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List of Abbreviations

MNC	Multinational company
FDI	Foreign Direct Investment
PLC	Product Life Cycle
R&D	Research & Development

1 Introduction

The first chapter includes the problem statement, the objectives and the research questions of the thesis. Moreover, information regarding its structure and organization is provided.

1.1 Problem statement and objectives

Researchers agree that classical and neoclassical trade theory cannot explain the phenomenon why products cross national borders and flow from one country to another. Economists tried to explain the flow of goods and researched this field of study to be able to answer one of the most essential questions in the research of international business: Why do firms operate in other nations besides their own (Wells, 1972, 3)?

For decades economists try to explain the nature of MNCs and the reason for their existence. The richness of research in this field shows the unbroken interest about this topic. The product life cycle theory, introduced by Vernon in 1966, is the basis for most research about this topic conducted afterwards. Since then, countless articles in journals, books, e-papers and articles regarding multinational firms and the IPLC have been published. Vernon concludes in his theory that in an early stage products are exported from the country where they have been innovated and developed. When the good gets accepted abroad the production transfers to developing countries. According to Vernon, in the end the product gets exported from the developing country to the country where it has been innovated (Hill, 1994, p. 119).

The intention of this thesis is not purely to provide a collection of papers, but also to offer a structured overview and introduction to the multinational firm and the international product life cycle theory. Above all, the underlying thesis shows a

critical view of the PLC theory, including developments and suggestions for future research. The creation of the IPLC model was a very important step in the research of international trade. The interest in this topic was huge back in that time. However, the interest seems to have faded away (Rao & Krishna, 1984, p. 122). Therefore, another aim of this thesis is to revive the topic and to regain interest in this field. Also, there is a lack of existing literature regarding the development of the PLC theory, its applicability in today's global world and other theories that build up on the original PLC theory by Vernon.

The underlying thesis aims to highlight the significance of the topic, clarify the approach of the PLC theory and show its origin, its historical development and its applications. The research questions that should be answered in this thesis are following:

1. Is the traditional product life cycle applicable in today's modern economy?
2. Can the product life cycle be applied to *any* product?
3. Are there examples of a developing country as an innovator?

1.2 Organization and structure

The first three chapters of the thesis deal with relevant definitions, topics and information that are important to understand the paper. Chapter 2 starts with defining the term MNCs and giving a historical overview of its development. Furthermore, advantages and disadvantages of MNCs are presented. The subchapter includes a short overview of the theory of the multinational firm. Another subchapter discusses Hymer's research about companies that are entering foreign markets and the reasons for it.

Chapter 3 defines the term innovation and explains its importance regarding MNCs. The subchapters explain the relationship between innovation and MNCs.

What follows is the main part of the thesis. Chapter 4 deals with Vernon's PLC theory and presents a detailed and critical analysis of the model. The chapter

starts with general information regarding the background of the PLC model. Next, the PLC is compared to other international trade theories. Additionally, the potential and limitations of these models are presented. Subchapter 4.3 explains the PLC model with all its stages in detail, following with its strengths. In chapter 4.5 some examples of products that follow the PLC suggested by Vernon are presented. What follows are the limitations of the PLC model, which represents the core part of the thesis. The answers to the research questions 1, 2 and 3 can be found here. A subchapter about Cantwell, who was one of Vernon's biggest critics, gives more insight into his opinion and presents differences between Cantwell's and Vernon's research. Next, some extension of Vernon's PLC model are shown. The chapter ends with a short excursion to the term 'born globals' and its linkage to MNCs.

In chapter 5 future research opportunities are discussed. Finally, the thesis ends with a conclusion that addresses the research questions and summarizes the most important aspects of the thesis.

2 Multinational companies

Multinational companies (MNCs) are firms that actively operate in foreign countries. It is not enough for a company to export goods to count as multinational. The definition of a MNC is a company that *“operates directly in the foreign country via the setting up of affiliates, and therefore through the ownership of assets located abroad”* (Grazia Ietto-Gillies, 2012, p. 12). According to Hill MNCs are companies that have established foreign direct investments (FDI), namely in countries besides the domestic country. Thus, being multinational means *“more than one country”* (Hill, 1994, p. 173).

Three main countries or regions were key players in the evolution process of FDI. These were the United States, Europe and Japan (Arena & Longhi, 1998, p. 614).

