority of the power in network. There is still the question if there are enough higher–tier suppliers in the world that MNE could flexibly change the supplier if it fails to fulfill the specifications of the flagship? In the age of high oil prices this would become even trickier.

2.4 Summary from Reviewed Literature

This chapter discusses briefly the reviewed literature and develops a framework that depicts the logic of global strategy by combining the two theories: Ghoshal's (1987) organizing framework of the global strategy and Ernst and Kim's (2002) slightly differentiated model from) theory of global flagship network of Rugman and D'Cruz (1997, which is here on called as global production network. Important is to understand that it still contains the rationale of value chain w

Concept and logic of global strategy has multiple definitions. Some academics are not convinced that there even exists a truly global strategy. The academic debate about the issue has been directed to word global and its definition. As important as the right definition of the concepts is in science, this paper holds the view that strategy of company is global if it exists in multiple regions of the world and its value chain is global. I also support the view of Peng (2006, p.5) which states that the concept's modern interpretation should be: "how to effectively strategize and compete around the globe". This definition releases the shackles of conflicting academic debate about the definition of concept. Nevertheless, the reviewed literature has helped us to understand the concept better.

Literature depicted how the resource-based view of the firm, organization of the industry and the (global) value chain literature have been contributed to global production network model that links the various stakeholders to the major MNE and how its strategy dictates the whole network strategy. These two theories also explain the competitiveness that MNE can source through global presence.

This literature review has been important for couple of reasons: the consequences of high oil prices can have many negative effects to global network and it cannot be rapidly adjusted to meet the global scale phenomenon. Via these effects, the study's hypothesis is that both global strategy and global value chain network will be forced to be reconsidered if the oil prices climb high enough and stay there.

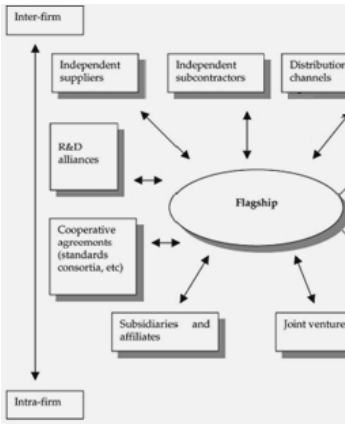
The organizing framework of global strategy that Ghoshal (1987) developed is holistic approach to the subject and captures the sources of competitiveness from a global presence. It is clear that companies can create global competitiveness in other ways also, for example, from Internet (Yip & Dempster, 2005). The framework is created in late 1980s, but it still applies very well to modern world although the role of IT and Internet has further enhanced the" innovation learning and adaptation", because of the speeded up information flows and the information treasury that Internet together with company data bases provide. Still, company must go, for example Japan, to truly master the markets and it must export its products to foreign markets or establish a subsidiary to offer financial services to citizens of neighboring country. Other notable feature of the framework is the lack of multidomestic/global strategy continuum (Yip, 1992). With this kind of continuum, the framework would have developed too complicated for this particular study, because it focuses on sources of competitiveness and not to the level of standardization in strategy and products. Other than these issues, work of Ghoshal provides an excellent platform to research oil price effects on logic of global strategy both from managerial and academic perspective.

Global strategy framework is not enough though, to assess the research problem, because it is does not take the perspective of resources and capabilities and their flow in the value chain, the contemporary trend of offshore outsourcing and the relationships and power distribution of the actors in the global production network. Globalization has made it possible for firms and industries to establish global value chains that are geographically dispersed and horizontally organized (Dicken et al., 2001). The horizontal organization of the industries has been driven by also the increasing role of mutual dependence, trust and value of reputation which has replaced the more vertical organization of value chain (Gereffi et al., 2005). This global vertical organization has given birth to new kind of MNE theory: the global flagship. Large amounts of resources, capabilities and knowledge gathered and created by different actors of the network flows through the globally dispersed production network. The strategy of the flagship dictates the overall strategy of the global production network and especially the role of the suppliers is to follow the strategy and keep in the pace of flagship. This hegemony of the flagship differentiates the theory from the cluster concept although the resources and capabilities of the key supplier can be originally derived from the cluster synergies (Rugman & D'Cruz, 2000).

2.5 Synthesis

The object of this paper is to find out the consequences of extremely tight global oil supply to multinational companies that have global presence and global production network. By combining the two theories we have a framework that is suitable for examining the causes of global scale phenomena from a MNE perspective. Table 9 illustrates the composition of this synthesis. Appendix A offers a larger version from the framework. A global strategy is based on the sources of competitive advantage and this strategy is implemented in the global production network. The glue that ties the flagship MNE and the other nodes of global production network deeply together is important because the strategy of MNE affects the whole network (Ernst and Kim, 2002). For example, if MNE has established that cost efficiency would be is its main strategy from now on, the whole production network can face wide implications, especially the suppliers which can be forced to move the production lower factor cost location in order to stay in the production network. The "sources" and the "objectives" of the strategy should be discussed briefly before the high oil prices analysis.

Table 9. Theoretical Framework of modern large MNE



Strategic objectives	Sources of competitive advantage: National differences	Scale economies	Scope economies
Achieving efficiency in current operations	Benefiting from differences in factor costs—wages and cost of capital	Expanding and exploiting potential scale economies in each activity	Sharing of investments and costs across products, markets and businesses
Managing risks	Managing different kinds of risks arising from market or policy-induced changes in comparative advantages of different countries	Balancing scale with strategic and operational flexibility	Portfolio diversification of risks and creation of options and side-bets
Innovation learning and adaptation	Learning from societal differences in organizational and managerial processes and systems	Benefiting from experience—cost reduction and innovation	Shared learning across organizational components in different products, markets or businesses

Source: Synthesis of global strategy by Ghoshal, (1987) and global flagship network by Rugman & D'Cruz,(2000) later on modified by Ernst & Kim, (2002)

The sources of competitive advantages that the framework lists at the right side of the Table 9 are gathered from the global strategy literature by Ghoshal (1987*): national differences, scope*

and *scale economies* are the sources and strategic objectives consists of *operations efficiency*, *risk management* and innovation learning and adaptation.

As mentioned, *national differences* are based on factor costs but also on societal resources of nation such as human resources, quality of work and materials, educational system and managerial know-how. *Scale economies* is well established concept in the business literature but Ghoshal notes that scale economies are not just a positive thing because it makes the companies to go after specialization and dedicated assets and systems. While this triggers most likely the more cost efficient production, it also make the company less operationally and strategically flexible. *Scope economies* act in the same way as scale economies, but when scale economies applies to one product, scope economies exists in the context of different multiple products/services and is most often referred in the context of marketing. Ghoshal's interpretation from the source of scope economies in global strategy can be seen from the main framework and from the Table 10.

Table 10. Scope Economies in Market and Product Diversification

	Sources of scope economies	
	Product diversification	Market diversification
Shared physical assets	Factory automation with flexibility to produce multiple products	Global brand name
Shared external relations	Using common distribution channel for multiple products	Servicing multi-national customers world-wide
Shared learning	Sharing R&D in computer and communications businesses	Pooling knowledge developed in different markets

Source: Ghoshal (1987)

As it can be seen, sharing of physical assets, external relations and learning with the other units of the MNE can help the processes of product and market diversification through various ways; such as flexible production plants, common distribution channels and global brand name.

The strategic objective of efficiency seeking is crucial in the global competition and the quest for efficiency controls the contemporary production network dynamics (Ernst & Kim, 2002), but

companies cannot go after efficiency without considering the risks involved in different locations. Ghoshal (1987, pp. 429–430,) divides the risks that a MNE faces to four categories: *macroeconomic, policy, competitive and resource risks*.

Macroeconomic risk is kind of risk that company has no control of, for example a global recession, exchange rates fluctuations or a war (Ghoshal, 1987). The effects of *policy risk* can be in the same magnitude, but company has some control over the risk, because it occurs from host country government decision(s) and not from equilibrium seeking global market. Although both macro economical risk and policy risk can both contribute to same effect, e.g. exchange rate change, the policy risk is seen at least controllable by the company. *Competitive risk* arises from the strategic moves of the competitors and when the markets and operations of the company are in multiple locations, it becomes more difficult to respond to these moves accordingly and to control the big picture. Technological risk, where the competitor adopts new significant technology and the other does not, can be also stated as competitive risk. Resource risk means the situation where the company does not have, cannot adopt, develop or procure resources that are needed in the strategy. The required resources can be anything from human capita, e.g. managerial talent, or plain finance.

MNE receives numerous different kinds of inspiration and ideas from the multiple locations where it operates (Ghoshal, 1987). Innovation learning and adaptation refers to these stimuli that the MNE can distribute throughout the organization and develop diverse capabilities. Ghoshal goes so far that he argues that the innovation and learning may be the main answer to the question why MNEs are so successful (1987, p. 431). Diverse set of internal capabilities can help the company to survive in the unpredictable future and develop joint innovations that are sums of the technologies and capabilities created in the different units that are located in the distinct locations. Just because there is internal diversity does not mean that the learning and innovation takes place automatically but organization must create systems and mechanisms for learning and international information flow to be effected.

I have now reviewed the right hand side of the framework. Next, the left hand sight should be reviewed briefly. The left hand side of the framework is a mixture of the original theory of the

flagship firm (Rugman & D'Cruz 1997) and the global production nodes version of Ernst & Kim (2002) but this paper will use the vocabulary of the latter. As mentioned already in the literature review, the global production nodes create a global production network that can be also called a firm specific global value chain network which connects the different nodes together to flagship dictated global strategy. The role of all the nodes is to enhance the efficiency of the network through different means. Distribution channels include all the direct key customers but also the other channels. Cooperative agreements, which are also called "the non-business infrastructure" by Rugman and D'Cruz (1997, p. 404) include "the service related sectors, educational and training institutions, the various levels of government, and other organizations such as trade associations, non-governmental organizations and unions". The black, two-pointed arrows present the relationship and the value chain that links the production nodes and the flagship MNE. Value chain here refers to the generic value chain by Porter (1986) but it does not mean that every primary and supportive activity is included in the relationship, for example the value chain between flagship MNE and the R&D alliance may not include any of the primary activities, nonetheless, it creates value and develops resources and capabilities and for the MNE and its production network.

There are many subject s in the context of global strategy and global production networks which have not been discussed, e.g. the product life-cycle, but the above discussion is meant to be a guide to the framework that is used to examine the strategic questions that the peaking global oil supply can bring about for the global MNEs. All the different cells of the network carry the means to gain competitiveness from the global strategy and the production network shows the platform where these strategic moves are implemented and honed.

Finally, it is notable that none of the theories that have been discussed in this section consider the cheap transportation prices and one of the most stable periods in the western world history as the driving —or even enabling —forces for the internationalization of company production.

3. Literature Review for the Future of Oil

This section explains the basics of oil and the importance of it to us and reviews two questions related to oil: how much there is oil left and do the substitutes for it arrive to markets in time, or too late for economy to adapt efficiently and with minimum damage to the standard of living that we have been used to? These questions are examined through related literature, which consists of institution publications, such as UN biodiesel report, books about oil and peer-reviewed journal articles.

3.1 Oil and Human Kind

The history of energy is also the history of the human kind. The invention of fire was the turning point that saw forefathers taking the overhand out of nature. Bio fossils such as trees and plants were the initial and the most logical victims of energy hunger of our ancestors. In 18th century the coal came to substitute the wood as a major energy source and finally oil substituted coal as the energy for transporting, but it also took a place in heating and electricity production, but also as multiuse raw material source of the 20th and 21tst centuries. The oil has been the motor of development for modern human, but it has been also the major source of conflicts and many modern wars have their story tangled more or less to oil.

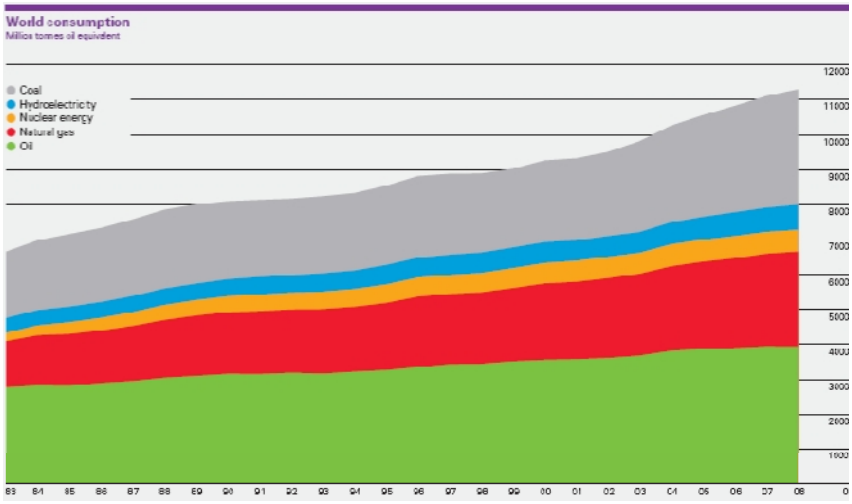
The ancient civilizations of Greeks were among the first that used oil in warfare—and most probably in shipbuilding—and they called it the medicine oil, although it was bitumen. Through centuries it has been also used as medicine to various diseases. Oil can be also found on the surface and these surface findings led to substitution of scarce whale oil by kerosene—a petroleum product— in oil lamps. Soon enough, the surface findings could not supply the demand for oil needed in the oil lamps and prompted subsurface drillings. The first oil well was drilled successfully in 1859 in Pennsylvania, United States. Oil lamps were eventually replaced by electric light bulb, but emerging of cars, petroleum powered trains and ships made petroleum the energy source of transportation and eventually more wide scoped phenomena, such as the urbanization and globalization.

Nowadays, oil is thought to be the only commodity traded in the financial markets that can cause global scale economical recession or even a war. Modern world can survive long times without minerals or agricultural products, but the lack of oil would but—especially western world and its transportation dependent infrastructure—world quickly bring to its knees and chaotic circumstances. Reflecting against this background it is very curious that the development of substitutes for oil is so late and there are so few them in numbers. This again, is a question of political economy and the various conflicting interests connected to oil. To understand the source of interests, we must look briefly the facts and figures associated to this commodity.

3.1.1 Importance of Oil

Oil is the Main energy source in the world. In 2008, it accounted 34.9% of the total energy consumption (BP, 2009). Chart 2 depicts the share of different energy consumption and their development from 1983 to 2008.

Chart 2. World Primary Energy Consumption, Million tonnes of equivalent[1]



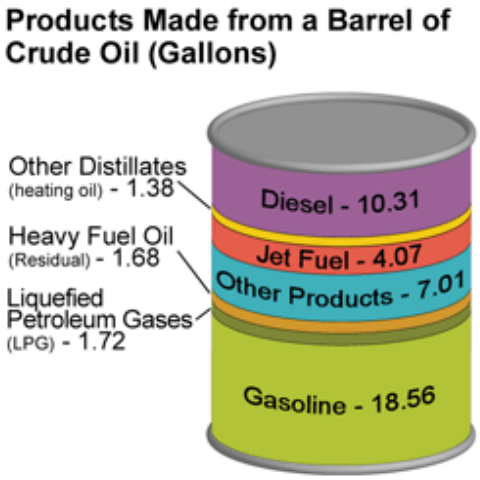
Source: BP (2009)

Judging from Table 11 on the next page, one is not far away from truth if saying that every product has its share of oil in it, one way or another. Some of them have material in them made out oil and all of them have been transported with the aid of fuels produced of oil. Once barreled,

[1] The tonne of oil equivalent (toe) is a unit of energy: the amount of energy released by burning one tonne of crude oil,

the oil has various end uses. Table 11 depicts how a barrel of crude oil (A barrel is 158.987 liters and 42 US gallons) is used between different useable products. Most of the oil products are used for some form of energy generation.

Table 11. Products Made from a Barrel of Crude Oil



Source: EIA, http://www.eia.doe.gov/

Other products contain such everyday categories like disinfectants, cosmetics and plastics. Modern cityscapes could not be possible without oil and its derivatives. Richard Heinberg (2006) argues that the three main petrochemicals, ethylene, propylene, and butadiene, are in fact the building blocks of modern society and humankind is very much depended on these products. Petrochemicals can be derived from other hydrocarbons also, but oil is the major source of the chemical products. One of the most important industries for modern society is the medical industry and it also relies much in oil as a raw material, but the fossil fuels made of oil are far more important economically.

The reader of this paper has today most probably used vehicle that has diesel or gasoline motor and eaten food transported with energy generated from oil. World's oil consumption in near past has been approximately 84 million barrels a day (EIA, 2009) which can be expressed also as 4gt (4gt standing for gigalitres) a year. This means that dwellers of Earth uses oil circa 31.000 barrels or 4.932.581 liters a day. Different fuels—by fuel it is meant gasoline, jet fuel, heavy fuel and diesel—makes 75 percent of the global oil usage.

If a barrel price of 60 dollars is assumed the oil generates total sales of 1832 billion dollars or (briefly put 1.83 trillion) and with record price of 150 the figure is 4580 billion dollars. It justified saying that there is money in oil business and the product itself sells as long as there is agreement on price.

According to IEA (2009) the world oil consumption total in 2009 will be 83.67 million bbls and as one single country, United States have thirst for gasoline with its total consumption of 18.97 million bbls. Other OECD countries make up 26.5 million bbls where Europe counts for 14.74 millioin bbls and Japan 4.3 million bbls. China's overwhelmingly fast growing economy consumes oil at accelerating speed and the country has started to secure its future needs by actively trying to acquire for exploration and production possibilities from different continents. China's car base per capita is relatively low, but the approximate of 1.3 billion inhabitants and pursue economic growth has made it the second to United States in oil consuming with 8.08 million bbls.