- American firms started to internationalize after WWII, in the 1940s and 1950s (Inkpen & Ramasqamy, 2006, p. 68).
- European countries followed the process of investments abroad in the 1970s. The FDI by European countries were mostly conducted in the United States. During this time FDI in Europe from US companies became sparse (Arena & Longhi, 1998, p. 614).
- Japanese companies began to expand in foreign markets much later. To be more precise, they started with the internationalization process in the early 1970s. Japan is known for its strong automotive and consumer electronics industries. Therefore, especially enterprises operating in these sectors became multinational (Inkpen & Ramasqamy, 2006, p. 68). Japanese companies moved its productions to other countries in South Asia to profit from lower labor costs (Hill, 1994, p. 14).

According to Rainelli these three phases were an indication for numerous studies about FDI and various theories have been created by means of those periods. Researchers often explored specific countries regarding their behavior in terms of FDI. Without a doubt, one of the most notable theories by that time was the

PLC theory by Vernon who investigated especially the FDI of US companies (Arena & Longhi, 1998, p. 614). A more detailed description of Vernon's model will be presented in section 4.

Multinational companies are much more complex than organizations that operate only in their domestic market. To be successful and stay competitive MNCs need to establish a strategy that fits to all its enterprises, in the home country as well as in all host countries (Inkpen & Ramasqamy, 2006, p. 79). MNCs became known as multinational networks that have a need of special strategies within the organization (Berghoff, 2004, p. 187). To be able to survive, a multinational company needs to "*plan, organize and control production*" (Grazia letto-Gillies, 2012, p. 11) in all countries it is present. This control happens from the center, the headquarters of a company, and is fulfilled by mutual goals and strategies. Due to our well-developed world in regard to technological progress and communication systems, MNCs have the possibility to operate, control and manage all its subsidiaries in foreign countries. The development and improvement in organization innovation concerning the internal structure of firms makes it easier for MNCs to coordinate (Grazia letto-Gillies, 2012, p. 11).

When the term multinational gets mentioned people mostly have huge companies like Unilever, Sony, Ford or Procter & Gambler in mind. All these firms represent big and complex organizations with established businesses around the world. However, this does not mean that only big companies operate transnationally. In fact, the number of multinational small and medium sized companies is increasing. An example for such a "mini-multinational" is Lubricating Systems, Inc. with headquarters in Washington. Back in 1991 the company had only 25 employees and generated a sales volume of 6,5 USD. Nearly one third of the sales was generated by exporting its products to countries like Israel and the United Arab Emirates. Thus, one should keep in mind that also medium-sized and small enterprises can operate transnationally and therefore count as multinationals (Hill, 1994, p. 17-18).

Improvement and facilitation in modern information and communication

technologies enabled smaller companies to become international and establish operations in foreign countries. Smaller companies learn from their bigger partners and use the chance to grow independently by becoming international (Grazia Ietto-Gillies, 2012, p. 13-14). Jaklic and Svetlicic outline that *“limited partners (buyers and suppliers) and scale economies”* demand internationalization from small companies (Brennan, 2011, p. 130).

The biggest percentage of home countries is in developed countries. However, the number of developing countries as home countries is rising. Moreover, the share of developing countries acting as host countries is huge. (Grazia Ietto-Gillies, 2012, p. 13-14).

MNCs are criticized for many reasons. Radically said, MNCs have the reputation to exploit their host countries and take all the advantages to its home countries. Home countries are seen as capitalistic and imperialistic. Furthermore, some argue that important positions in subsidiaries in host countries are occupied by employees with citizens from the home country (Hill, 1992, p. 197). Especially big, well-known multinational companies like Nike and Levi's garner criticism due to their behavior towards their work force employed in developing countries. It is known that organizations like this profit from lower or no regulations regarding environmental and/or workplace standards (Doh, 2005, p. 701-702). Doh underlines that *“such firms scan the globe for the cheapest, least regulated, and most exploitive situations in which to source raw materials and semi-finished products”* (Doh, 2005, p. 702).

The ideal type of a MNC has subsidiaries in each of its market. It transfers innovation within its multinational network. Thus, dispersion represents an important characteristic of a MNC. The headquarter of the company and all its subsidiaries are connected to each other. All units are interdependent in regard to people, technology and products. An additional characteristic that is important for MNCs is a good and quick communication flow to keep the subunits close together. In other words: a tight coupling of subunits is of high importance. Without a doubt one of the main positive effects of multinationals is the possibility

of each subsidiary to exploit their local environment in order to develop innovations. Thus, by the means of cross-unit learning the whole MNC is able to benefit from innovations developed in one subsidiary. The last factor that makes a MNC ideal is its structural flexibility. However, this is not directed to the formal structure of the organization, but rather on the ability of being flexible in regard of decision making and shared values (Borghoff, 2004, p. 188).

To get a better understanding for the term multinationals, important definitions regarding this topic are listed below.

Home country: The home country of a company is the place where it is legally registered and where its main headquarters are located. There can be also more than one home country. For example, the Netherlands as well as the UK represent home countries of Unilever (Grazia letto-Gillies, 2012, p. 12).

Host country: *"Host countries are the foreign countries in which the company invests and owns affiliates"* (Grazia letto-Gillies, 2012, p. 12).

Parent enterprise: The company that is responsible for the control of assets of affiliates in countries across national borders is defined as the parent enterprise. It is always based in the home country (Grazia letto-Gillies, 2012, p. 12). *"The MNE can assign various roles to its subsidiaries. From the standalone miniature and fully integrated versions of the parent company to a discrete value-chain activity that supports a global strategy"* (Inkpen & Ramaswamy, 2006, p. 71).

Foreign affiliates: As the name already reveals, foreign affiliates are located in foreign countries, thus in host countries (Grazia letto-Gillies, 2012, p. 12).

2.1 Theory of the multinational firm

A multinational company is *“a corporation that owns assets and operates direct business activities in at least two countries”* (Letto-Gillies, 2012, p. 11)

The roots of multinational firms go back to the 17th and 18th century. Firms like the East India Company and the Hudson Bay Company were the pioneers of international trade. These companies were established by governments in order to operate in their colonies. The fact that the companies have only been chartered with the aim to serve colonies that belong to the governments makes them different to today's MNCs. However, the economist Steven Hymer, whose doctoral thesis plays a key role in the international trade theory, does not agree with the idea that companies like the Hudson Bay Company should be seen as the forerunners of modern transnational corporations. He compares these companies to dinosaurs: huge in their size but small in their brain. Hymer and other business historians suggest early joint stock companies to be seen as the antecedents of today's multinational firms (Letto-Gillies, 2012, p. 7). Hymer's theory will be explained more in detail in chapter 2.2.

The main characteristics of multinational companies is that they do not only operate in foreign countries by just doing exportation or importation of goods. A multinational company operates through direct business activities in foreign country and produces its products abroad (Letto-Gillies, 2012, p. 8).

Due to globalization and the increasing trade across borders multinational companies get more and more important in today's economy. The growing number of researches about international trade shows the interest in this field. In the last decades, a lot of theories regarding multinational firms have been developed. Nation-states and frontiers are the reason for the necessity of these theories. Researchers try to explain why and how international trade takes place (Letto-Gillies, 2012, p. 3).

Generally speaking, theories of the multinational firm can basically be grouped

into three categories. At the very beginning, when the first theories about international trade were conducted, the capitalist system dominated the world. Theories have been established upon a world-wide perspective. Thus, the first group of studies focused on the accumulation of capital. After that time researchers began to see the firm as an organization as the centre of research. This period can be seen as the research about the internationalization of firms. Finally, studies dealt with *“the relations between the strategies of the firms and the market structures”* (Arena & Longhi, 1998, p. 614).

This thesis pays attention to the firm as the central player of research. Therefore, a large amount of information provided in this paper will put the firm in the spotlight.

2.2 Hymer

Stephan Hymer was a Canadian economist who plays a key role in the research of multinational companies. His doctoral thesis with the title “The international operations of national firms: a study of foreign direct investment” was written in 1960 and published in 1976. He concentrated in his research on the individual firm as an organization and its strategic investments abroad. This aspect made Hymer’s research special. Before Hymer, studies about FDI had a strong focus on the macro level. Hymer tried to answer the question why firms enter foreign markets and why FDI is growing enormously (Forsgren, 2013, p. 16-17).

Firms that enter foreign markets suffer from the fact that their knowledge of the market is not as good as from already established, local competitors. This phenomenon is known as the “liability of foreignness”. In case of perfect competition and under the assumption that all firms have the same access to all needed resources and technology, an organization that is handicapped with the liability of foreignness obviously would not be able to compete with local companies. Logically, the question that arises is, under these circumstances, why

does FDI exist and why is it growing so rapidly? (Forsgren, 2013, p. 16-17)

According to Hymer there must be certain advantages for companies that invest across borders in order to profit despite of the disadvantage that they carry with them. Hymer's intention was to find out more about these firm-specific advantages and to analyze why some firms have it and others do not. The national firm was the central player of Hymer's research. Hymer investigated the process of a national company that invests in a foreign country and thus, becomes international. According to Hymer the firm-specific advantages (or the firms' special advantages how Hymer used to call them) are *"things that are created and developed in the home market"* (Forsgren, 2013, p. 17).