Table 12, shows the global demand and how it is divided between the regions in 2005. The total consumption in 2005 was 20.7 million barrels a day which is 7555.5 mbsd or 7.5 tbls. In near future, BRIC countries are the ones that will push the global demand up. Much depends on how many people in these countries are able to buy a car and in what pace this happens.

Table 12. The Key Figures of Global Oil Demand 2005

	Unit	EU-27	Japan	USA	China	India	Russia	Brazil
Population	millions	490	128	297	1313	1134	144	187
Urban population	% of total	80	66	81	40	29	73	84
GDP in PPP terms	billion US $	13,054	3870	12,376	5333	2341	1698	1585
GDP/Capita in PPP terms	US $	26,652	30,290	41,674	4091	2126	11,861	8606
TPEC	Mtoe	1815	527	2340	1717	537	647	210
TPEC/Capita	toe	3.7	4.2	7.9	1.3	0.5	4.5	1.1
POC[a]	Mtoe	671	249	952	327	129	133	85
POC/Capita[a]	toe	1.4	1.9	3.2	0.2	0.1	0.9	0.5
No of vehicles[b]	millions	230	69	232	34	11	35	27
No of cars/1000 people[b]	cars/1000 people	466	540	776	26	13	245	145

POC: primary oil consumption.
[a] POC and POC/Capita refers to 2005 apart from Brazil (2004).
[b] Refers to passenger cars for all countries apart from India (LDVs) including all 2-axis, 4-tyre vehicles in USA and minicars in Japan, year 2006 for EU-27 and Russia, 2005 other countries.

Source: Kjärstad and Johansson (2009)

In the 1950s United States was producing 50 percent of the world's oil supply, but the depletion of its wells has decreased its share to 10 percent. Currently, on national level the global oil supply can be said to be ruled by the OPEC and Russia. The oil MNEs which have operations in multiple locations around the world like Shell, Total and Exxon Mobil, play also special parts in the oil game — the public largely considers these companies as the synonym of oil company — but when the importance is measured with the holding of reserves, the national oil companies of major are the most influential institutions in the industry. Joint ventures between the big public oil companies and national oil companies is common arrangement in the industry because companies like Shell and Total possess the technology that the other national oil companies often need in the operations.

3.2 The Origin of Oil

Oil is a hydrocarbon and its main ingredient is organic residue of dead animals and plants. The residue is normally broken down by bacteria, but in certain circumstances—aquatic places with low oxygen such as lakes, river deltas and inland sea beds—where the residue is secure from bacteria it survives and gets bind to sediments. The pressure within the sediments produces kerogen. The normally insoluble kerogen is a mixture of organic molecules and clayey of rock which is known in petroleum geology as the source rock. Because of geological subsidence, sediments are transported to higher depths, where the temperature and pressure gets higher. These extreme conditions transform kerogen to hydrocarbons by breaking up the long molecular chains and expelling oxygen and nitrogen. In the temperature of 50 °C - 70 °C the kerogen is transformed to crude oil and in 120 °C - 150 °C the oil itself turns to wet and dry gas.

Expelled from their source rock, the newly generated oil and gas are lighter than water and they start to ascend toward the surface. If these substances get to the earth's surface they lose volatile components embedded in them and solidify to bitumen redolent to tar. Oil can be produced from tar, but is far more costly than from crude oil. In order to keep existing as crude oil, the liquid must encounter an impermeable layer and trapped underneath the surface in the pores and fissures of a rock reservoir. Once trapped in reservoir, fluids arrange to layers from the lightest to

the heaviest, gas on top, then oil and finally water. An oil field is made of large number of reservoirs in close proximity.

The exploring of the hydrocarbons is nowadays harder and harder, because the undiscovered reservoirs are usually situated in the depths ranging from 5000m to 6000m and often located offshore (Babusiaux**,** Favennec, Lepez & Copinschi, 2007, p. 57). The technologies in oil exploration are constantly developing, but the art of drilling is still the only definite way to be sure about the existence of the oil reservoir. Because exploration drilling in the contemporary circumstances is very costly (onshore between 2-5 million dollars and offshore 8-20 million dollars) oil companies rely firstly on geological, geochemical and geophysical research beforehand.

Geologists search for areas that fulfill the criteria for where hydrocarbons are probable to accumulate. Geophysics is used to study seismic reflections which help to discover more about the properties of the subsoil. As said, the reservoir can't be certain and the drilling is needed to get core samples, cuttings and electrical data which then are used to analyze if the structure under the surface can hold economically noteworthy amount of hydrocarbons. Once the green light for drilling is shown, there is still much to do. First there are conceptual studies to compare the technical variants associated to oil rig design and costs and probable difficulties embedded in the project. Then the preliminary design phase is done in order to decide the detailed final concept, measuring the capital costs carried and making agreement between the different parties involved in the project which sets the pertinent choices and parameters for the project. Next comes the basic engineering and detailed engineering before the construction of the rig starts. At the end, the entire project takes years rather than months and billions rather than millions from geological studies to first barrels (bbls) shipped to refinery for extracting and eventually for further development.

3.3.2 Views on Peaking of Oil Production

After the end of World War I, the former French President, Georges Clemencau, announced that *"petroleum is necessary to the economy as blood the human body"*. The classic way to get oil

from reservoirs to refineries that produce this precious substance is to drill it under the earth's surface and the other way is to extract it from the tar-sand. At the moment Canada is the most active practitioner of the latter option and tar-sand is one of sub-groups of non-conventional oil. Other non-conventional oil is deep offshore drilling and ultra-deep drilling. The non-conventional is more costly, it requires more advanced technologies, larger investment projects to get it to refineries than the conventional oil. The conventional oil is the one that human kind has enjoyed for many decades, but which is nowadays very rarely found.

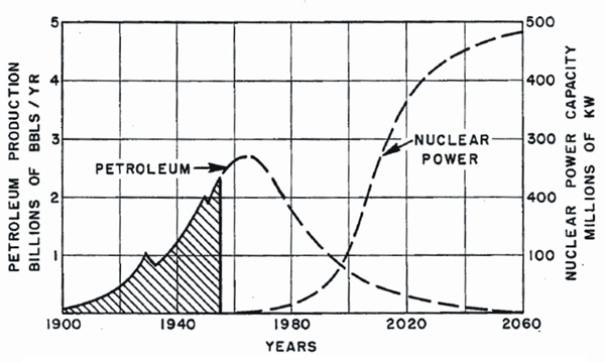
The whole subject of remaining oil reserves is difficult to study—especially when the word "scientifically" is involved—because there are so many political, social and economical interests linked to it and no matter what forecast one believes on, the truth is that no one knows the real situation. This section still tries to get a big picture from the subject.

Still in 1980s the finiteness of oil was not an issue to nearly anyone. It has happened in this century that big oil producers have brought their estimations of the world reserves to much lower than they previously were (Leggett, 2005). Shell and Saudi Arabia shocked the world news by stating that the reserves still to be found are overestimated. This was a major political win for the group of scientists and thinkers called Peak Oilists.

Peak Oil concept means situation where half of the extractable oil in the world has been used and mbpd (thousand barrels per day) rate cannot be increased and hence it can be called the maximum point of global production. The first researcher to conceptualize and predict peak in the oil production was Hubbert (1956) who predicted the peak of U.S. oil production right, roughly 15 years beforehand. Chart 3 shows his original work which included also a prediction how the production of nuclear energy will grow due to oil peak. Later on, Campbell and Lahèrre (1998) argued that global peak in production would come sooner than imagined. His reasoning was based on findings that showed that demand of oil was far greater in comparison with new oil reserve findings. They predicted that peak will be reached before 2010 and this would increase the price of oil because the demand is still growing significantly. To promote the ideas and implications of Peak Oil, Cambell founded Association for the Study of Peak Oil and Gas (ASPO). Important for reader at this point, is to understand the many peak oilists predict that

high oil prices at this point of history would put global economy through changes that can reverse the globalization.

Chart 3. Concurrent decline of the petroleum production and rise of production of nuclear power in the United States



Source: Hubbert (1956).

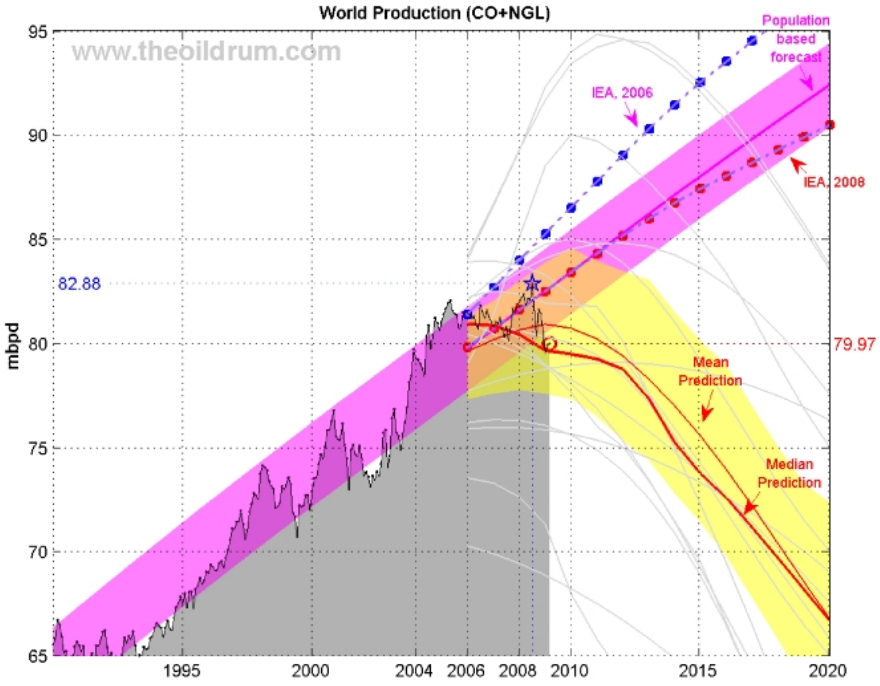
Chart 4 on the next page depicts the wide differences in modern predictions (mbpd meaning production of million barrels per day, CO stands for crude oil and NGL for natural gas liquid). Notable is that mean prediction predicts the peak approximately to 2009 and this is based on the estimations that predict the peak happening before 2020. These predictions can be stated to belong to peak oilists' view of the future oil production/supply. There are various other organizations that study the peaking oil supply beside the already mentioned ASPO, such as Oil Depletion Analysis Centre (ODAC) and Energy Watch Group (EWG) (Kjärstad et al., 2009) and The Oil Drum (TOD). Some notable individuals in the discourse are already mentioned Campbell and Lahèrre, Simmons (2005) and Leggett (2002).

When examining the different lines of production curves from Chart 4 below, it is not exaggerating to argue that the scientific debate about the oil reserves is mixed, biased and full of conflicting political, social and economical interests. The thick magenta (or grey) line represents the projected oil and NG consumption of the world, based on population.

Some of the largest oil field reserve figures are veiled in secrecy, for example biggest producer country, Saudi-Arabia, is known to transfigure its reserves (Simmons 2005). Oil companies,

importing nations and different organizations have their own interests to predict the production to certain direction.

Chart 4.World oil production (EIA Monthly) for crude oil + NGL[2].



Source: (www.theoildrum.com)

For example, the I did not find a single research from ASPO web site that predicted the peak to be after 2030. However, even IEA, which has been the most optimistic of international and unbound institutions, has urged governments to reduce oil consumption and has also stated that the global production of 116 mbpp that it had earlier predicted is not to be seen in 2030 (King & Fritsch, 2008). Further evidence that peak oil could be near or nations are afraid of it, has been the change in political atmosphere and the fact that nations are seeking to reduce their oil dependency (see e.g. Deutch, Schlesinger & David 2006). Zhao, Feng and Hall (2009) see in their paper, that peakoilism has not yet developed to a publicly accepted theory and they argue

[2] The median forecast is calculated from 15 models that are predicting a peak before 2020. 95% of the predictions predict a production peak between 2008 and 2010 at 77.5 - 85.0 mbpd. The thick (gray) magenta line is the 95% confidence interval for the population-based model.

that one of the reasons for this is the inevitable fact that current economical plans rely heavily on consumption of oil and projecting of oil depletion is politically unpopular maneuver.

A phenomenon this complex and severe is often accepted widely in public through scientific evidence, which is put on more simplified form for the general public and politicians. Perfect example from this is the global climate change and the Nobel Peace Prize that validated it. The former US vice president Al Gore was the face for the large group of scientists and researchers that presented the evidence which fossil fuels can indeed accelerate the warming of atmosphere. Peak oilists are in many ways a similar group, but their central theorem is the one of Hubbert's and it lacks the scientific evidence that it would be a proper model for predicting the peak of production. The predictions of Cambell and Laferrere have encountered hefty amount of opposition and critic. The main critic has been related to Hubbert's model and that it has serious deficiencies in logic and application (Cambridge Energy Research Associates**,** 2006). Babusiaux et al. (2007, pp. 99 - 100) conclude that Hubbert's model of forecasting the production decline has been successful only once, in 1969, so it is still far from universally validated framework or theory. In fact, there is not any scientific evidence for the model's effectiveness in forecasting the global scale production peak. Babusiaux et al. continue to point out that Hubbert's model and its justification has been tried to explain with a mathematical theory called central limit theorem, but he reminds that this kind of prediction making falls to the area of time series analysis . Even that some of the production profiles of world oil field follow the normal distribution with a bell-shaped curve that doesn't meant that they all are normally distributed, or even symmetrically. Hubbert's model makes time the only explanatory variable for the production of a certain region which according to Babusiaux et al. is an "astonishing idea" because it predicts a mirroring of growth phase to decline and does not take account the technological development that shapes the curve away from normally distributed shape. When a field depletes or is no more economically sound the *post mortem* profile of the field is often different than the initial one and this is most often the case due to technological development.

Kjärstad and Johansson (2009, p. 447) add further critic towards Peak Oilists: "In theory, one can model peak oil to occur at any point in time under a given production/demand profile since peak will depend basically on one single parameter, namely the assumption on URR (or, if not

considering past production, ultimately remaining recoverable oil). Choosing a low URR will lead to an early peak while choosing a higher URR will prolong the period up to peak". URR refers to the oil that remains in given region and can be recovered. Given how difficult it is to estimate the URR in a global scale, peak searchers can be said to throw educated guesses.

When moving out from the question of whether who are right in their predictions, the majority of different global scale profile predictions can be divided to optimists and pessimists. Pessimists see that technological development will only lead to more rapid depletion when optimists argue that technology can lead to increased reserves. There are examples of both cases in single oil fields. The importance whether the overall reserves act according to optimist or pessimist way is essential when estimating how the reserves will develop and what kind of impact they will have. Peak oilists represent the pessimistic view of the world which was already discussed, as optimists base their thought on the fact that predicted increases in prices have not materialized, except the two shortage fear based and artificially from supply side constructed oil crises in 1973 and 1979. Optimists acknowledge the fact that oil is a finite resource and will be eventually consumed to extinction but they—the opposite what pessimists predict—believe that price will stay stable in the long term. In a sense then, the only major difference in the views of optimists and pessimists is the question of what will happen to price. Babusiaux et al. (2007, pp. 104-105) thinks that because the prediction of the pessimists have not been fulfilled in the price, then the markets refuse to accept the pessimist view. The many times predicted or even statistically proven shortages in supply that lead to price increases, have been avoided because of gradual shifting to non-conventional oil and particularly investing in nuclear energy in the aftermath of 1970s oil crisis.

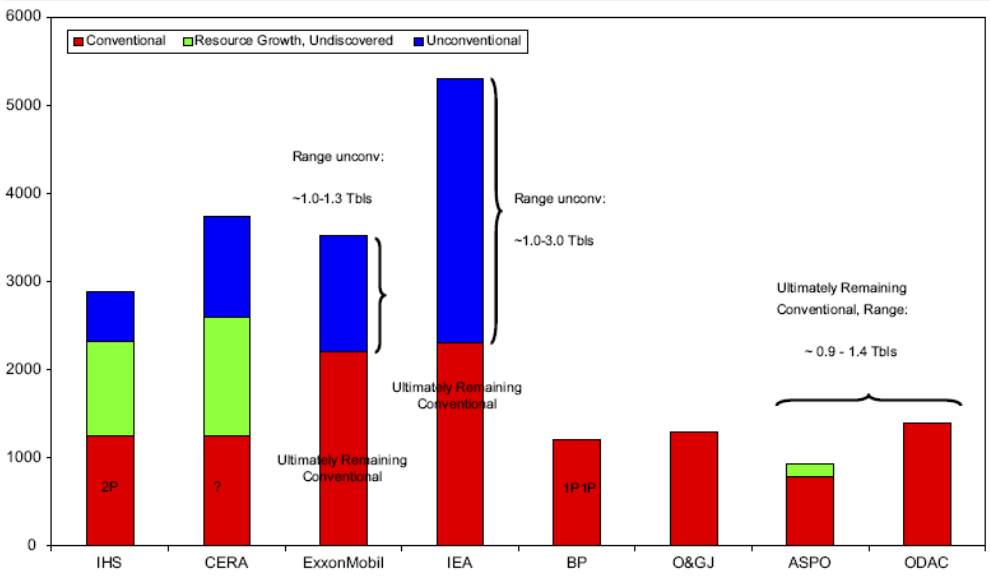
Kjärstad and Johnsson (2009) approached the subject of oil supply/demand with their neutrality seeking research that looked the discovered resource base from three different levels: country, oil company and oil field. With this approach they assessed how much oil can be extracted from the discovered fields and how much oil is to be discovered. Their research contains very large review of different data sources (oil and consultancy companies, international institutions and national statistics) and some estimates, like Middle East reserves, have been gathered through multiple separate estimations. Their study is one of the most holistic approaches to subject that I

encountered and their argumentation seems unbiased and careful. Chart 5 shows 8 estimations (see Abbreviations for the name full names of different estimation makers) from different entities.