Kindleberger (1969) listed advantages that make it possible for companies to profit from FDI:

1. *"departure from perfect competition in the goods market, including product differentiation, special marketing skills, retail price maintenance, administrated pricing and so forth;*
2. *departure from perfect competition in factor markets, including the existence of patented or unavailable technology, discrimination in access to capital, differences in skills of managers organized into firms rather than hired in competitive markets;*
3. *internal and external economies of scale, the latter being taken advantage of vertical integration;*
4. *government restrictions on output or entry."*

(Forsgren, 2013, p. 18)

3 Innovation

Innovation is highly related to IPLC theory introduced by Vernon (1966) and therefore it is essential to understand the term and its impact on international business. In today's highly globalized and dynamic world innovation plays a significant role and it can be found everywhere (Dobni et. al, 2015, p. 3). Innovation can be viewed at the level of firms, industries or countries as wholes (Ietto-Gillies, 2012, p. 196). Being innovative means for businesses to change, to be different, to grow, to distinguish from others (Corsi & Dulieu, 2008, p. 8). According to Krugmann innovation is *"the process by which new products are created"* (Krugmann, 1979, p. 259). Riboud defines innovation as *"an alliance between research, marketing, instinct, imagination, product and industrial courage"* (Corsi & Dulieu, 2008, p. 3). According to Rogers *"an innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption"* (Rogers, 2003, p. 11).

Innovation can relate to products or its production process. One can distinguish between two types of innovation:

The first one is known as radical innovation and means that the product or process introduced is totally new in the firm as well as in the whole economy (Ietto-Gillies, 2012, p. 196). Such innovations may create totally new industries. This phenomenon happens every 10-20 years. Popular examples for it are Henry Ford and the automotive industry, Walt Disney and its theme park, Facebook and the social media world. Such creations are seldom. However, they create new industries. When the products get adapted, the product is standardized and competitors start to enter the market (Dobni et. al, 2015, p. 5).

The second type is called imitative innovation and as the name already reveals it includes products and processes that are new only to the company. Thus, the company develops something that is already known in the economy (Ietto-Gillies, 2012, p. 196).

However, innovation can be compared to a big ecological game of our modern society. To innovate means to destroy an approach from the past in order to create place for a new one (Corsi & Dulieu, 2008, p. 9). We know that new products and services arise through innovation. However, companies do not only benefit from the introduction of new products. Being innovative creates new value for the whole organization (Dobni et. al, 2015, p. 4).

Innovations are costly. To be innovative a company needs to invest in R&D. Companies expect to be rewarded and to profit from its innovations. Thus, in the short-run the costs of R&D may be seen as very high. However, in the long-run the company assumes to benefit from new products and processes and this again allows the company to compete in the market and to stay profitable (Ietto-Gillies, 2012, p. 196).

Innovation does not simply mean to make technological changes (Parsons & Rose, 2007). *“To innovate implies the ability to operate at the rich intersection between technology and market”* (Corsi & Dulieu, 2008, p. 5)

3.1 Innovation and MNCs

The following citation captures the meaning of innovation in regard to MNCs: *“The innovative firm has a monopolistic advantage which it exploits at home and abroad via exports and FDI considered sequentially. Knowledge and technology are gradually transferred from country to country and firm to firm as imitation processes set in.”* (Ietto-Gillies, 2012, p. 196-197).

Innovation has a big role in multinational companies. Firms that are innovative have a higher chance to be successful in operating in several countries. Also, these companies are appreciated in the market and more likely to find partners for international joint ventures (Ietto-Gillies, 2012, p. 196). Multinational companies also tend to spend a lot of money by supporting their subsidies in foreign countries in the innovation process (Corsi & Dulieu, 2008, p. 12).

A company needs to be innovative in our highly dynamic economic world with customers having changing demands. Furthermore, as mentioned before, on account of innovation a firm stays competitive (Dobni et al., 2015, p.4).

However, does it mean that a multinational firm is more innovative than a company operating in only one country? The following paragraphs should highlight the innovation potential of MNCs and show if they are, in fact, more innovative than uninalional companies (Ietto-Gillies, 2012, p. 196).

First, let us have a look of some negative effects of MNCs regarding the innovation process. According to Cowling and Sugden (1987) MNCs *“increase the degree of monopoly in the industry and this reduces the incentive to invest and innovate”* (Ietto-Gillies, 2012, p. 197). Furthermore, the market in the host countries may be full of competitors, thus it may be crowded out. This can lead to the fact that MNCs lose their innovation potential (Ietto-Gillies, 2012, p. 197).

However, the arguments that put MNCs in favor regarding the innovation process seem to outvote the negative impacts. The first factor that highlights the MNCs ability to innovate is the size of the company. Multinationals are usually huge and huge companies mostly have more resources available. This makes them able to invest more money in R&D. Hence, more investment in R&D leads to innovative ideas and outcomes (Ietto-Gillies, 2012, p. 197). Not surprisingly, innovative companies may outperform their competitors (Inkpen & Ramaswamy, 2006, p. 79).