Kjärstad et al. (2009, p. 445) come to conclusion that no matter what demand scenarios we use, two thirds of current estimates of proven reserves are by 2030 and thus, it is necessary to ‘‘prove up’’ more oil to meet demand or to significantly reduce global oil consumption and avoid peak before 2030. They continue to argue on the base of their study that resources are sufficient enough to meet the demand in 2030 because oil companies and producing countries have found new reserves that are substantially larger that proven reserves and there is significant potential lies in already discovered fields. They are also optimistic that all new reserves can still be found.

The problem (Kjärstad et al. 2009, p. 462) lies in recovering the resources in time and they predict that the global oil supply continues to be tight because of rapidly declining production of Mexico and North Sea, geopolitical tensions, lack of surplus capacity, price and difficulties of producing non-conventional oil, limited access to Middle East, Russia and Venezuela and budgetary constraints of some national oil companies.

Chart 5. Various estimates of proven reserves and remaining oil resources by the end of 2005



Source: Kjärstad and Johansson (2009)

Thus, they see a possibility that global oil production may peak or plateau in relatively near future, but not because of limited resources, but insufficient investments to exploration and production. They still continue to remind that the coordinated global effort to reduce the effects of global climate change will mitigate the long-term demand of oil. In the future, oil is getting more expensive to recover to surface and this will lead to oil price increases. The majority of production will be in the regions where the transparency of oil industry is poor and ongoing polarization of the producing and importing countries will increase when the production is concentrated on Russia and Middle East. It is clear that this will make the creation of artificial supply shortages more effortless for producing countries, which would also lead to price increases.

It seems that producing countries are holding all the aces at the moment and even if the peaking of oil supply would not happen, the price of oil is under continuous threat to increase. Not least because producing countries and oil companies require higher oil prices in order to invest to, for example, deep water reserves. Because we cannot predict the underneath oil reserves clearly or see the what happens in the oil producing countries, it is more a question of substitutes and the time pace that they become seriously taken technologies that can replace oil in a long run.

3.2 The Substitutes for Oil Economy

Many nations acknowledge the problems associated to oil's finiteness. No matter what theory or forecast you believe when it comes to oil reserves, the consensus is that substitutes for oil must be developed. Several technology developers and believers of these new technologies have announced that their "substitute" is the one. When we think the market size of oil business it is no surprise that economical stakes are high and different technologies compete also between each other and lobbyists are busy convincing politicians to add their energy solution to official government programs. This section of the research goes briefly through the different substitutes and their prospects. The substitute technologies that are most often mentioned in the context of oil or other hydrocarbon energy source as coal are hydrogen, synthetic oils, bio fuels, natural gas (a short term solution) and plain old electricity. In order to understand how the future oil prices

can have impact on the MNEs, it is essential to have a closer look to these technologies and their prospects and predicted time lines when they begin to be in reach of every consumer and company.

Electricity

At the time of writing the global car industry seems to believe in the electric mobility, even that the electric cars have small radius of use (circa 100km according to Volkswagen) and requires huge infrastructure investments because the cars need charging stations. Hybrid motors, which use both gasoline and electricity, are then obviously the near future trend of freight forwarding. Even companies like Audi (one executive of the company said that electric car "is for idiots") still in 2009, are going after hybrids and after that the all electrical line of products will follow. Despite the small radius, it is enough to solve the transportation in cities, but the oil consumption of global supply chains are not definitely solved by electric mobility in the near future. Still it can curb the oil consumption and eventually price also because the urbanization of the world is still increasing.

There are many studies and reports that compare the relative cost of electricity generated by different technologies, but results are mixed and generalization is brave because of the multiple factors (see e.g. UK Energy Research Centre 2007: California Energy Commission 2009) that are involved in the subject. Nuclear Power is a hot topic in the politics in various countries and despite the countries, such as Sweden is decreasing its nuclear capacity, other countries like Saudi Arabia, China and India are investing to nuclear power plants, but the total number of nuclear power plants will most likely drop because of the lead times of new plants (Schneider, Thomas, Froggatt & Koplow 2009**)**. Other solutions to generate electricity are wind power, solar power, tide power, hydroelectricity, geothermal and renewables, but at the moment nuclear energy seems to be number one solution by governments that face increasing energy demand. However, solutions should be—whatever they may be—quickly decided, because energy consumption of the world will increase once again as it recovers from the financial recession.

Hydrogen

Hydrogen economy enthusiastic predicts that hydrogen will be the major source of energy for global village and it could be used as fuel for transportation. However, according to Romm (2004) the hydrogen will not solve the climate change, because hybrid motors are simply better and cheaper, most efficient of the hydrogen is by natural gas which would produce emissions, and finally the cost to turn oil economy to hydrogen one would be too high. Romm sees the future of car as flexible-fuel, plug-in hybrid vehicle running on a combination of zero-carbon electricity and a biofuel blend. Lovins et al. (2004) countered some of these arguments, but at the time of writing it seems that hydrogen has lost its highest appeal, as the Administration of Barack Obama cut 100 million dollars from the hydrogen fuel cell projects (newspaper source).

Biofuels

Recently biofuels are the most discussed renewable energy products and many countries and industries hope that these fuels derived from the wide variety of biomasses can substitute at least percentage of oil. Biofuels are of courser used also for electricity generation, but to understand better the future of oil, this paper focuses more on the transportation usage.

In public and political debate, biofuels have been mostly linked to fight against global warming through reduction of greenhouse gases in transportation and to the problem of increased food prices which are result of using corn and other food stocks in biofuel production. Biofuels are already in the markets and biodiesel and bioethanol are two the most common forms and second generation biofuels such as pulp based are still in the development phase. The world's bioethanol production tripled during 2000 and 2007 from 17 billion to 52 billion (UNEP, 2009 p. 33). The percentage of total transportation linked energy consumption is still modest. From the average consumption of 2005-2007 to 2008, the share of ethanol in global gasoline type fuel use increased from 3.78% to 5.46% and the share of biodiesel in global diesel type fuel use from 0.93% to 1.5% (OECD/FAO 2008 referenced by UNEP 2009).

By 2020 EU targets to have 10% of transportation energy from renewable sources. This figure contains also electricity and other "fuels" as long as they are renewable by nature. The timeline of the target implies that the biofuels are not considered as the short-term answer to get out of the oil economy. Furthermore, the first generation bio fuels, which are produced also from food-crops, have received negative publicity because they are said to take land from the food and increasing food commodity prices, plus it is argued that increase of palm oil plantations have led to deforestation. This debate continues and according to UNEP report (2009), the impacts to environment and agriculture needs more research.

Still, the biofuels seems to be promising because many countries have started the development. The target of this is most likely to secure an energy source for the future, promote rural development and combat climate change despite that using biofuels in transporting is not considered to be the best way to battle the climate change (UNEP, 2009, p. 88). Second and third generation biofuels, which use non-food crops, waste, cellulose and algae are promising, but their applicability in large scale (UNEP, 2009, p. 55) is not yet demonstrated.

Synthetic oils and fuels

Biofuels could be under this category but are excluded because their raw material origin is very different in nature event that the technology behind can be the same. During a second world war Germany developed a process called Fischer-Tropsch process, which converts gas or coal into synthetic light oil (Babusiaux et al., 2007). Beside the coal and gas, heavy and extra heavy fuel oils and tars can be used in the process, but despite the honorable age of the process it is still difficult and costly way to produce synthetic light oils. Kjärstad et al. (2009) argue that synthetic fuels, gas-to-liquids (GTL), coal-to- liquids (CTL), do not attain more than a marginal role in the short term and medium but can offer significant production potential in the long term.

Natural gas

Although there are already a lot of cars and some cargo vessels running on gas and it is used to produce large amounts of electricity in certain regions of the world, it is not a solution to global

climate change. Natural gas can be found to a large extent in the same areas as oil and its price is often indexed to the oil price which makes it difficult to treat as true substitute for oil. There are some developments though, in the gas extraction technologies and some U.S. based sources have denounced that the new technologies will transform the whole country to a large gas field (newspaper source). Nothing is certain yet and the technology is so new that it will probably take several years before it can be used in large scale. We must wait and see.

3.3 Conclusions about the Future of Oil

We have now reviewed a set of literature that discussed how the future of oil is seen by different parties and notable individuals. The main insight is that even that peak oilists would be wrong in their predictions that the peak oil would happen before the 2020 or already happened, the supply of oil will remain tight, which can lead to price increases and fluctuations. The end of non-conventional oil will have tremendous pressure to price and the cat-and-mouse game of OPEC and the oil importing countries—where OPEC tries to keep oil price on a level that does not courage to more rapid alternative energy development solutions—is likely to continue in the future.

The discussion in this chapter shows that the world is sailing in unknown waters when it comes to future of oil economy. The overall picture from the future energy solutions are developing all the time and there might show up new unexpected breakthroughs that change the current picture. The economical rewards that a breakthrough technology would bring are huge. Therefore, it is probable that the suitable solution is developed in the end. When does this occur is a different and more difficult which remains to be answered because the new infrastructure that an oil substitute, (e.g. electricity) needs, is simply enormous. World energy consumption increases in steady rate as the developing countries pursue towards more western lifestyle. Large MNEs (especially those with global production network) should understand this when planning their future strategies because the effects that oil has to economy and society are numerous.

4. Oil, Economy and MNEs

This section demonstrates first how oil price is formed and what can impact. Then the global and national macro economy and industry level effects of oil are discussed. The motivation behind this is to depict how important the oil is economically and how special its price formation is when compared to other commodities.

4.1 Price Formation of Oil

The formation of oil price and effects to economy would cover a doctoral dissertation on its own, but in order to understand the effects better to global strategy and global production network we must cover the basic literature linked to subject.

Crude oil comes in variety of qualities. There are some 400 different qualities that all have their own names and abbreviations which refer to single oil field or blend of different oil fields (Babusiaux et al., 2007, p. 38). Despite the vast number of qualities, the oil price is considered very coherent between the market places, but varies between the qualities. Some qualities yield more gasoline (and are more costly) and some are better suited to heavy fuels. Many countries use Brent quality as a benchmark for the crude that they produce and Brent blend price is published daily. This quality is used in agreements in spot and long-term contracts. Two crude of the same quality should have similar prices. Industry uses the FOB and CIF prices. FOB should be the same for the same crude, but CIF varies between the ports of destination. Despite these practical matters, the physical location of the oil field has most important relationship with the price in the age of non-conventional oil. The main reason is that when the oil prices are low, major oil companies are reluctant in investing to millions of euro exploring projects in difficult circumstances, because they cannot be sure that they will break even with a project. The relationship can be considered to be self repairing in long term view as long as there are new reserves to be found, because if the oil prices are down the companies don't invest and prices go up because markets consider that supply can be insufficient in the future. In the time of writing this study the industry reported in the news that 2009 was the record year for new oil reserve

findings when measured in barrels. This can be seen as consequence of record high oil prices of 2008, which allowed oil companies to invest in exploring.

In the aftermath of 1973 oil crisis, economists argued that the crisis could be explained with Hotelling's (1931) Law of exhaustible resources (Babusiaux, 2007, p. 44). The theory states: if production costs are negligible the price of an exhaustible resource follows the discount rate, and if the production costs are not negligible then the discount rate would equal the marginal extraction cost of the resource. The theory's main idea is that if the price is increasing slower than the discount rate, then the producers produce the resource as fast as they can and vice versa. Solow (1974) proved that the oil price followed the theory but (Babusiaux et al., 2007) argue that in the age of non-conventional oil, the theory cannot explain the price formation. Hotelling's Law is based on assumption that the finite resource can only be replaced by a substitute or new technology with significantly higher cost. However, the R&D efforts initiated by the oil crises and OPEC domination in the markets have led to major cost reductions in the exploration and production and thus also to cost differential between the conventional and non-conventional oil. For example, in the start of 1990s the extra heavy crude of Orinico (located in Venezuela) would have break even if the barrel price would have been 30$, but the break-even point had decreased to 15$ in the beginning of 2000s and the production took off.

Rogoff (2006, p. 3) points out that the oil industry's nature is that the investment cycles and long lead times also reflect on prices. The under investment of the 1990s—when oil prices were low— lead to a price increase in mid of 2000s because of insufficient supply. The markets and their view on supply conditions did not always set the price for oil, and there have been many different systems throughout the last century for setting the price (Babusiaux et al., 2007, p.42). Around 1980 the forward and future markets begun to develop. This made it possible to arbitrage between the different crudes with a similar quality, but eventually led to more coherent prices between the markets and arbitrage became more difficult.

OPEC and especially the Arab members (Saudi Arabia, Kuwait and United Arab Emirates) of the cartel hold the keys in price formation. Because of their wealthy financial situation, they don't need stable cash flow in the short term from the oil revenues and thus they can adjust their

production up or down in order to adjust the supply and eventually price (Babusiaux et al., 2007, p.46). But real world is not plain macroeconomics and interplay between supply and demand and OPEC noticed this when the "oil weapon" backfired in 1980s and importing countries countered the high oil price with energy conservation, reducing investments to OPEC countries and substitution which lead to severe damages in national economies of OPEC countries (Yetiv, 2006). Giraud (1995) pointed that there is a range where the price can flow without major causes to oil demand and which suits also for OPEC. As the technology develops and non-conventional oil becomes cheaper to produce—Gulf oil is in the league of its own in low production prices—Babusiaux et al. (2007) argue that new non-OPEC countries could become able to cause instability to the price. Still, Hamilton (2003) argues that historically wars in the oil producing regions are the most severe oil shock reasons, but he holds that the main reason behind this could be the psychological fears of that future energy prices will be high.

Now, the price formation can be considered as interplay between the available supply (naturally, wars, conflicts, terrorism and natural disasters in producing locations and supply chain have effect to supply), demand and technological development which lowers the production costs, but the financial markets and brokerages that deal different oil derivatives have also a word in price formation.

4.1.1 Financial Markets and Oil Price

Oil has a double personality—a commodity critical to the security and economic viability of nations but also a financial asset. Although some suggest that financial markets stabilize the oil price there are others that believe that speculation with oil futures and forwards is a major problem for the stability of the world economy.

Financial markets have been stabilizing the oil in some occasions (Babusiax et al., 2007, p. 36). For example, when the Iraq invaded Kuwait the oil prices increased rapidly by 100%, because the global supply dropped by 4Mbbl/d. Saudi Arabia, Unites Arab Emirates and Venezuela quickly reacted by increasing their production to answer the shortfall. However, before these countries increased their production the futures markets predicted that prices drop back to initial

level within several months. The reason behind this was that markets believed—and betted—that U.S. will react to situation with armed intervention and the supply will be back to normal. When the U.S. reached the Kuwaitian soil, the markets discounted the future prices with short military operation and actual price fell, even that experts predicted that attack will lead to a brief increase in crude price.

The above example depicts the influence that financial markets have on the oil price, but the operations, moods and speculation in the financial markets can work also to opposite direction with negative consequences to world economy. Kaufman and Ulman (2009) made a research that studied the causal relationships between the prices for the ten crude oils and suggested that the rise in oil prices, towards in early 2008, was generated by both changes in market fundamentals and speculation. The result is not surprising despite the public debate which usually tries to highlight one or another reason. The researchers depicted that the process started as supply/demand balance led to higher prices because of stagnant non-OPEC production. Speculators saw this and predicted that these market fundamentals would increase the price further and this was seen on future markets. This eventually reached also the spot markets and led to beyond justified prices—if judged by then existing supply/ demand balance. United States Senate Permanent Subcommittee on Investigations (2006) has released an investigation report, where it is stated that speculation in the U.S. energy commodity markets is worth tens of billions dollars and this has both increased the energy prices and distorted the historical relationship between crude oil prices and inventories. This has led to situation where the inventories are high together with high prices.

The above examples show that the financial markets are involved in oil price formation and can distort the price beyond market fundamentals. At the time of writing, U.S. and U.K. are planning to curb some of the biggest speculators in order to put an end to extensive speculation. The results are to be seen, but the main insight from this is that the financial markets can both stabilize and fluctuate energy and oil prices.

4.2 Consequences to Macro Economy and Industry Level

Oil has been one the main sources of energy in the 21st century and energy is one of the basic building blocks of economic development (Toman & Jemelkova, 2003). Oil crisis of 1970s showed for the first time how vulnerable the global economy is when it comes to higher oil prices. Second time was the year 2008 when barrel prices breached record after record. In the globalized world where our fortunes are the same, the higher oil price equals higher production and transportation costs around the world (Deutch et al., 2006). In short or medium term period, demand of oil is inelastic; hence the consumption stays at the same level despite the higher oil price. This again, develops to situation where consumers have less income to spend to consumption. Increased costs lead to higher inflation and together with increased input costs, lower investment levels and reduced non-oil demand, the oil importing countries see their budget deficits increase and tax revenues fall due to rigidities in government expenditure, which tends to develop also to higher interest rates. Inflation puts pressure to real wage increases and increased wages summed with reduced consumption pursues companies to cut personnel costs and thus increasing unemployment.

Given the effects of this vicious circle, the initial price rise of oil barrel produces a magnified effect to global GDP. The longer the price stays up, the bigger the effect. Price has also effect on transfer of wealth from oil importing countries to oil exporting countries. Dwindling balance of trades in importing countries causes pressure to exchange rates to go downward. This results more expensive imports and cheaper exports, which produces lower real national income. IEA (2004) has calculated that an increase of 10 dollars in the oil price, leads at least drop of 0.5 percent in GGDP, if the price increase sustains one year. In monetary terms, this equals 255 billion dollars. The impact is relatively more severe in developing countries than in OECD countries and IEA argues that the same scenario results drop of 1.5% in GDP for developing countries, when OECD countries suffer deterioration of 0.4%.