Theories like the network theory claim that multinationalism has positive effects on the innovation process of firms. Operating in several countries means having more knowledge. MNCs are capable of transferring the knowledge and innovation from nation to nation and from firm to firm (Ietto-Gillies, 2012, p. 198).

The literature available about the transfer of knowledge and innovation is enormous (Krugmann, 1979, p. 253). A well-known theory about how innovation is transferred between business units is Cantwell's theory. The theory suggests that MNCs learn from each other, no matter where it is located. Cantwell deals

with questions like how different types of knowledge can be transmitted from one location to another. It is important to know that there are different kinds of knowledge (Ietto-Gillies, 2012, p. 198-199).

- *Codified knowledge* is everything that can be defined clearly and written down, so that staff from every location can make easy use of it and in the best case generate new and innovative ideas from it (Ietto-Gillies, 2012, p. 199).
- *Uncodified or tacit knowledge* is the opposite of the first type. Thus, it is not possible to write it down explicitly. Uncodified knowledge is more about how groups work together, how they act within a group, how they fulfill their working tasks etc. (Ietto-Gillies, 2012, p. 199).

Companies use mobility of skilled labor to transmit expertise knowledge. It is the people themselves who transfer knowledge directly from location to location. There are two possible ways how people can forward their expertise to another business unit (Ietto-Gillies, 2012, p. 199). One alternative is that “*skilled labour moves from subsidiary to subsidiary within the same country or between different countries*” (Ietto-Gillies, 2012, p. 199). The other possibility is “*that the transfer of knowledge, innovation and technology can operate in both directions: the firm transfers to the local environment and receives from it*” (Ietto-Gillies, 2012, p. 199). This scenario may be planned wisely or happen by coincidence. For example, employers naturally carry their know-how from company to company. Another possible way for knowledge transaction can happen through communication with external stakeholders of the subsidiary (Ietto-Gillies, 2012, p. 199).

Several factors influence the transfer process of knowledge, respectively innovation. These include “*the balance between the organizational structure of the company and its degree of centralization; the degree of embeddedness of the subsidiary into the local economy; and the absorption capacity of the locality*” (Ietto-Gillies, 2012, p. 200).

Like Vernon, numerous other researchers linked innovation to the

internationalization of a firm. Oestrle (1997) is one of them. Table 1 shows a clear overview about Oesterle's assumptions regarding innovation and its impact on the internationalization process of a company (Borghoff, 2005, p. 82-83).

Situative suitability	Positive	Not- or late internationalizing firm (sequential mode if exclusively based on continuous innovation as setting-up advantages)	Sequential mode of internationalization (initially growth within the home market)
	negative	Dying firm (if exclusively based on continuous innovation as advantage)	Immediate, internationalization of the firm
		Continuous	Radical
		Level of innovation	

Table 1: Conditions of time-spans until internationalization (adapted from Oesterle 1977: 144, seen in Borghoff 2005, p. 83)

3.2 The changing nature of MNCs

The changing nature of MNCs was the reason for scholars to study their behaviour. Cantwell played a key role in analysing multinationals. Since the end of the 1980s Cantwell studied the field of MCNs with a strong focus on its technological innovation activities (Uzundis & Boutillier, 2012, p. 31).

In the past three decades, the behaviour of MNCs has changed. While in former times their multinational activities only included trading, business and production activities today the focus is on R&D. In the early stages of MNCs R&D was something that was always operated and regulated in the home country of a multinational company. Innovation got more and more important for companies. Being innovative means staying competitive in our globalized economy. MNCs recognized the importance of sharing knowledge and information. Therefore, R&D spendings are increasing continuously and subsidiaries in developing countries play important roles in the R&D process. Unlike in the early stages of MNCs, today innovation does not only take place in the home base. MNCs are networking more than ever. Terms like 'open innovation', 'network innovation' and 'cooperative innovation' became frequently used in the past few years (Uzundis & Boutillier, 2012, p. 23-24).

The accumulation of knowledge is the basis for innovation and an important reason why MNCs change the structure of their companies. Also, companies form partnerships and cooperations with the intention to learn from each other, share knowledge and profit from those advantages by developing new, innovative products (Uzundis & Boutillier, 2012, p. 24).

The rising importance of innovation in MNCs, its context to Vernon's PLC model and to Cantwell's theory will be highlighted in the next chapter.