Economists have tried to explain the underlying macroeconomics of oil impact (e.g. Finn, 2000: Barsky & Killian, 2004), but there is not one universally applicable theory and some authors, like Hamilton (2003), points out that the relationship between oil and economic activity is not

universally linear and depends on the case, which may well be the reason why there is no “theory of all”. Rogoff (2006) points further out that high oil prices can lead to recession, but low oil prices don’t lead to economical boom. If this would be the case, then the oil price would not be so critical factor for economy because it would balance its own effects.

Global economy has developed much since the great oil shocks and is less vulnerable to oil shocks; thanks to the international financial integration, which allows the sharing of risk between different importers and producers (Kilian et al., 2009). Oil price has been cushioned by many developed country governments with wide variety of policies and control mechanisms, such as taxes and subsidies of fuel (Rogoff, 2006). These policies work in the short-term but in long run they add stress to financial stability and government debt. As Kilian et al. (2009, p. 20) suggest: ”the widening imbalance in the U.S. current account can be explained to a large extent by the cumulative effect of demand and supply shocks in the crude oil market”. Beside the above listed effects, the most important concern for global economy is that it cannot deduct the possibility of oil inflected recession (Rogoff, 2006).

Consequences to stock markets have also been studied. For example, Sakellaris (1997) found that oil price shock of 1973–1974 had impact on value of firms whose profitability was linked to oil prices. Park and Ratti (2008) saw that stock markets of oil exporter countries had positive response from oil price increase, when stock markets of many European importers felt depressing effects in real stock returns. Interesting in their study was the fact that U.S. did not felt the effect, even that it is the most largest oil importer in the world. This might have a linkage to the imbalance of U.S. current account described above by Kilian et al. (2009).

The evidence that oil is one of the most important factors in the world economy and it has effect to almost every macro economy metric is clear, hence the next step is to investigate industry and firm level consequences. Edelstein and Kilian (2007) point that there are two main mechanisms by which energy price shocks may affect nonresidential fixed investment in a macro economy (consists of purchases of both nonresidential structures and equipment and software which are made mainly by companies). First mechanism affects through increase in the price of energy raises the marginal cost of production depending on the cost share of energy. A second

mechanism comes to effect by lowering the demand for the firm's output, as consumer expenditures fall in response to rising energy prices. These are still very large scale effects and vary between the companies. If the stock market study by Sakellaris (1997) already pointed out that the firm values are affected by oil prices, the study by Lee et al. (2002) lists the effects to certain industries in Table 13. Although the data for their study is relatively old, it gives a picture how the oil price affects the industries and companies and how the effects to one industry are shifts to other.

Table 13. Summary of Trade Journal coverage of effects of oil price shocks in 1973–74 and 1978–81.

Industry	Magazines or trade journals	Major stories during the oil crises	Main impact on industry demand and supply
Petroleum refinery	Petroleum Engineer International	Increase in input cost	Reduction in supply
Industrial chemicals	Chemical Week, Chemical & Engineering News, Industry Week	Increase in cost of production of chemicals. Reduction in demand for chemicals plays a secondary role	Reduction of supply, and minor reduction of demand
Paper products	Pulp & Paper	Shortage of petroleum reduced production of paper in 1974, weak demand caused shutdowns of many paper mills in 1982	Reductions in supply and demand.
Rubber and plastic	Industry Week	Reduction in demand in rubber and plastics due to slumps in auto sales, reduction in supply of plastics due to higher input cost	Reduction in demand and supply
Steel and nonferrous metals	Ward's Auto World, Chemical & Engineering News, Industry Week	Reduction in demand of steel and aluminum due to slumps in auto sales, increase in demand of steel in energy related sectors (rig and pipeline building)	Mixed effect on demand, minor reduction in supply
Apparels	Apparel Industry Magazine	Gasoline price increase reduces demand for apparel through income effect	Reduction in demand
Automobiles	Ward's Auto World, Industry Week	Slumps in sales of full-size cars	Reduction of demand
Machinery and tools	Industry Week	Increase in demand of machines used for energy related projects, reduction in demand of certain machine tools for the auto industry	Mixed effects in demand

Source: Lee, K. and Ni, S. (2002)

One important insight that the authors point is that oil price shocks mostly reduce the supply of oil-intensive industries and mostly reduce demand of other industries, such as car industry. Unfortunately there are not more modern peer-reviewed publications from the topic, but the world has not changed so much since 1970s that the study would not provide insight to effects.

4.3 Highlights of high oil prices to global and national economies and industries

- Macro economy can suffer from relatively small fluctuations in oil price.
- Oil price formation is complex and has many factors such as geopolitics, conflicts, OPEC, supply & demand and financial markets.
- An oil based global recession is possible.
- Larger macro economical impacts like inflation, consumption and exchange rates take effect with delay.
- Financial markets can stabilize and fluctuate oil price and oil price itself can affect financial markets returns.
- Different kinds of industries react differently to high oil prices, but usually negatively.

5. Oil price and International Operations

This study examines if the logic of the MNE global strategy and GPN might have to be revisited in the near future because of changes in the global oil supply. The existing and new substitutes for oil and its derivatives may not arrive soon enough to fix all the problems that the tightening oil supply and the eventual peaking of oil supply causes to global economy. Previously reviewed literature has covered the issue and also highlighted some impacts that industries suffered from the previous oil crises. The Section 5 goes through the four topics that are important when a company acts internationally/globally and which can be affected by the oil price: *transportation, exchange rates, manufacturing* and *consumer tastes*. Some of the papers cited in this section are not peer-reviewed, but they are retrieved from specialized journals (for example Harvard Business Review, Supply Chain Management Review and Accenture reports) or they are reports made by companies or organizations. However, they must be approached more critically than peer-reviewed publications.

5.1 Oil Price Effects to Transportation

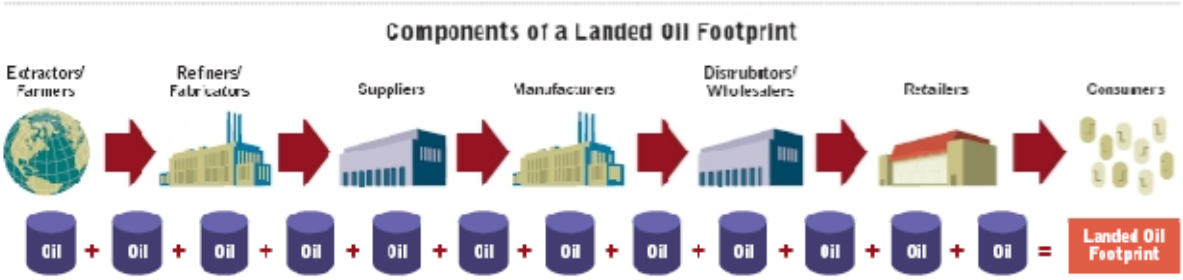
Oil has many uses, but the most important usage is energy production for transportation and logistics. In order to connect the different nodes of the production network, components and final products travel thousands of kilometers. Affordable transportation is one the main pillars of globalization and international trade. This is seldom mentioned when the drivers of globalization are listed by the academia. This might be because the affordable oil and fuel have been obtainable before the latest wave of globalization took off: when inflation is taken in account, oil price has been always relatively stable, except during the oil crises in 1970s and 1980s and the 2nd and 3rd quarters of 2008.

Transport costs and logistics costs are called pervasive costs (Jiménez-Rodríguez & Sánchez, 2005), because they breach the whole economy and have cost effect on almost every economic activity. The negative economic effects of high oil prices tend to emerge over time and most of the impacts can be felt approximately one year later. This time lag may stem for example from stock inventories which slow the rate at which higher costs transmit into the price of

non-perishable products, while forward hedging by airline companies may serve to reduce price exposure in the short-term. Eventually, prices reach also the end users, which again may drop the demand for inelastic products. Companies in the global production networks can of course choose whether to shift the rising transport and logistics cost directly to end-user or supplier, cut their own profits or force the logistics firms to keep the freight charges normal with their bargaining power. The last scenario was the case during the price peak of 2008, when many oil importing countries witnessed series of demonstrations and strikes from freight forward companies that were struggling with the rising fuel prices.

One product and its components can travel thousands of kilometers before the product reaches the end user. This physical travel is called oil footprint (Lapide 2007, p. 10). This footprint is the simplest form of evaluating the vulnerability of a product to oil price shocks. The concept measures how many oil barrels it takes for a product to travel through the whole supply chain. This journey requires fuel for transportation and energy for manufacturing and raw material extraction. Below, Table 14 illustrates a supply chain and the role of oil in it.

Table 14. Component of a Landed Oil Footprint



Source: Lapide (2007)

If a company is going to thrive in the new economical environment, Lapide (2007) argues that the oil vulnerability of the supply chain should be reduced by letting go the old supply chain techniques, like just-in-time (JIT) and usage of premium freight[3] and struggle for lean inventories. Deering and Forbes (2009), see that new time-definite transportation services will

[3] Premium freight is usually referred as a more expensive form of transportation, like air freight or a truck that is not fully loaded, but it is more time-definite and it is often used to keep the cycle times of supply chain low.

come to resolve the problem of oil dependency when it comes to transportation, but they also argue that JIT has to be revisited by many businesses, because fuel costs of suppliers may eat up the positive impacts of JIT and buffer stocks come more sensible as long as the interest rates grow incrementally. This is due to fact that interest makes 70−90 percent of the costs of holding inventory (Deering & Forbes, 2009, p. 39). Gosier, Simchi-Levi, Wright, and Bentz (2009) echo the same ponderings as Lapide and Deering & Forbes, but in addition they state that railways and water way are the cheapest elements to do transporting in the future and those companies that must stay on the asphalt or above the clouds should consider joint shipping and thinking the efficiency of holding private fleets versus third party logistics service providers. The minimizing of trips, full loads, longer and fixed transportation price contracts with third parties and efficient spot buying capabilities of transportation and the advantages of new technologies such as GPS telematics will be common techniques in the future.

Global trade is to a large extent built upon trans-oceanic shipments which are made mainly with large ships, owned by major shipping companies. Many global production networks have also been built on the fact that transportation of raw materials and components is affordable from various locations. Containerization of the world trade has made it also possible to export products with affordable logistics cost. The sea transportation cost per one product has increased due to oil price increases. Goel et al. (2008, p.1) provide an example of this: *"The economics research institution CIBC World Markets estimates that in 2000, when oil prices were near $20 a barrel, the costs embedded in shipping were equivalent to a 3 percent tariff on imports. Today, that figure is 11 percent—meaning that the cost of shipping a standard 40-foot container has tripled since 2000"*.

Stalk (2009) argues high oil prices together with insufficient transportation infrastructure will constrain global trade and increase the costs of logistics. He calls this a global gridlock, where the global logistics system can paralyze. As supply chains have grown longer and longer, the possible number of bottlenecks and delays have also increased, which can mean that factories that wait the late being goods are idle and do not work at full capacity. This adds to labor costs. Sourcing across the world has also increased the time that goods are on the transit and it ties up working capital. This means losses in sales in industries where the consumer demand changes

rapidly or the customer needs the order in a given deadline or he turns to another supplier. Stalk sees that air freight can come more sensible in industries like these because it takes much less time to arrive to shelves or to an anxious customer.

Lovins et al. (2004) argue that transportation can be more energy efficient and less costly to customers. The key for this are lighter trucks with low fuel economy or/and new fuel alternatives. According to these researchers, customers do not care about the energy efficiency before it begins to affect their business. Large logistics companies have finances to replace their entire truck fleets in a relatively short time and they would get competitive advantage from smaller fuel costs. The same applies to airline companies (fuel cost are the second largest variable cost for airlines after labor), but their investment amount and pay-back periods are significantly larger, so the replacement of the fleet is not possible in a rapid pace.

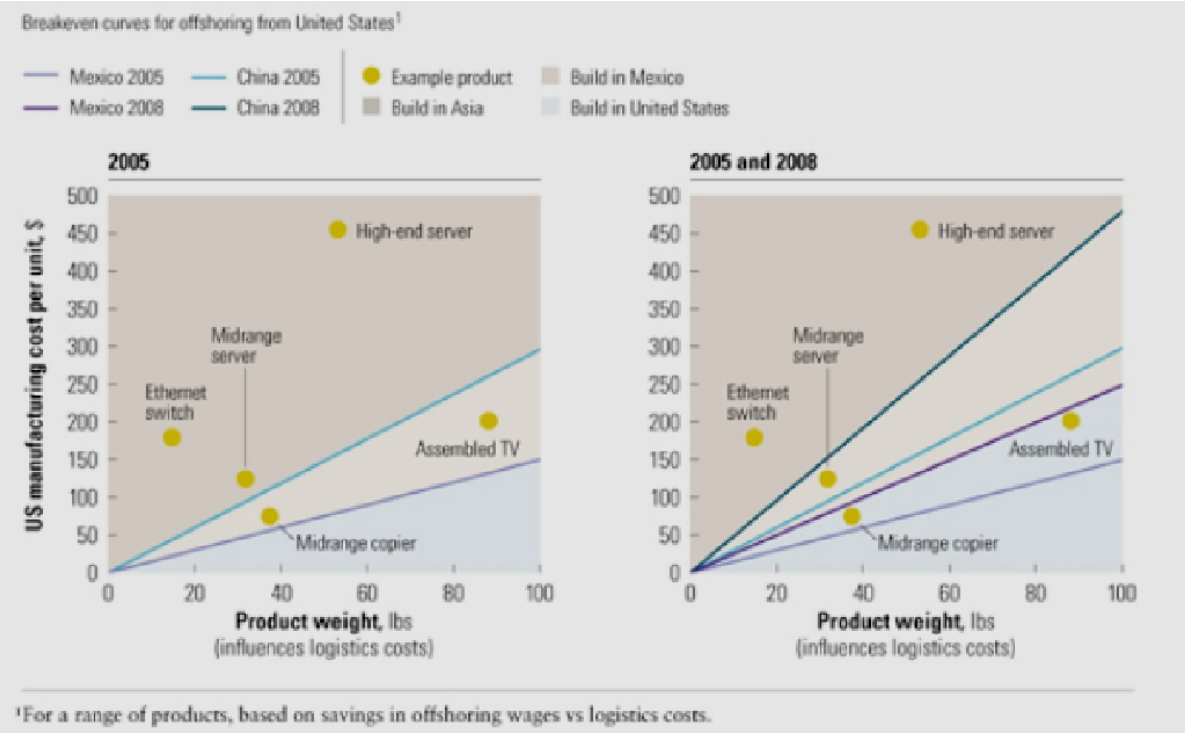
5.2 Oil Price Effects to Outsourcing and Manufacturing

Developed countries have witnessed the steady flow of manufacturing to low cost countries. This has forced many countries to develop their economies more towards R&D, knowledge and services and the initial public upheaval from job losses to Asia and Latin America has transformed to just woeful reality for the developed economies. The logic of this phenomenon is questioned by very few companies because cost efficiency and maintaining of competitiveness rules these decisions.

Highly volatile oil prices or incessant triple digit prices can however change the logic of manufacturing or offshoring in low-cost-work locations. Gosier et al. (2009) call the companies to revaluate low-cost-country outsourcing and global manufacturing in the light of different oil price scenarios. Obviously the question of manufacturing in low-cost-countries is about the cost of logistics, but there are more variables to be taken in account. The U.S based research for McKinsey by Goel, Moussavi, and Srivatsan. (2008) argues that the wage inflation of Asia, the weakening dollar and rising oil prices combined undermined the savings of offshoring. Furthermore, the authors state that oil price shocks increase also the prices that manufacturers pay for raw materials. I could add that quality issues—both real and perceived— and reliability

of timely supply add their weight to production considerations. The research (Goel al., 2008) was made at the time when oil barrel cost over $100 thus their calculations reflect well the scenario of high oil prices. Chart 6 indicates the optimal regions for products **(high-tech goods)** with a range of different unit manufacturing costs (all associated with the converting of raw materials into one unit of finished goods in U.S. dollars) and the weight of various products which again has an effect on logistics costs.

Chart 6. Rationale of Offshoring in the Light of Different Oil Prices



Source: Goel, Moussavi, & Srivatsan (2008)

From the statistics it comes clear that manufacturing in USA gained ground, when measured with production costs per unit because of the logistics cost. Mexico also became a more inviting option for manufacturing a range of products which were previously cheaper to produce in China. Deering and Forbes (2009, p. 36) provide another example: when the barrel of oil was $30, US based companies saved 18% - 25% cost savings by sourcing from China. They add that this happened on cost of poor on-times delivery, increased complicity and longer lead times. On

this level of barrel price, the freight costs were 20% of landed goods and fuel made 20% of the freight cost. With a barrel price of $150 the cost of landed goods would increase to 16%, an increase in certain categories that would demolish all the savings that low-cost-country sourcing adds to profit margins of products sold.

The state origin fuel subsidies are also an important aspect which distorts the transparency of production and raw material costs in certain countries (Deering & Forbes, 2009, pp. 36-37). When states like India, China and Indonesia subsidies fuel prices to keep their economies intact and roads full, companies must note that the subsidies don't always reach raw material (e.g. plastics) and electricity (produced from fuel) consumed in production. As the oil price increases, so do the commodity prices and savings from outsourcing and overseas production may disappear.

Goesier et al. (2009, p. 47) underline that the key to comprehend the effects of oil prices to sourcing is the net landed cost analysis, which takes in account the acquisition costs and the life-cycle costs. The result is that any item's acquisition can include purchase price, transportation, fuel, material handling, storage, supplier qualification and supplier retooling for new or customized products. Life-cycle cost adds the maintenance, spare parts, warranties, administration, software quality management, supplier relations, service risks and end of life disposition. The researchers furthermore stress that if companies do the net landed analysis they find that fuel price can have an effect to almost any purchase that they will do. The key issue when estimating the impact is the local fuel costs, shipping distance and transparency of company supply chain. The fuel price rises will eventually lead to a situation where hemispheric supply markets are considered more lucrative because the market demand is closer to manufacturing and sourcing activities. Thus low-labor countries will play a smaller role in the supply chain costs. Other notable argument by Gosier et al. is that oil prices will lead to more versatile production plants which can effectively supply diversified market demands from near distance to the markets. They also stress that more flexible contractual agreements and multiple regional suppliers are used to hedge against volatile transportation costs.