4 Product Life Cycle (PLC)

4.1 Background

Existing economics literature shows the importance of international trade and its influence on the economic growth and development of a country (Morgan & Katsikeas, 1998, p. 68). Multinational firms are important agents in the contribution to national welfare and economic growth. Stephan Hymer was a Canadian economist and plays a significant role in the research of foreign direct investment. In 1960 he wrote a doctoral thesis putting the firm and its operations across borders at the center of the research (Forsgren, 2013, p. 16). In the time before Hymer *“international economists dominated the field and focused on national competitiveness at the country level, using national statistics on trade and foreign investment”* (Rugman et al., 2011, p. 756).

The increasing simplicity of crossing borders resulted in many chances for firms to profit from exports. To decide which goods are likely to succeed abroad it is essential for businessmen to have tools that help to predict the future of a product. The product life cycle (PLC) is one of these tools (Wells, 1988, p. 25).

Since the early fifties countless research about the product life cycle has been published. The richness and intensity of research highlights the importance of this topic. According to Dandekar (1987) the idea of the product life cycle is replicated from biological sciences. Like multicellular organism also products pass certain phases in their lives. Thus, the stages birth – growth – maturity – death apply for both, products and organism. Butterflies as well as human beings pass several phases during their life. Before becoming a beautiful butterfly, the insect has to evolve from an egg to a larva and pass some time in a cocoon. The lifetime of each butterfly is different. Also, the time span of each stage may differ from insect to insect. The same phenomenon can be found in the life cycle of a product (Dandekar, 1987, p. 12).

The founder of the PLC model was Raymond Vernon. He tried to explain the reason for companies to operate abroad by concentrating on the dynamic comparative advantage and combining them to the life cycle of a product. Vernon was one of the first who recognized the importance of firms in the research of international trade and extended existing theories about the topic with his PLC model (Rugman et al., 2011, p. 756).

However, before explaining the original PLC model by Vernon in detail, a short summary about its background and development will be illustrated in this chapter.

4.2 Comparing the PLC to other international trade theories

This subchapter gives an overview about different international trade theories. International trade theory can be seen “*as the expansion of the theory of economics*” (Dulupcu & Demirel, 2005, p. 28). Thus, it is essential to understand economic theory of the firm as it counts as a foundation for international business theory (Casson, 2014, p. 205).

The chapter starts with a short description of the classical theories about competitive advantage by Smith and Ricardo. The basic principles of absolute and comparative advantage will be presented in a few paragraphs. The chapter continues with the Heckscher-Ohlin theory and Leontief’s paradox.

The models will not only be presented but rather compared to the IPLC, respectively the differences to the PLC model will be demonstrated. Generally said, the beneath described theories see international movements of firms as a phenomenon at the macro level. The company itself does not play a specific role. With the introduction of the PLC the firm as an organization got in the center of research in the analysis of international business (Forsgren, 2013, p. 13).

4.2.1 Classical View: Smith and Ricardo

Competitive advantage has been used a lot in the economic theory to explain international trade. The pioneer work in this area was written by Adam Smith. In his well-known book *“The Wealth of Nations”* (1776) he explained that countries are able to produce certain products more efficiently than others and thus, create an absolute advantage. His basic idea is that the wealth of nations can be increased by international trade (Dulupcu & Demirel, 2005, p. 28).

Smith suggests countries to specialize in producing goods where an absolute advantage exists. These products should then be traded with other nations. According to Smith both countries benefit from specializing in the production of goods with an absolute advantage and trading them among each other. Smith’s theory demonstrates that the output of produced goods in both countries raises and in total, a higher amount of products can be consumed (Hill, 1994, p. 121).

David Ricardo questioned Smith’s theory and presents in his book *“Principles of Political Economy”* (1817) the benefits of a country when it produces and trades goods where it has comparative advantage. Ricardo suggests that nations should only produce goods that they produce most efficiently and trade them with other countries. That means, although a country could possibly produce a good more efficiently itself, it should still import it from countries that have a comparative advantage producing it. Again, both countries benefit from having higher outputs and trade allows both countries to consume more of the produced goods (Hill, 1994, p. 123-124).

Classical trade theory has been criticized a lot. The main reason is that in both theories assumptions got extremely simplified. Also, it has been criticized because the theories only include an analysis of the supply-side. An analysis of demand-side is missing. The IPLC model, by contrast, covers those critical points (Dulupcu & Demirel, 2005, p. 28).

4.2.2 Heckscher Ohlin

Two of the most influential theoretical ideas in international economics are without a doubt the Heckscher-Ohlin theory and the Leontief paradox. Both theories attempt to explain the international trade patterns. The Heckscher-Ohlin Theory has been introduced by Eli Heckscher and Bertil Ohlin – two Swedish economists who lived in the 19th century. They overthought the concept of competitive advantage and interpreted it differently than their predecessors (Hill, 1994, p. 129). The theory is also known as Factor Endowment theory (Dulupcu & Demirel, 2005, p. 29).

According to them competitive advantage depends on a country's factor endowment. That means, it depends how rich a country is in resources like land, labor and capital. Differences in the richness of resources among countries result in different factor costs. Hence, the theory underlines that a country will export those goods that it can produce with its abundant factor endowments. And respectively, import those goods that are produced with factors that are scarce in the country. This phenomenon can be explained easily by looking at the productions costs. *"The more abundant a factor, the lower its cost"* (Hill, 1994, p. 129). Respectively, resources that are scarce are more expensive (Hill, 194, p. 131-132).

According to this theory the United States should export products that are capital-intensive and import goods that are more labor-intensive. This outcome was derived by the fact that the United States are good equipped with capital but less with labor (Wells, 1972, p. 4). By contrast, South Korea has high exports *"of goods produced in labor-intensive manufacturing industries, such as textiles and footwear. This reflects South Korea's relative abundance of low-cost labor"* (Hill, 1994, p. 132).

Thus, the Heckscher-Ohlin theory tries to explain international trade patterns by showing the influence of factor endowments. Ricardo's theory by contrast, as explained in the subchapter before, attempts to explain international trade

patterns by looking at the difference of productivity between countries (Hill, 1994, p. 131-132).

However, comparing the Heckscher-Ohlin theory to the PLC one can recognize numerous differences. The basic differences between the two theories are presented on the next page. Additionally, the two models differ also in the following facts: the PLC is only applicable for manufactured goods. Thus, the PLC only explains *“trade in manufactures”* (Wells, 1972, p. 21). Whereas the Heckscher-Ohlin theory is seen as an *“all-encompassing model”* (Wells, 1972, p. 21).

Actually, in some cases the theories have even totally converse assumptions. For example, according to the Heckscher-Ohlin theory the United States exports products that are more capital-intensive than its imports. By contrast, the PLC model suggests that the United States export more goods that are labor-intensive. Thus, it imports products that are less labor-intensive (Wells, 1972, p. 21).

Another difference between the both theories is the ability to predict changes. International business is dynamic and trade patterns do not stay the same. Change occurs over time. However, the Heckscher-Ohlin theory does not help to predict these changes. By contrast, the PLC model *“does give ways of describing the changes in patterns which have occurred and or predicting future patterns”* (Wells, 1972, p. 21).

The table on the next page shows a compact overview about the differences between the Heckscher-Ohlin theory and the PLC.

Heckscher-Ohlin	Product Life Cycle
Identical production functions in all countries for each commodity, or differences due only to a neutral efficiency differential.	Production function changes with time; early in the life of the product it is more labor- and skill-intensive than later.
Linear, homogeneous production functions with diminishing marginal productivity for each factor.	Increasing returns to scale.
Nonreversibility of factor intensities.	Reversibility not excluded. Some authors argue that reversal will not occur late in the cycle. Such authors assume essentially identical production functions in all countries in the late phase.
Identical consumption patterns in all countries at any given set of international prices, i.e., all commodities are consumed in the same proportions regardless of income level.	Consumption patterns differ by income levels. Some goods account for a higher proportion of consumption for countries at higher levels of income. Such products are called "high income" products.
Perfect markets, free trade, and no transportation costs.	The transmission of knowledge across international boundaries is assumed to have a cost. Inside a country, the transmission of knowledge between firm and market is assumed to have a cost. Trade barriers and transportation costs are allowed to exist.
International immobility of productive factors.	Capital is assumed by many authors to be at least partially mobile.
Qualitatively identical production factors.	No assumption.
Full employment, static.	No assumption on employment, dynamic.

Table 2: Comparison of the Hecker-Ohlin theory and the PLC (adapted from Wells, 1972, p. 20)

4.2.3 The Leontief Paradox

Wassily Leontief was an economist who won the Nobel prize in economics in 1973. He is also one of numerous economists who questioned the Heckscher-Ohlin theory. Leontief tested the named theorem empirically. His results were contradictory to the given predictions of Heckscher and Ohlin. According to Leontief, exports of the United States showed a lower capital insensitivity than its imports. Thus, his empirical test did not support the Heckscher-Ohlin theorem. As already described in the subchapter before, the Heckscher-Ohlin theory suggests that the United States exports more capital-intensive goods and has higher imports of products that are labor-intensive. Leontief's finding got known as the Leontief paradox. The reasons for Leontief's observations cannot be defined clearly. However, some assumptions exist that try to explain the phenomenon (Hill, 1994, p. 132).