Authors like Gosier et al. are supply chain professionals and concentrate on efficient supply chain designs, but it is interesting how the basic logic behind the global offshoring boom is asked to be revisited in a subordinate clause. It goes without saying that the impact on the evolution of global economy will be huge if companies start to regionalize/localize their production networks.

5.3 Oil and Other Energy Costs

Oil itself is already an energy cost, but it has an important relationship with natural gas price: the gas price is indexed to the oil price by the gas market players, whose argument is that there is no other price mechanism available. Stern (2007) points out that this linkage has no rationale, but it does not mean that the linkage will disappear. He continues that even if this indexation would disappear in some point, natural gas prices could still have a relationship with oil price.

Natural gas is used mainly to generate power. In 2009 it accounted circa 23% of the global energy consumption (BP, 2009). North America consumed 27.6%, Europe and Eurasia 37.8% and Middle East 10.8%. On contrast, BIC countries consumed 4.9% in total. The gas prices can have a linkage to electricity prices and heating costs and finally to production costs, especially in these regions. Gas price shadowing high oil prices can also lead to geopolitical conflicts such as in the Ukraine gas dispute with Russia that threatened to shut the gas supply of EU. Because oil is a fossil fuel, it also has a big role in the CO^2 emission regulations/legislation and carbon trading schemes (and carbon taxes in some parts of the world). In order to curb these costs, manufacturing and office electricity usage and heating should be aimed to be energy efficient.

Even though high oil prices do not directly affect emission allowances, they act as an incentive to lower the emissions by having more efficient fuel economy in the operations. This environment-competitiveness relationship was discussed by Porter and van der Linde (1995) who linked that good regulation on emissions can lead to increasing competitiveness as firms are forced to enhance energy efficiency of their operations. Hence, CO^2 regulations can be both negative and positive for companies. However, Lovins et al. (2004, p. 142) argue that many companies do not invest enough in the energy efficiency due to several reasons:

- These investments do not help to gain growth.

- Companies do not realize the risk/return advantage of energy efficiency investments.
- Energy costs are treated as a small portion of overall costs.
- The party who would save from energy costs due to the investment does not own the equipment
- Lack of activity-based costing and cost accountability prevents line managers to see the actual costs before they reach the head office.

Lovins et al. (2004) write furthermore that energy efficiency investments have usually a good rate of returns and even the most efficient companies have a lot to develop in energy efficiency.

5.4 Exchange Rates

Exchange rate managing was in the heart of many economies two decades ago. For some nations (China being a great example) it still is. The number one motivation in low cost country sourcing is most often the savings in production per unit. One of the main motivations for a firm to internationalize is new markets and lower factor costs, but exchange rates can deteriorate cost competitiveness of the products and reduce profits from goods sold. Given this, it is bizarre how little international business or supply chain management literature deals with the effect and how it can affect the sourcing and global strategy.

I have discussed the role of oil prices in the various components of supply chain and they have been linked directly to the manufacturing location and the cost of distribution. Exchange rates have also influence on supply chains on their own, but also through oil. One example from the effect is that the dollar follows oil prices and the renminbi tends to follow the US dollar. Bénassy-Quéré et al. (2007) are one of the latest researchers that proved the relationship in their study. The research suggested that a 10% rise in the oil price corresponds with a 4.3% appreciation of the dollar in the long run, and that this causality goes from oil to the dollar. Now, an interesting point from these researchers is their argument that the emergence of China as a global economy power house will eventually break or distort this causality. The reason behind this is that China is more and more active in the oil and foreign exchange markets due to its

energy intensive growth (Mitchell et al. 2001), export based economy and dollar pegged exchange rate.

In July 2005, the Yuan exchange rate was formally allowed to float referring to the basket of different currencies, but the composition of the basket is secret and China's currency has followed dollar closely ever since. This can strengthen the pattern observed in 2002-2004 by Bénassy-Quéré et al. (2007): when oil prices went up, the dollar depreciated. The logic behind this is that when dollar depreciates, so does Yuan and this is better for China's exports and economy, but this also would mean a rising oil demand for People's Republic energy intensive growth and the real prices of oil would go up even the dollar would depreciate. If the China would peg the Yuan to a differently composed basket or float the currency, then the relationship between oil and dollar could stay positive.

However, judging from the strong comment by Wen Jiabao on 14.03.2010 (newspaper source) it does not seem that China will allow the renminbi to strengthen or lose its linkage to the dollar value. The implications from this are that China's oil imports are getting more costly and this can slower the economic growth. Given this, it is no surprise that China subsidies the fuel price to keep the economic motor rolling. It could also mean that the China's exports become more cost competitive as oil prices get higher. This scenario would lead to difficult circumstances for other nations' exports as transportation, energy and raw material prices increase due to oil and China's Yuan based exports are even cheaper.

Exchange rates affect overall allocation cost of supply chain through transportation, inventory and production costs (ElMaraghy and Mahmoudi, 2009). Oil price movements and its impact on real exchange rates form a complex partnership especially for global MNEs, which can have own and outsourced operations across the wide variety of exchange rates and countries. As stressed many times, low-cost-countries have become increasingly important for maintaining and building cost based competitive advantage. Strong currency makes imports cheaper and weak more expensive. The rates are hard to forecast in long term view and changes can be rapid.

U.S. firms have also suffered from long falling dollar, but the fall of dollar is not only an American problem, for example global pulp and paper industry is using frequently dollar as its trade currency and this has weakened their financial results, which are translated to euros. Because majority of the world economy growth is happening in Asia, the depreciation of these currencies is also problematic if the international companies have large share of their sales or growth there.

Exchange rate risks are not new in international business and companies have used financial instruments to hedge against the fluctuating currency values. These tools are however most often insufficient or may cost too much to handle in large scale supply chains and long-term exchange rate shifts (Mahidrar, 2006, pp. 1-3). Futhermore, Guay & Kothari (2003) have pointed out that large corporations hedge modestly with derivatives in a first place. Together with oil price inflected transportation prices, the localization/regionalization of the supply chain becomes an attractive option. This leaves them vulnerable to exchange rates and fuel prices.

Amano and Orden (1995, p.1) point out: **"**The exchange rate is arguably the most difficult macroeconomic variable to model empirically." Therefore, it is hard to predict how the different currencies react to the scenario of oil price fluctuation. However, international business pursuing companies should keep a close eye on the relationship between exchange rate and oil price, especially in China and U.S.

5. 5 Consumer Tastes

Global climate change, general well-being, stable political conditions have all contributed to the rise of ethical and sustainable consuming. In the wake of the oil crisis of 1973, the western consumer first acknowledged the limits of oil driven economical growth and this led to the first major shifts in consumer tastes and global oil production decreased significantly. Rapid short-term rise of food and oil prices in 2008 were a sign of what can happen when their demand soars (there is also speculation said to be around) and how the world can be hurt very easily, as it did in the 1970s when OPEC created an artificial oil supply shortage. We are now living the period where the blue print of future economy is drawn. Global financial recession diminished the

effects of oil and food prices as governments and companies had more acute problems to face and the prices descended. The next growth side of the business cycle will most probably see the oil prices increase, because oil industry needs higher prices to keep exploring for new resources.

Some consumers and businesses are already adjusting to the new life style and sustainability is a widely discussed topic in the media. Governments have the power to influence consumer tastes through regulations and legislation and the trend seems to be towards sustainability. If oil prices climb high enough, there will be unexpected changes in consumers money use. For example, if air travelling comes too expensive for some of the consumers because of oil price, they will spend this money most probably to some other services or products that they see increasing their individually perceived quality of life. When the current recession arrived, even the richest of consumers slowed down consuming and started to prefer products that they perceived to carry true quality and strong and deep brand image such as luxury company Hermés. High oil price can further strength this kind of consumption.

I think that this preferring of quality and strong brand over multiple products will be further strengthened every time when the oil price climbs above $100 per barrel. Media will take care of that. Companies can either follow the trend or be proactive and offer the solutions which create the new lifestyle trends. When it comes to MNEs, the host country culture and economical realities will still play a big role in the consuming preferences, but initial reactions towards tightening economic realities are pretty much the same all around the world. The reactions that come with delay are more culturally and location bound. In oil producing countries, the initial reactions go, most likely, to opposite direction than in importing countries.

5.6 Highlights of high oil prices effects to company operations

- High oil prices increase transportation costs and with a certain level, global trade might get stuck. New transport solutions should be thought in order to be less dependent on fuel prices.
- Production locations might be more sensible to have the markets and/or the final assembly nearer.
- Localization of supply chain and rethinking of old supply chain strategies like just-in-time might come justified. New supply chain techniques such as the use of premium freight should be assessed.
- Customer and consumer tastes change because of global pursuit to be less dependent on fossil fuels. The oil crises of the 1970s showed this. Now, global climate change and sustainable life-style add their weight to the equation. Greenwashing is not enough in the age of Internet.
- Oil affects other energy related costs such as gas prices. It also impacts indirectly via being incentive for governments to pursue carbon taxes and emission legislation, which can lead to extra costs for companies. On the other hand, regulations can force to change more rapidly than competitors in locations where regulation is weaker.
- Company growth contributing investments are often preferred against energy efficiency investments, which have generally low risk and good rate of returns.
- U.S. dollar and Yuan are linked to oil prices at the moment. Because of the importance that both have in the world economy and the fact that they do not have large own oil resources; MNEs should observe how the relationship of the triangle develops.

6. Data and Methods

I have now reviewed the literature that tries to depict the future of oil, shows how oil price is formed and how it affects in the different levels of economy. Furthermore, the expert literature pointed out how oil prices have and can affect the company operations through transportation, manufacturing, exchange rates and customer tastes. The gap in the research can be filled already partially with the literature, but the subject still lacks the view of large MNEs. This section shows how the data was gathered and how it was used in the study. The purpose has been to review annual reports to see how companies have reacted to high oil prices in their investor communication. This information is then used to add insight to the final framework, but also to investigate if the companies really care about the oil prices that much.

6.1 Data

The initial method of research for this study was to do surveys or case studies with companies and ask how the high oil prices have affected them and what kind of strategic and operative moves they have used to counter the effects. When contacting companies, it quickly became clear that companies were not interested to share this kind of information with the public. Thus, I decided that I should look for official company releases from the time period when the oil price was significantly high. Chart 1 demonstrates why 2008 is a fitting year to study the data. This qualitative method is called *Analysis of documents and materials.* (Marshall & Rossman 1998).

Chart 1. NYMEX Crude Oil Front Month 02.02.2005- 02.02.2010

Source: Financial Times

An annual report does not include the exact description of all that management keeps important, but it is the best document to research the company's attitudes towards high oil prices, when a direct contact to company is lacking. Furthermore, it shows the official opinion of the company and it is meant to inform the existing and potential future shareholders. Another problem with surveys and case studies (or even with interviews) would have been the problem that who and from which part of the value chain would have answered to them. Inside the company the opinions surely differ between the employees, when it comes to such a complex phenomenon as oil prices and their impact on a company. Opinions and views differ also between the companies. Much depends on how vulnerable the company's industry and operations are to the high oil prices. A company like FedEx is very vulnerable because their business is international logistics. The organization of the industry also plays a role. Highly specialized industries are more prone to transportation costs because of global value chains.

This study focuses on MNEs that have global production networks and are product companies rather than service, because service companies are not that oil dependent. The companies were picked in order to have diversified outlook on different companies and how they felt the record oil prices of 2008. For some companies which had their fiscal year 2008 ending in the summer of 2008 or earlier, I have reviewed the 2009 annual report. From certain companies I have read Form-10K[4], because some companies like Apple do not publish "glossy" annual reports. The annual reports of MNEs for this study were collected from the Forbes Global 2000 list from the year 2009 which ranks the top 2000 MNEs in the world. The ranking is based on a mix of four metrics: sales, profit, assets and market value but the ranking and metrics are not a relevant factor in the study *per se*. The picking of companies simply started from the top of the list, but in order to maintain many-sidedness in the studied companies (for example, the top 20 of the list has 5 financial and 9 oil/energy companies), I used my own judgment to pick companies from diverse industries. The major criteria for the 30 "flagship companies" was that companies would be high in the level of internationalization when it came to production network. I picked companies from diverse home bases, not just from U.S. Japan and Europe but these three regions

[4] A Form 10-K is an annual report required by the U.S. Securities and Exchange Commission (SEC), that gives a comprehensive summary of a public company's performance.

still populate the majority of the sample. 50 companies were picked which are shown in Table 15 below.

Table 15. Companies in the Study

	Company	Country	Rank	Industry
1	Denso	Japan	174	Consumer Durables
2	Toyota	Japan	3	Consumer Durables
3	Volkswagen	Germany	15	Consumer Durables
4	Tata Motors	India	1157	Consumer Durables
5	Vodafone	UK	20	Telecommunications Service
6	Dell	USA	187	Technology Hardware & Equipment
7	Flextronics	Singapore	1082	Technology Hardware & Equipment
8	Hewlett-Packard	USA	36	Technology Hardware & Equipment
9	Nokia	Finland	81	Technology Hardware & Equipment
10	Sony	Japan	82	Technology Hardware & Equipment
11	Panasonic	Japan	89	Technology Hardware & Equipment
12	Apple	USA	113	Technology Hardware & Equipment
13	Cisco Systems	USA	69	Technology Hardware & Equipment
14	Ericsson	Sweden	198	Technology Hardware & Equipment
15	Canon Group	Japan	122	Technology Hardware & Equipment
16	Procter&Gamble	USA	22	Household & Personal Products
17	L'oreal Group	France	176	Household & Personal Products
18	NIKE	USA	349	Household & Personal Products
19	EDF	France	27	Utilities
20	ENEL	Italy	43	Utilities
21	RWE Group	Germany	57	Utilities
22	PetroChina	China	14	Oil&Gas Operations
23	Marubeni	Japan	279	Trading Companies
24	Mitsui&Co.	Japan	97	Trading Companies

Table 15. Companies in the Study continued

	Company	Country	Rank	Industry
25	Rio Tinto	UK/Australia	70	Materials
26	Vale	Brazil	74	Materials
27	Fosun International	China	1391	Materials
28	Arcelor Mittal	Luxembourg	41	Materials
29	Wal-Mart Stores	USA	8	Retailing
30	Inditex	Spain	416	Retailing
31	Berkshire Hathaway	USA	19	Diversified financials
32	GoldmannSachs	USA	56	Diversified financials
33	Nordea Banking	Sweden	116	Banking
34	Intel	USA	95	Semiconductors
35	Samsung Electronics	South Korea	47	Semiconductors
36	Nestlé	Switzerland	32	Food, Drink & Tobacco
37	Coca-Cola	USA	110	Food, Drink & Tobacco
38	Carrefour	France	111	Food Markets
39	Singapore Airlines	USA	454	Transportation
40	FedEx	USA	280	Transportation
41	Möller - Maersk	Denmark	107	Transportation
42	Vestas Wind Systems	Denmark	770	Capital Goods
43	ABB	Switzerland	157	Capital Goods
44	ThyssenKrupp Group	Germany	169	Conglomerates
45	General Electric	USA	1	Conglomerate
46	Johnson&Johnson	USA	42	Drugs and Biotechnology
47	Pfizer	USA	50	Drugs and Biotechnology
48	IBM	USA	28	Software & Services
49	Microsoft	USA	49	Software & Services
50	SAP	Germany	268	Software & Services

Source: Forbes Global 2000 List (2009). **Rank** shows the ranking in the list.

As the sample is handpicked, it is unrepresentative as a subset of a whole population. I do not see the problem in here because the main motivation of the analysis is information gathering. Of course this means that the results cannot be generalized throughout the companies in the Forbes 2000 List which acts as the population of the study.

There are 13 companies in the data that are global in their operations, but are from industries that do not necessarily fit in the global production network theory, but are included in hope of that they could add insight to the effects of the high oil prices. There are five subgroups which shows the emphasis in the sample:

- Flagships: 37 MNEs that have that have operations, production and/or outsourcing in multiple regions of the world.
- 4 Energy MNEs that have their main business in energy production: PetroChina, Vestas EDF, RWE Group and ENEL.
- 3 Financial & Banking MNEs: Goldman Sachs, Nordea Banking and Berkshire Hathaway.
- 3 Transportation MNEs: logistics, FedEx, A.P. Moller-Maersk and Singapore Airlines.
- 3 Software MNEs: IBM, SAP and Microsoft.

6.2 Method

The main goal of the data survey was to find information of how the high oil prices of 2008 had affected companies. The content analysis method I used is close to the interpretive method of data, called coding (Marshall & Rossman, 1998). In coding, the researcher reads the data and tries to recognize segments in it and labels these segments with a code word that shows directly how the segment could help in solving the research problem. Next, the prevalence of codes is summarized and can be discussed e.g. across distinct original sources/contexts. My method of research differs from the text book example coding, because even if I have counted the number of mentions of different segments per MNE, I have not turned the qualitative data to quantitative and analyzed it excessively. This method was chosen because I believe that it offers best information value in order to answer the research problem. The weakness of the method is the reliance on the subjective judgment of the researcher. There is also a probability that some effects are missed because of the nature of the texts and the amount of data and it cannot be generalized to a whole population.

I examined special text segments from the annual reports and then made my impressions from the data. There were initially ten segments I noticed, but I quickly reduced the number to 5 segments, because the ten segments overlapped too much. Next, the five segments of oil effects were formed, analyzed and then textual examples from companies' views were gathered. Appendix B was constructed to show the segments and if a company was included in the segment.

Annual reports are secondary data and if one is to analyze them, there should be a certain level or criticism and an ability to read between the lines. I divided the companies in industries, because it plays a big role in the level of oil dependency. Annual reports were gathered and then read through. I searched mentions about the five segments which are listed below. The aid of text searching software tools was also used. Words after themes are examples of searched words and themes in the segments. I searched for the exact mentions, but also text excerpts that mention these themes and then carefully reflected if a mention was relevant and linked to the context oil and fuel prices.

The five segments:

- Oil: oil, gas, fuel, petroleum and gasoline and their macroeconomic effects and overall company performance.
- Operations: production, manufacturing, outsourcing, raw materials, components, suppliers, value/supply chain, exchange rates linked to oil / fuel and hedging.
- Transportation: logistics, transportation and freight prices linked to oil /fuel.
- Energy: energy costs and efficiency, emissions, carbon taxes, CO^2 regulations/legislation.
- Customer and consumer tastes: customer tastes, customer purchasing power affected through oil / fuel and energy.

The energy segment was first delimited in the following way: if a company had produced energy with oil and its business was affected by carbon taxes or energy costs, or the company targeted to reduce CO^2 emissions. This was a difficult definition to analyze, because of the differing concepts between companies and industries and the wide scope of the segment. Also, the link to oil/fuel prices was sometimes a line drawn on water. Thus, I decided that if a company was pursuing to save in energy costs and reduce CO^2 emissions, it counted as a mention.

The customer segment was treated similarly, if the customers of the company were to seen demanding more energy efficient products, the mentions are listed in Appendix B. Again, it was difficult to say if the oil/fuel prices were the driving force behind these demands. Most probably they are one of the drivers, together with issues related to the corporate social responsibility.

Next, I listed all the segments that were mentioned and wrote them down and analyzed what were the most common effects in the annual reports regarding oil. Appendix B shows the full list of companies included in the study and also a table that lists the themes that the company mentioned in the annual report.

6.3 Results

The results section goes through the five segments that were introduced above and discusses the observations and reflects these to reviewed literature. Then a summary of results is presented. The road map framework uses the results as building blocks in the conclusions section. There is a lot of word-to-word quotations used to show also the tone that companies use when discussing the effects. Quotations are used in order to illustrate the typical comments on each segment, but also some interesting effects of oil/fuel prices. Italicized text means quotation. Italics are normally used to emphasize a word and not to quote, but I felt that the use of them makes the reading of the quotations more practical. Quotes are by default from annual reports. Form-10Ks based quotes are mentioned in the brackets. See Appendix B for further information.

6.3.1 Oil Segment

The oil/energy/fuel prices as a macroeconomic phenomenon was mentioned 29/50 times. The initial hypothesis was that there would be some mentions directly to high oil prices and maybe even to peak oil. Companies like Toyota and FedEx would certainly offer some insight in their annual reports, because they are highly vulnerable to oil prices, but companies like Microsoft and Intel would not consider high oil prices worth mentioning. This was to large extent a correct hypothesis. In general, none of the global flagship MNEs was truly shocked by the oil prices and the future of oil economy or peak oil was not discussed directly.

Warren Buffet of Berkshire Hathaway holding firm (2008, p.28) was the only one who was truly surprised from the record oil prices, but he was even more surprised that oil prices fell so rapidly in the fall of 2008. General Electric (2008, p.4) reacted similarly and was predicting that oil prices of 2009 would be smaller and this would affect negatively to the corporate profit. This might explain the overall result of the segment to some extent: oil prices were not in record high long enough, to truly hurt the business and global production networks. Also, in the end of the year 2008, the financial recession took the world's focus in the macro economical climate. Many reports discussed the oil prices on general tone, for example:

PetroChina (2008, p.16): *International crude oil prices fluctuated significantly in 2008. The prices continued to increase significantly in the first half of 2008 due to factors such as strong demand for crude oil, weakening of the United States Dollars, speculative activities, decline in crude oil inventories, shortage of unutilised capacities and geopolitical tensions.*

Panasonic (2008, p.7): *Although high growth is expected to continue in emerging economies, the global economic outlook for fiscal 2009 is uncertain. In fact, there are a variety of downside risks, in particular the negative effects from the subprime loan problem, persistently high prices for raw materials and energy including crude oil, and foreign exchange fluctuation risks such as the sharp drop in the value of the U.S. dollar.*

There were few direct linkages to energy prices and company overall performance. For example, Canon announced (2008, p.4): *In the first half of 2008, energy and raw material prices skyrocketed, which had a major impact on corporate earnings.*

Nestlé (2008, p.64): *The decline in EBIT margin is a direct result of the reduced sales, exacerbated by cost pressures, particularly oil-related, as well as under-performance in parts of the European Home and Office Delivery (HOD) business.*

Car manufacturers and energy intensive companies were the group that was the most anxious of industries. Toyota saw that high oil prices led to flat markets in 2008. Volkswagen (2008, p. 124) comments on the development of their share price*: After share prices bounced back for a short while in the second and third quarters, prices again dropped considerably in each case. The strength of the euro and high oil prices had a dampening effect mid-year. Both trends weakened again in the fourth quarter.*

The above quotations show that some companies feel that investors and shareholders should acknowledge that high oil prices affect the economical climate and the overall financial performance. This is not surprising, given how important oil is for the global economy. Still, some companies do not see oil prices relevant for their performance. For example, technology companies with global production networks clearly felt that the financial turmoil of late 2008

was a more important event to report; which it was, given the short time period that oil prices remained above $100.

6.3.2 Transportation Segment

In this segment the transportation, the logistics and the freight prices are discussed. 18 companies out of 50 mentioned rising transportation prices or the curbing of them. The four consumer durable companies were awkward to study. Their business model is to make fuel efficient (at least these four) transportation vehicles or parts to them. Companies talk a lot about this in their annual reports. Still, three of them did not mention transportation in their own operations so they are not counted in the mentions. Food markets, transportation, materials and retailing companies were the major group in this segment. All these companies transport huge amounts of products and their freight costs are substantial, which explains the result. A direct link between oil prices and these costs was often hard to find or non-existent. I had to use my own judgment whether pursue for more efficient transportation was driven by general energy efficiency/sustainability programs and /or reducing transportation costs. Thus, if a company had programs or projects that were targeted to reduce the amount of transportation, they are included in the Appendix B.

Coca-Cola (2009, p. 27) provides an example: *Enterprises introduced 142 customized diesel-hybrid delivery trucks—currently the largest in widescale use. The trucks are 37 percent more fuel-efficient than traditional delivery fleet, reducing overall vehicle emissions by 32 percent.*

Another example is from Volkswagen (2008 p. 46): *From truck to rail: two to three times a day, freight trains transport new cars from SEAT's Martorell plant to the port of Barcelona. As a result, 80,000 cars arrive in the Catalonian capital by rail each year – cutting 25,000 truck journeys a year and saving 800 tonnes of CO2.*

These kinds of means to curb emissions bring most probably significant saves in transportation costs and I am pretty sure that the reducing of CO^2 was not the only corporate motivation in the above projects. Almost all the companies had tendency to speak about emissions rather than fuel costs. This has a direct linkage to the global climate change and the sustainability surrounding

the current energy discourse. Being environmentally friendly a company appeals more to investors and media, than reducing kilometers and fuel usage in transportation for cost savings. However, there were also direct linkages between oil prices and transportation costs.

Material company, Rio Tinto (2008, p. 79): *The dry bulk shipping market had a year of mixed fortunes during 2008, with freight prices achieving new highs followed by a fall to the lowest rates seen for many years.* This is in the same timeline with the fluctuation of oil prices.

Steel producer, Arcelor Mittal hedges its freight costs with forward contracts (2008 p. 52) and announced that it had considerable losses in the fair value of forward contracts on freight in the 4th quarter. The reason for the losses might be that the oil prices slumped in the 4th quarter of 2008 and it had acquired forward contracts in the time of higher oil prices. Here it can be seen that volatile oil prices are also problematic, not just high.

Singapore Airlines (2008, p. 6) again, was pleased that they do not hedge fuel prices as actively as many competitors: *Second, we have always resisted the temptation to opportunistically gamble heavily on fuel and currency hedges, preferring a consistent approach through good times and bad. This means our hedging losses in the short term, while there, will be much less than those of some of our more adventurous competitors.*

FedEx (2008, p. 30), as a global transportation company, provides also some insight between oil prices and transportation: *Historically, our fuel surcharges have largely been sufficient to offset incremental fuel costs; however, volatility in fuel costs, as seen in the rapidly rising price of oil in 2008, may impact earnings because adjustments to our fuel surcharges lag changes in actual fuel prices paid. Therefore, the trailing impact of adjustments to our fuel surcharges can significantly affect our earnings in the short-term.* FedEx stressed many times the importance of applying fuel surcharges to its service prices in order to curb the effects of high oil prices.

A. P. Moller - Maersk (2008, p. 17): *Total fuel costs rose by 43%, affected negatively by an increase in the average bunker price of 51%, but positively affected by approximately 5% lower fuel consumption due to a large number of fuel reduction measures, including service speed*

reductions. A large share of the higher costs resulting from the bunkers price increase was covered by surcharges and in 2008 Maersk Line introduced a new, more transparent method of calculating the fuel surcharge. The two quotations above can depict how the oil prices affect the companies that use second party transportation services: transportation companies add the rising costs to their prices via fuel surcharges in order to stay profitable and customer companies will eventually pay the effect of rising oil prices.

There were some examples from far-flung systems of companies which are reducing the amount of transportation. French food markets giant, Carrefour (2008 p.41): *Upstream, the Group's warehouse deliveries are increasingly reliant on alternative forms of transport.In 2008, Carrefour France shipped over 40% of its imported merchandise by riverborne and rail transport. Now that Carrefour has five consolidation platforms throughout Europe, suppliers can deliver to a single location. Carrefour then takes it from there, using fullyloaded multi-supplier trucks for warehouse deliveries. Downstream, transport rounds are being increasingly streamlined. In Italy, a software program adjusts the daily delivery schedule to fluctuations in the volume of orders. As a result, the number of kilometres travelled has dropped by 5% and the amount of fuel burned by 7%.*

Inditex (2008p. 18): *The pilot project initiated at Pull and Bear is taking into account factors such as the distance between centres, types of packaging, loading and unloading timetables, types of vehicle, levels of emission of CO2, etc…, with the aim of redefining the logistics, thereby reducing the emissions of CO2*.

Nokia (2008, p. 55) mentioned a simpler expedient: *From February 2006 to the end of 2008 we reduced the weight of packaging materials and user guides of our most affordable devices by over 60%, which amounts to some 100 000 tons of saved paper. Smaller and lighter packaging has also reduced the need for transportation. The improvements in our packaging solutions have also translated into significant monetary savings.* Again, the sustainability theme shows here in the form of saved paper, but Nokia speaks also about monetary savings.

The main insight from this segment was that companies use direct and indirect means to curb the fuel costs in transportation. For example, complex distribution systems, alternative transportation such as railroad and river shipments, hedging, fuel surcharges, smaller packaging and hybrid motor transportation fleets. Many of these expedients are mentioned by the authors such as Lovins et al. (2004), Lapide (2006), Deering and Forbes (2009) and companies also provided ideas which are not mentioned in the literature section such as riverborne shipping and service speed reductions. It is not known what the A. P. Moller – Maersk means exactly with service speed reductions, but these might have a linkage to the international supply chain jams predicted by Stalk (2009), although he did not approached the issue through service speed reductions of container operators.

Developing the efficiency of transportation is not a new idea. It was a little disappointing how the high oil prices appeared in such a small scale in the context of transportation. It might be that many of the mentioned projects and programs have their background also in the proactive reactions to rising oil prices, but this study cannot prove the linkage.

6.3.3 Operations Segment

In the operations segment I searched mentions from high oil prices affecting the operations of the companies, other than transportation or logistics. There were 23 mentions out of 50 and eight of these have oil and gas related operations and three are transportation industry companies. The most typical comment about the operations was that energy efficiency of the supply chain will be developed continuously with the suppliers. Someone might argue that supply chain overlaps with the transportation segment and partly it does, but energy efficiency of supply chain includes also materials and production. Other mentions of oil were in the context of general energy production, for e.g. heating. Again, the linkage of oil prices was a question of interpretation.

Ericsson (2008, p. 142)*: Energy-optimization and due diligence along the supply chain help differentiate us in a competitive market. Increasingly, customers evaluate us on sustainability performance and many customers have introduced ambitious goals to cut C02 emissions, and want to secure their supply chains.*

Ericsson mentioned also a clearer link in the lease agreements of office buildings (2008, p.142) *The Company's lease agreements normally do not include any contingent rents. In the few cases they occur, it relates to charges for heating linked to the oil price index.*

Brazilian mining company, Vale (2008, p.10), provides one of the clearest linkages: *Fuel costs represented 10.4% of our cost of goods sold in 2008. Increases in oil and gas prices adversely affect margins in our logistics, mining, iron ore pellets, nickel and alumina businesses. Due to relatively high international oil prices, which increased by 38% in 2008, and low nickel prices recently, we have announced cuts in nickel production in Indonesia, where we use oil generators.*

Whereas, A.P. Moller - Maersk (2008, p.42) had positive effect**:** *Revenue amounted to DKK 312 billion (DKK 279 billion). The increase is particularly due to higher oil prices, which led to increased revenue from the oil and gas activities as well as higher revenue from the container activities as a consequence of a higher fuel surcharge (Bunker Adjustment Factor[5]).* Rather surprising for me was the fact that Moller – Maersk (2008, p. 46) mentioned that high oil prices in long term is solely a good thing for its result—given that it is the world's largest container ship operator and supply vessel operator: *...as the positive effect for the oil and gas activities more than outweighs the negative effect for the container activities, where a larger share of the increased bunker prices must be expected to be compensated through freight rates*. Whether this is good for other companies that use the services of the company is another question.

Some companies like Pfizer (Pfizer, Form10-K, 2008 p.10) mentioned the oil prices in the context of rising costs of raw materials: *The rise in the price crude oil has resulted in pricing pressure on raw materials that are derived from petroleum and used in our business.*

[5] Bunker adjustment factor or BAF refers to floating part of sea freight charges which represents additions due to oil prices.

Nokia (2008, p.55): refers indirectly to the usage of oil in plastic: *In early 2008, we started shipping Nokia 3110 Evolve, the first mobile device whose biocovers Use 50% renewable materials, thus reducing the amount of fossil fuels used to manufacture it.*

The most severe impact of high oil prices to company operations came surprisingly from Berkshire Hathaway which operates in financial industry. This example shows well how oil prices can affect the financial markets and the finance sector companies. The quote (2008, p. 17) is directly from Warren Buffet: *I told you in an earlier part of this report that last year I made a major mistake of commission (and maybe more; this one sticks out). Without urging from Charlie or anyone else, I bought a large amount of ConocoPhillips*[6] *stock when oil and gas prices were near their peak. I in no way anticipated the dramatic fall in energy prices that occurred in the last half of the year. I still believe the odds are good that oil sells far higher in the future than the current $40-$50 price. But so far I have been dead wrong. Even if prices should rise, moreover, the terrible timing of my purchase has cost Berkshire several billion dollars.*

Nordea Banking (2008, p.13) had profited from tight oil supply in its oil and offshore industries: *Demand in the oil and offshore segments remain high, thanks to tight oil supply.* Other notable example (2008, p.93) from indirect effect of oil price to company operations was also provided by Nordea Banking: *"Nordea uses historical data on probability of default to estimate the risk for a default in a rating class. These loans are rated and grouped mostly based on the type of industry and / or sensitivity to certain macro parameters, e.g. dependency to oil prices etc.*

The loans that are referred here are discussed in the context of loan impairment test. If Nordea has this kind of a rating system for loans, it is very probable that the vulnerability to oil prices can affect the loan interest rates and access to finance for a company—although we do not know the weight of the oil factor in the assessing process. Still, I find it important finding in the context of oil price effects.

[6] Third largest integrated energy company in the US and the fifth largest oil refiner in the world.

None of the companies mentioned—in any way—that the logic of global production network/ global supply chain/or similar concept could be jeopardized in the future because of oil prices. Neither there were any mentions that manufacturing/production should be developed more flexible or more localized as suggested by Gosier et al. (2009) or Deering and Forbes (2009).

Canon (2008, p. 48) however, approached the issue indirectly with a quote about exchange rates: *Despite efforts to reduce the impact of currency fluctuations on operating results, including localization of manufacturing in some regions along with procuring parts and materials from overseas suppliers, Canon believes such fluctuations have had and will continue to have a significant effect on its results of operations.* This example by Toyota shows how the localization of the production is used to tackle the exchange risk, to some extent. The localizing of production would also tackle many of the risks that the oil prices carry. Nonetheless, these kinds of examples were non-existent. The exchange rate risk itself was often mentioned in the data, but it never had a direct linkage to oil prices.

In overall this segment demonstrates that oil and its price fluctuations can affect company operations directly, but especially indirectly, both negatively and positively. Cost of financing, energy production, heating raw materials, investments in securities and direct effects to energy intensive operations such as mining can be affected.

6.3.4 Energy Segment

This section was mentioned most often: 39 out of 50. I suspect that the 11 companies used the CSR report to discuss about energy. The result was evidently due to general popularity of energy and sustainability discourse. There are numerous tools to achieve energy efficiency and mitigate the carbon footprint of the company. Therefore, I will quote just two examples. Generally oil was involved indirectly to MNE businesses via energy efficiency, climate change, sustainability and CO^2 emission control. Energy efficiency was the key word in both production and in the actual products (e.g. Intel 2008: Hewlett-Packard 2008:Canon 2008: Denso 2008).

Vodafone (2008 p.46): *Last year, the Group announced that by 2020 it will reduce its carbon dioxide ('CO_2') emissions by 50% against the 2007 financial year baseline of 1.18 million tonnes. This baseline includes all operating companies within the Group throughout the 2007 financial year. The primary strategy to achieve the 50% reduction is through direct reduction in CO_2 emissions. This is to be achieved through the evolution of network technology, investment in energy efficiency and by making greater use of renewably generated electricity.* This kind of text was very typical energy jargon in the annual reports. L'Oreal, Inditex (company behind the clothing retail company Zara and Pull&Bear) and Vale were especially robust in their energy issues. For Vale, energy issues were very important as I showed in the Operations segment, when L'Oreal's text felt more like greenwashing of the brand image. Inditex (2008, pp. 190–206) provides numerous charts, tables and measures consumption of energy, water and raw materials accurately and extensively. The company would be a very good example for other companies to study energy efficiency issues—especially when it comes to office buildings.

ABB had an original approach and had included an interview with the MIT professor Ernest Moniz who shared his views on the future of energy. His words summarize pretty well the whole Energy segment findings (2008 p.28): *At the same time, many governments are seeking to reduce their dependence on fuel imports by developing alternative sources of energy, and countries in North America and Europe in particular need to replace aging infrastructure. In industry, the slowdown will increase global competition and the need to raise productivity. Improving energy efficiency remains the most cost-effective way to lower emissions and costs.* Moniz views reflect the same ideas as presented by Porter and van der Linde already in 1995, where they stated that company being environmental usually contributes positively to its overall competitiveness.

Lovins et al. (2004) argued that the energy efficiency investments are not that popular investment objects for companies, but I feel that the sample MNEs do invest to energy efficiency and sustainability. Whether it is due to their size, regulations, greenwashing, customer demand or pursuit for cost competitiveness or all of them remains to be answered, but in any case these investments and programs reduce the dependency to fossil fuels.

6.3.5 Customer Segment

The price effects of oil to consumers and customers was discussed in the literature review in the context of inflation, industry demand and general changing of customer tastes in the age of aware consumers. The studied companies linked the oil and customers rarely (18 out of 50), and the car companies were the most concerned group, which is self-evident.

Quote from Tata Motors (2008, p. 28) explains this: *Increase in fuel prices has an adverse impact on automobile demand as consumers think of alternative solutions and postpone purchases, as was seen last year when oil prices reached a peak of US$ 145 per barrel.*

Ericsson (2008, p.122) tells how its operator customers demand energy efficiency: *Further, operators desire energy-efficient multi-technology solutions, driven by environmental and cost improvement opportunities as well as ability for effective forward migration.*

PetroChina (2008, p.64) generally benefitted from the oil price, but it explains why its customers—oil refinery companies—were in trouble when the oil prices rapidly soared: *During the first half of 2008, international crude oil prices surged and as a result, domestic refineries incurred heavy losses in processing and some of them ceased production. Supply in the refined products market was very tight at a point in time.*

However, the MNEs themselves were the best example from a customer that demands energy efficiency, continuous supply chain development and ecofriendliness (term from Samsung, 2008) from their suppliers. Denso, which is a major supplier for Toyota, was investing a lot to the energy efficiency of car components. For example, Inditex (2008) ranks its suppliers to various levels and shows the ranking in the annual report and it has a Kyoto protocol based program with the transportation companies that is has contracts with. This is one way to reduce the dependency to oil and make sure that suppliers pursue to cut their costs. The software company SAP has recognized this movement and offers a wide range of different applications developed to improve energy efficiency of supply chain and production.

Once again the direct linkage between oil/fuel prices and customer tastes unveiled to be rare. Wal Mart was the only company which mentioned the high fuel prices directly affected their customers' purchase power. But if we look at MNEs as possible customers then the linkage is significant and other companies must acknowledge this if they are to win contracts. This was one major idea that the data offered. Still, we have to remain critical towards the nature of the data. It would be interesting to know what the MNEs would choose if they had two suppliers with a same quality: one which pursues energy efficiency and lowering of oil dependency and one that offers just lower prices.

6.4 Summary of Results

First of all, the coding method I used was not probably the most meaningful for this kind of data, but it helped to arrange the effects to categories and it fulfilled the objective of answering to research problem although the majority of the effects were indirect. There might be many indirect linkages to oil prices missed due to the amount of data, but I found the overall results in line with the reviewed literature and there were even some fresh perspectives derived from the data. It belongs to the nature of science that sometimes the reviewed data cannot offer direct or definite answers to the research question.

Annual reports are made to keep the shareholders informed and convinced about the future, not to scare them. In 2008 and early 2009, global climate change and sustainability were the large themes (beside financial recession) energy vice; obviously companies wanted to show that they are doing something to change their businesses to be more sustainable. Even if they would have thought that soaring energy prices will be a hot topic in the future, the oil price was already down in the end of 2008. Hence, from the company point of view, there was not any reason to be gloomier than the economical climate already was.

Lovins et al. (2004) argue that the most efficient way to lower oil dependency is to make transportation more efficient. This stands out also from the results and is important for enhancing the costs of having a global production network. In conclusion, MNEs do consider the oil price, but indirectly, through energy efficiency. This they do in order to please changing customer

tastes, do their share of corporate responsibility and strive towards more efficient operations, not because they believe in the Peak oil theory. There are many reasons and means for companies to be energy efficient and sustainable as Lovins et al. (2004) argued. The actual motivations behind the "greenwashing" could be linked to the fear that oil prices and emission regulations together with other energy prices soar in the future, but there is no evidence about this. In a sense, the race for winning the oil-end game has started in the world's leading MNEs, but they just use a different vocabulary than this study, key words for them being energy efficiency and emission reducing. However, there were many ideas in the annual reports on how the production and transportation of products can be made more energy efficient and also less dependent of oil and fossil fuels. The synthesis from results and theoretical framework is done in the next section in order to avoid unnecessary repetition.

7. Conclusions

This study has been unorthodox and robust for being a Master's Thesis, because of the wide scope and the solutions that I had to use to answer the extensive research problem. The main motivation for this study was to research the effects that high oil prices can have on MNEs, to provide a framework which depicts how the oil prices affect their operations and to give general information about the future of the oil economy and the oil prices. Hence, the literature review and the data section are extensive. MNEs were chosen to the study because they use heavily transportation and they are the most influential, especially the ones with global production networks. The results of the literature review and the annual reports survey provided a hefty amount of diversified data and information. This data is now constructed and discussed in the context of the theoretical framework with the aid of qualitative modeling. Finally, the future of oil and large MNEs is discussed, managerial implications are provided and suggestions for further research are suggested.

7.1 Road Map Framework and Discussion

Table 16 in the next page shows the road map framework which summaries this study and answers to the research questions, which were:

Main research questions:

1. *How high oil prices affect global MNEs?*
2. *How oil price is formed and how it will develop in the future?*

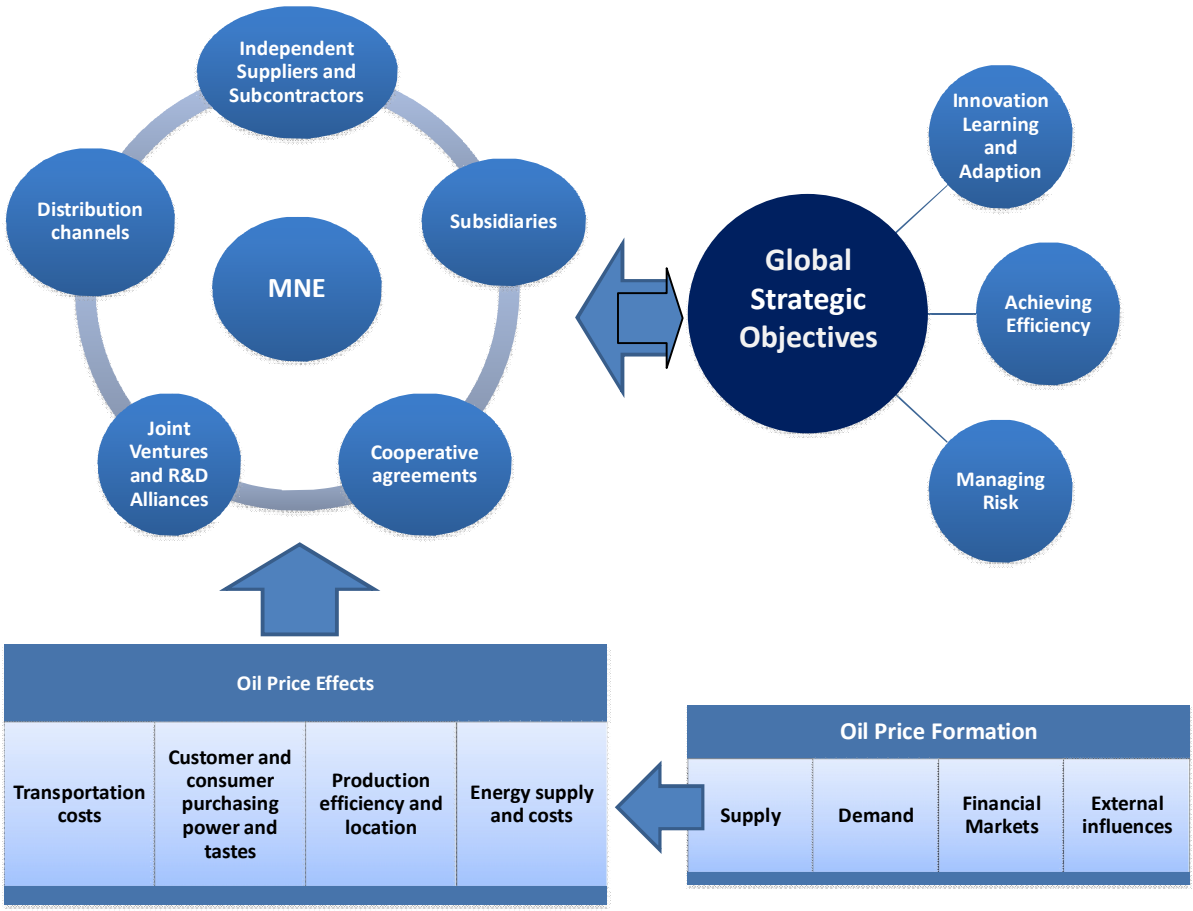
Sub-questions:

3. *How does this reflect in global production networks and strategies of global MNEs?*
4. *What tools are there to counter the effects?*

The idea of the framework is to show how oil price is formed, which kind of effects it has and how this finally affects the global production network and its nodes. This again is in interplay between global strategic objectives and GPN. Oil price formation and oil effects are already

discussed in a great extent in the Sections 3, 4 and 6, but they are also summarized in here and discussed more freely. Next the different nodes of global production network are covered and then the global strategy.

Table 16. Road Map Framework



Source: Ghoshal (1987), Ernst & Kim (2002) and the author's own work.

7.1.1 Oil Price Formation

The price formation of oil is an interplay between supply and demand as with any commodity. The growing energy consumption of the world and the depletion of non-conventional, cheaper oil puts pressure to price. In the other end of the scale are the oil substitutes, developing oil exploring and extraction technology and the mitigation of the global climate change through reducing the CO^2 emissions and pursuing for general energy efficiency. The financial markets are where the price is formed finally and they can both stabilize and fluctuate the prices though speculation and herd behavior in financial markets. The major external influences to oil price are geopolitical conflicts, terrorism in the production locations and along the oil supply chain. Although the fuel subsidies/taxation and national oil resources do not affect directly to the market oil price, they can significantly affect the price of oil condensates in certain locations. For example, in 2005, Venezuelan paid $0.12. from a gallon, when Spaniards paid $4.55 from the same amount of gasoline (http://www.air-inc.com/). Naturally, the location of the nation and its fuel refining and supply infrastructure also affects the price.

7.1.2 Oil Price Effects

Rising transportation costs through the fuel price is the main effect of the increasing oil price. Through macro economical effect it means lowering purchasing and investing power for B2B customers and consumers and general slow down for a macro economy. Some supply chain authors present that the incessant high oil prices would deteriorate the cost benefits of offshoring and sourcing in low-cost-countries because of the rising transportation costs.

The rising oil price means usually also higher commodity prices and hence affects raw material costs which makes production more costly. If rising fuel prices produce supply chain bottle necks due to transportation industry strikes and service speed reductions, it will also affect on production efficiency because of supply chain disruptions. Futhermore, it can add to the general energy costs in heating and manufacturing, depending on the energy sources of location and company. In some extreme oil price circumstancies crude oil price can affect also on the local energy supply (PetroChina, 2008, p. 64).

7.1.3 Global production network

It became clear from the company data, that some of the leading MNEs of the world are pursuing large scale energy efficiency programs which consist of various energy related projects. These programs can be extended to a whole global production network by assessing the different product nodes and their oil dependency. This requires great transparency from a GPN and is a large scale operation but helps companies to be less oil dependent. Also, doing the net landed cost analysis (which takes on account acquisition costs and life-cycle costs) to products that have a global value chain can help MNEs to comprehend all the fuel related costs during the products lifetime.

The organization of the industry usually dictates how the companies have established their global production network. When an industry is vertically integrated the reforming of GPN is difficult and the reduction of oil dependency of the whole GPN is the only viable option. Also, even if the company would be horizontally integrated, some destinations with superior cluster advantages cannot be excluded from the value chain.

Independent Suppliers and Subcontractors

According to the GPN (e.g. Ernst and Kim, 2002: Gereffi et al., 2005) literature, the role of suppliers is coming more and more important, but at the same time they must continually develop in order to be included in the GPN of major MNEs. Oil prices that affect the transportation costs and the general trend of energy efficiency pursuit can further add stress for suppliers to be more cost efficient. This applies especially to weaker companies that supply raw materials or components that can be easily acquired from multiple sources. Suppliers with more specialized products are in better position. For example, Dell cannot very easily replace its highly specialized suppliers without some major consequences to the distribution of their final products.

Most of what applies to suppliers, applies also to subcontractors. Subcontractors are, however, more attached to the GPN because the training and education of subcontractors is more time

consuming and sometimes (e.g. Microsoft and its Xbox video game console) subcontractors are responsible for the production of the whole final product. Even though the rationale of outsourcing from distant locations might suffer because of rising oil prices, it might be very difficult for MNEs to replace the sole supplier of a certain product. One solution would be that subcontractors and suppliers would move closer to markets and/or final assembly. This is a quite normal procedure for example in car industry. The problem in here is that the components could become more expensive for MNEs as the location based cost advantage disappears. Another problem is that highly specialized cluster advantages (e.g. Silicon Valley and semiconductor cluster of Taiwan) are impossible to move across borders.

When MNEs choose their important future suppliers and subcontractors they should weight also the possible consequences of transportation costs, both valid and incoming CO^2 regulations of the location and how vulnerable the supplier is to these factors. When there is an option to choose continuously from multiple suppliers in diverse locations, MNEs should use shorter contracts because the fluctuating oil price can add pressure for cost increases. Negotiation of contracts regarding the fuel surcharges and role of raw materials will play a bigger role—in my opinion—if the MNEs wants to retain attained cost level. When a MNE is subcontractor itself (e.g. Flextronics), it should take on account that the customer can contemplate the above presented issues.

Cooperative agreements

This is a large or small node in the GPN, depending on the industry of the MNE, so the generalization is difficult. The main concepts here are technology standards and consortia that back them—for example, Blu-Ray Disc Association. When it comes to consortia, companies that want to shape the future to a desired direction should choose their side in the development of oil substitutes (for energy production and raw materials) and back the chosen technology with investments, possible own research work and by lobbying. Also, it would be essential to negotiate with other companies, organizations, universities and institutes for joining the consortia. At the moment, a number of different energy technologies are lobbed to the governments and the winner of the race is decided, to a large extent, in the cabinets of power. If a

company invests and founds its supply chain, energy production and raw materials to technology that will prevail as the major substitute, it could gain advantage compared to competitors from being in the first movers and having contacts with the companies that can offer services and products using the new technology.

The type of technology that should be backed can be highly location dependent and it is probable that the development of major breakthrough will be long and fossil fuels will long stay ahead the renewables and electricity, speed and cost vice. If a MNE has a global production network, I suggest that it would be important to focus on the competing technologies that are most important for the global supply chains: more efficient and alternative fuels using diesel motors for cargo vessels and trains and biofuels and hybrid motors for automobiles. In the production, emission control technologies will come more and more important as the regulations and carbon trade comes more common in global scale.

Subsidiaries

The views that were presented for *independent suppliers and subcontractors* apply also to foreign subsidiaries. They do have two major differences though: information sharing to headquarters and flexibility. With the latter term I mean that subsidiaries are company owned and sharing of costs which the higher oil prices bring do not need to be negotiated because they are more a question of a company policies. Also it means that subsidiary can be moved across borders more "easily" or closed if the process is seen as necessary. Again, the location-based advantages are lost. The role of information diffusing is not a new role for subsidiaries. In the age of handheld Internet connection the ideas and trends flow rapidly inside the nations and the whole world. When it comes to effects of high oil price and countering of them, the world is still at a learning phase. There might be great new ideas applied to supply chain energy efficiency, consumer and customer tastes, raw materials, hedging and CO^2 controlling in some part of the world. It is important that subsidiaries diffuse these kinds of ideas forward, no matter if they are the subsidiary's own or simply a observation from the local developments. The ideas can vary from material and packaging solutions to new international distribution routes such as the

Trans-Siberian railway which is currently developed to offer transportation from Beijing to Hamburg.

Distribution Channels

In the scenario of high oil prices, I think it would be the retailer and eventually consumer/ customer that would pay the rising transportation and raw material prices of MNE and its GPN. Not initially, but as we learned from the literature review (e.g. Rogoff, 2006) that oil prices take time to have impact on the inflation. However, if the retailer is significant in size and has cost competitiveness as its strategy (e.g. Wal Mart) this surcharging of oil prices to the consumer and the distribution channels can be difficult for product MNEs. The overall reduction of oil dependency is thus important. Every major MNE that focuses on cost competitiveness of the end-product should of course pursue the same. Furthermore, the retailers are more and more interested on sustainability of the products they sell, so there are multiple advantages to be achieved though overall energy efficiency.

Joint Ventures and R&D Alliances

What was said about *Consortia* node applies also to this node and especially to R&D alliances. Joint ventures are a little different as they can bring efficiencies to GPN that are not always thought. Lapide (2007) proposed joint shipments to reduce the oil footprint of the supply chain. Next step would be co-owned transport fleets and energy production plants. The Finnish energy company TVO is a good example of an energy company which is co-owned by such global MNEs like UPM-Kymmene and Stora Enso.

The oil dependency of the partner's operations should be assessed in the partner choosing phase. When companies are establishing joint ventures, the negotiations should include the energy and oil price related issues which were already mentioned in the context of *suppliers and subcontractors*. When it comes to R&D, the development of technologies linked to energy efficiency and new materials is now important for any company, but in the scale of MNEs they can be crucial for staying in competition. The majority of business customers and an increasing

number of common consumers will demand more and more energy efficiency for products and services in the future and some of the R&D should be allocated to these technologies or sourced from GPN.

7.1.4 Global Strategy

The interplay between the MNE strategy and its global production network is one of the most challenging issues when it tries to develop a global production network to be less oil dependent. The power and importance of advanced suppliers and subcontractors and their dispersed locations make the total control difficult. Thus, the considerations presented in here can be easier said than done, especially in a global scale. Nonetheless, companies can concentrate on areas of strategy that they feel are most important to their businesses.

Achieving efficiency in current operations

Countries of low factor costs are one of the main reasons for MNE to have a global production network. As it has been discussed, some authors argue (e.g. Deering & Forbes 2009: Goel et al.) that the economical logic of outsourcing cross-regionally should be revisited, if oil price achieves a certain high level. In the light of the evidence that the literature review offered from the future of oil supply, I think these arguments are not exaggerated, but much depends on the context. Oil prices should be very high if the logic of outsourcing nuts and screws from China to Finland is to be challenged. Things might be different if the products and/or components are more complex, quality and/or timely supply are important factors and the price differential is not. There have already been some examples in the media that unreliable quality and time has led to situation where outsourcing contracts are cancelled or production is brought back, nearer to the final assembly and the main markets. but I do not believe that the oil price considerations played a major role in these cases.

If oil prices would increase significantly, I believe that if a MNE operates in an industry where cost competitiveness is essential and it cannot transfer the costs to retailers and customers, it initially would turn to classic tools of cost savings like reducing staff. Other, more long term

solutions would be to invest in marketing and brand building and/or superior quality and add characteristics to the image of the product which would justify the premium price compared to competitors. This is a very taxing process if the company is a global one, but not impossible. We should remember the argument of Rugman (2005) that the majority of the sales of top 500 MNEs of the world derives from home regions. Sales are seldom as globally dispersed as the supply chains and thus the brand building is not an as extensive global project as global production network building. Still, global brand building is a much more reliable long-term solution, especially if the consumer starts to buy less products in general because of the inflation and general macro economic downturn related to high oil price.

The ongoing IT age and globalization has made it possible to focus more on scale economies through specialization. The future requires to develop more versatile production with factories which can produce multiple products efficiently and flexibly. This flexibility could be acquired with the aid of constantly developing automation (proposed already by Ghoshal, 1987) and modern robotics. High oil price together with the fluctuating exchange rates, the wage inflation of the low-cost-work countries, automation, timely and reliable supply and quality issues can make it sensible to have more regional/local supply chains near to major markets. Toyota has been pursuing this strategy and it has almost always brought its suppliers to the new factory location. This has led to company having a global, but still local production network. The age of scarcity could also well be the age of scope economies.

Managing Risk

Macroeconomic risk

High oil price is a macroeconomic risk and most of the discussion in this study is intended to illustrate how it indirectly affects company operations. Major MNEs should assess the effects to their business, industry and customers and then observe the development of the oil industry and oil supply. Ghoshal (1987) said that a company cannot control a macroeconomic risk, but I think it can observe how the risk develops. For oil price, the four factors that are presented in the Road Map Framework can used to study the signals from the macroeconomic risk. This can save much time and money. For example, if a company is planning to invest in a location (e.g.

Russia),where economy, energy and fuel prices are linked heavily on the oil price, it should assess the risks that oil price development would mean to the objectives of the investment.

Political Risk

The main insight from political risk is that MNEs should observe the development of local regulations and legislation of CO^2 emissions, energy efficiency and governmental stand on subsidizing energy/fuel prices and oil substitute technologies. This helps to assess the political risks that oil price might bring to the business in a certain location. At the moment, China is heavily subsidizing fuel prices and it actively searches foreign partners that can fulfill its growing oil thirst. At the same time, Sweden has introduced carbon taxes which increase the fuel prices. From an economical point of view, oil dependent industries will obviously choose China when pondering FDI locations for production. On the other hand, the regulations of Sweden gives incentive to learn and develop energy efficiency production, which would evolve to competitiveness trough costs and brand/company image.

Competitive Risk

This competitive risk refers to the risk that competitor moves might produce for a global strategy. Although complex to assess thoroughly, the obvious expedient to reduce this risk in the context of oil prices, is to keep developing the operations less oil dependent and observe what the competitors are doing in the same field. Benchmarking on companies like Inditex or Vale (depending on the industry) will offer much insight to the company that wants to be energy efficient. Below is listed the expedients that this study found to be most meaningful for reducing oil dependency:

- Pursuing general energy efficiency of all the operations including supply chain, production, offices and retail locations and special software and technology to implement and control the overall energy strategy.
- Hedging with securities and contracts. Remembering also that the oil price effects to macro economy come with a delay.

- Operational hedging with portfolio of production and market locations that react differently to oil prices.
- Fixed prices and longer time periods for transportation contracts and favoring of transportation companies which invest incessantly to fuel efficiency.
- Keeping fuel efficient private fleet beside second party freight services.
- Using newer logistics solutions such as riverborne shipping and considering new possible routes like the northwest passage.
- Using less and lighter packaging and extra materials like instruction manuals together with full cargo loads and minimized number of supply trips.

Furthermore, MNEs should observe the new energy technologies that competitors invest in. Betting on technologies which do not develop to global standards is costly.

Resource Risk

Stalk (2009) predicted that the logistics of the whole global trade system might be jammed to some extent in the near future. Furthermore A.P. Moller – Maersk explained that it reduces service speed in the case of higher fuel prices and many companies were relying on sole suppliers in some important parts or whole products. This would mean that companies that rely heavily on resources that are transported from distant locations could face the risk that resource/ product supply stops or significantly slows down. Company data and reviewed literature offered some solutions to this problem:

- Keeping buffer stocks in inventories.
- Air freight might become more reliable if MNE operates time-sensitive industry such as fashion clothing.
- Localizing of a supply chain when it comes to most important resources

The flexibility of the supply chain is crucial if the oil prices would rise significantly. Although it might be a small detail, dependency to oil can also affect the interest rates of company loans, which increases the cost of finance. This adds further incentives to reduce the dependency.

Innovation learning and adaptation

One of the strengths that global presence and strategy when effectively used has is that a company can learn from diverse locations and cultures. What was said in the *Consortia* and *Joint Ventures and R&D Alliance* applies here. The best global practices regarding the reducing of oil dependency are important to be studied and diffused through the organization and operations because most of the practices and systems that can reduce the dependency are universally applicable to different products and operations. The both scale and scope economies apply to these practices and they can produce competitive advantage both from cost, customer and quality perspective. Energy efficiency and oil substitutes are important innovations to focus on, but continuous challenging of the rationale of current supply chain techniques such as just-in-time and lean inventories, is more important. In order for this to happen, the knowledge sharing inside the organization and in the global production network must be integrated to the strategy and great transparency from the operational side is needed.

7.2 Concluding Remarks

Few would argue that the world can sustain the pace of economical growth we have witnessed in the past hundred years. Oil is a finite resource and there are numerous views and predictions how the supply of it will develop in the future. No matter what will exactly happen and when, it will have wide implications to world economy and also to the leading corporations of the world. Contemporary global economy has better resistance for oil shocks than its 1970s counterpart, but it still should be prepared for the real and psychological effects of soaring energy prices.

At the moment of writing (4.April.2010) global economy is still in recession according to GDP growth metrics and a barrel of Brent Crude costs $84.01. The price has climbed 59.11% in a year. Tomorrow can bring terrorist attack to the pipelines and price would increase further. What tomorrow does not bring, is an infrastructure for an efficient oil substitute. Even electricity needs a more updated infrastructure which can reserve the produced energy (e.g. a smart grid). The world will be dependent on oil still for decades and crude oil prices will continue to fluctuate.

I do not believe that there will be a paradigm shift in how MNEs tout competitiveness by gathering resources and capabilities across the regions of the world. Neither will GPN and ideas of Ghoshal's global strategy framework lose their rationale. I find it also difficult to see that cluster advantages could be eroded by higher oil prices or any other high commodity price. Still, as conventional oil slowly depletes, R&Cs sourcing comes more difficult and in some cases lose the rationale, not only because of transportation and raw material costs but because of sustainability, supply reliability and quality issues. Furthermore, the economic growth of the BRIC and other developing countries deteriorates slowly the factor cost advantages and eventually knowledge will be the most important R&Cs to gather in a global scale— like Doz et al. (2001) proposed with their metanational company theory.

As said already in the introduction, the ongoing decade is predicted to be the era of scarcity and this will lead to a change in customer tastes. The quality and brand image will play still a larger role as the customer wants/can buy less than before. Although oil prices are not the sole reason for this, they are one of the drivers of this trend. The best thing to do for MNEs at the moment is to develop their GPN and product life-cycles more energy efficient and hedge against the possible oil price effects with a portfolio of businesses, long-term contracts and securities.

7.3 Managerial Implications

The oil prices affect all the companies in some way. What happens to oil price in the future is uncertain. The framework that I created is the main managerial implication of the study. It can be used as such to assess the possible effects of oil prices to global production networks and operations and even strategy. The framework does not provide all nor direct answers but it acts more like a thinking tool. Together with the scenario building tools it offers insights to long and medium term strategic considerations.

7.4 Suggestions for Further Research

The most obvious suggestion for further research would be quantitative studies about the oil prices and companies in different industries. It would also be interesting to see more research on

the rationale of localizing production or an entire supply chain in a region or country where fuel prices are higher. Actual interviews from MNE executives and their general views on future of oil should provide much insight regarding how the international operations and organization of the industries will develop. Another important field of study would be to see if any company has yet linked the FDI decisions and oil prices. My study excluded the social effects of high oil prices. For example, oil price affects the food prices and some countries are very dependent on imported food. This area would be the most important to study and add insight, especially in the context of possible early peaking of oil production.

Finally, my personal bet is that electricity will eventually win the race of oil substitutes. The future of electricity production and infrastructure in global scale would thus add insight to the world and international business of tomorrow.

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Internet Sources:

http://www.air-inc.com/

-Fuel prices in different nations

http://www.eia.doe.gov/

- Table 11. Products Made from a Barrel of Crude Oil

http://markets.ft.com/tearsheets/performance.asp?s=1054972&ss=WSODIssue

-Chart 1 . NYMEX Crude Oil Front Month 02.02.2005 - 02.02.2010

http://www-pam.usc.edu/images/world.gif

-Table 6. Global Value Chain of Dell

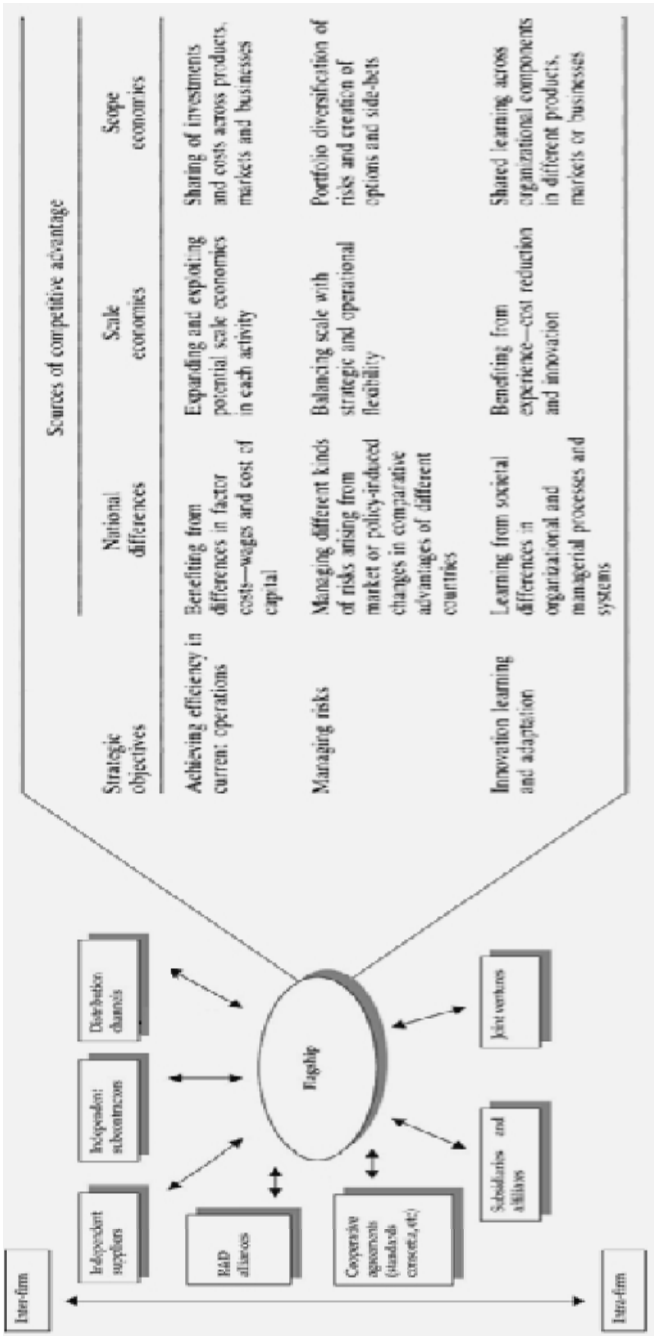
http://www.theoildrum.com

-Chart 4.World oil production (EIA Monthly) for crude oil + NGL

APPENDICES

Appendix A. Theoretical Framework

Synthesis of global strategy by Ghoshal, (1987) and global flagship network by Rugman & D'Cruz,(2000) later on modified by Ernst & Kim, (2002).



Appendix B. Data, segments and mentions

	Company	Industry	Oil	TP	OPR	ENR	CST
1	Denso	Consumer Durables					
2	Toyota	Consumer Durables					
3	Volkswagen	Consumer Durables					
4	Tata Motors	Consumer Durables					
5	Vodafone	Telecommunications Service					
6	Dell	Technology Hardware & Equipment					
7	Flextronics	Technology Hardware & Equipment					
8	Hewlett-Packard	Technology Hardware & Equipment					
9	Nokia	Technology Hardware & Equipment					
10	Sony	Technology Hardware & Equipment					
11	Panasonic	Technology Hardware & Equipment					
12	Apple	Technology Hardware & Equipment					
13	Cisco Systems	Technology Hardware & Equipment					
14	Ericsson	Technology Hardware & Equipment					
15	Canon Group	Technology Hardware & Equipment					
16	Procter&Gamble	Household & Personal Products					
17	L'oreal Group	Household & Personal Products					
18	NIKE	Household & Personal Products					
19	EDF	Utilities					
20	ENEL	Utilities					
21	RWE Group	Utilities					
22	PetroChina	Oil&Gas Operations					
23	Marubeni	Trading Companies					
24	Mitsui&Co.	Trading Companies					

	Company	Industry	Oil	TP	OPR	ENR	CST
25	Rio Tinto	Materials					
26	Vale	Materials					
27	Fosun International	Materials					
28	Arcelor Mittal	Materials					
29	Wal-Mart Stores	Retailing					
30	Inditex	Retailing					
31	Berkshire Hathaway	Diversified financials					
32	GoldmannSachs	Diversified financials					
33	Nordea Banking	Banking					

	Company	Industry	Oil	TP	OPR	ENR	CST
34	Intel	Semiconductors					
35	Samsung Electronics	Semiconductors					
36	Nestlé	Food, Drink & Tobacco					
37	Coca-Cola	Food, Drink & Tobacco					
38	Carrefour	Food Markets					
39	Singapore Airlines	Transportation					
40	FedEx	Transportation					
41	Möller - Maersk	Transportation					
42	Vestas Wind Systems	Capital Goods					
43	ABB	Capital Goods					
44	ThyssenKrupp Group	Conglomerates					
45	General Electric	Conglomerate					
46	Johnson&Johnson	Drugs and Biotechnology					
47	Pfizer	Drugs and Biotechnology					
48	IBM	Software & Services					
49	Microsoft	Software & Services					
50	SAP	Software & Services					

A cell in a segment line is colored, if company has mentioned effects of segment in the annual report. For example, SAP mentioned energy and customer segments, but did not discussed oil, transportation and operations segments.

Form-10K of 2008 was read instead of Annual Report 2008 from following companies:
Pfizer, Apple, Microsoft and Mitsui & CO.
Annual Report 2009 was read instead of Annual Report 2008 from following companies:
Sony, Marubeni, Coca-Cola, Panasonic and Denso

Abbreviations in Appendix B

Oil Oil as a macroeconomic phenomenon
TP Transportation linked to fuel and oil prices
OPR Operations linked to oil and fuel prices
ENR Energy efficiency and sustainability discussed
CST Customers / consumer linked to oil and fuel