Leontief's conclusion resulted in confusion among economists and the controversial outcomes to the Heckscher-Ohlin theorem confirmed the need for further research of international trade patterns. Leontief explained the different outcomes by seeing labor of the United States as more productive than labor abroad. Other factors that have to be considered to be able to explain international trade patterns, especially regarding the United States, are the role of skilled labor in export industries, the persistent "dollar shortage" after WWII and the lag in technological innovations (Wells, 1972, p. 4).

Innovation and technological advancement may explain Leontief's findings. The United States possibly profits from a special advantage because of its innovative technologies, thus, goods that are produced by innovative technologies. Hill describes this scenario as follows: *"Such products may well be less capital intensive than products whose technology has had time to mature and become suitable for mass productions techniques. Thus, the United States may be exporting goods that heavily use skilled labor and innovative entrepreneurship, while importing heavy manufactures that use large amounts of capital"* (Hill, 1994, p. 132). Numerous other studies that included empirical tests in dependence on

the Heckscher-Ohlin theory support Leontief's paradox (Hill, 1994, p. 132).

The Heckscher Ohlin theory as well as the Leontief theory failed to explain patterns of international trade to the fullest (Hill, 1994, p. 199) and Vernon's product life cycle theory was an *"early response to the failure of the Heckscher-Ohlin theory to explain the observed pattern of international trade"* (Hill, 1992, p. 119).

Generally said, economists seemed as they were not satisfied enough by the outcomes and finding of the aforementioned theories. All of them (absolute and comparative advantage, Heckscher-Ohlin theory, Leontief paradox) showed limitations. More research on international trade patterns had to be done in order to get better results and explanations for trade across borders. Vernon extended this research with focusing on the production of a product and raised, at least at the beginning, a cheer. However, as it will be presented later in this thesis, Vernon's theory also got questioned and criticized a lot (Hill, 1994, p. 132).

4.2.4 Technological gap theory

The roots of the product life cycle theory go back to the 1950s. Kravis, Balogh and Williams as wells as Posner, Freeman, Douglass and Hufbauer contributed a lot to the research about the PLC because their explanations were helpful in the creation of it (Wells, 1972, p. 23). All developed theories that dealt with the basic concept of technological gap (Ietto-Gillies, 2012, p. 59). The main focus of the research was in regarded to the technological progress of the innovating country (Wells, 1972, p. 23).

Kravis states that the innovating country benefits from owning the newest goods. He presented a very similar theory to the PLC. However, due to his weak statistical tests he was not able to proof the validity of his hypothesis (Wells, 1972, p. 23).

Posner (1961) extended the existing knowledge and analyzed the advantages of initial product innovation. The innovating country profits from cumulative technological as well as trade advantages. The duration of these benefits depends strongly on how high the demand of the product is and how fast the product gets imitated by rival firms in domestic and foreign countries (Ietto-Gillies, 2012, p. 59). Posner was the first who introduced the so-called “imitation lag”, consisting of the demand lag and the reaction lag. The demand lag occurs from the consequence that new foreign goods may not be seen as the ultimate substitutes for already known, domestic products (Wells, 1972, p. 24). *“The reaction lag is the time between the production of a new product abroad and the time when a potential producer in the local market views the foreigner as a likely competitor to whom he should reach with local production”* (Wells, 1972, p. 24).

Hufbauer (1966) broadens the technological gap theory of trade by considering the differences in relative wages in the trading countries. He comes to the conclusion that countries with high-wages benefit by having a much quicker imitation process than countries with lower wages (Ietto-Gillies, 2012, p. 59). He came to this conclusion by using the “imitation lag”. His research included one product group, namely synthetic materials. Thus, by using the *imitation lag* Hufbauer was able to contribute to the research in the field of the technological gap theory and international trade by proofing the theory for one product line (Wells, 1972, p. 24).

Douglass tried to explain trade in the movie industry by using a theory very much alike to Hufbauer’s technological gap. Douglass states that a country benefits if it was one time a leader. He named this phenomenon “imitation lag”. According to him *“one innovation in a sector creates a demand for improvements in related products”* (Wells, 1972, p. 25). As an example he refers to the United States. The US was able to benefit from its leading position in the movie industry by exporting innovative products (products related to the movie industry) that were not available in other parts of the world (Wells, 1972, p. 25).

At the same time researchers like Simon Kutznets (1953) link the growth of demand for products to the product life cycle. He highlights that the demand for a product is slow in the innovation phase and speeds up afterwards. In the end the speed of demand reduces again (Ietto-Gillies, 2012, p. 59-60).

Hirsch (1965) additionally takes account to the country's competitive advantage in his analysis. His research shows that the United States benefit from a competitive advantage in the growth phase of the product. In the last phase the product gets standardized and production is mostly moved to developing countries that offer unskilled labor force at low wages. Obviously, this is the point where the US loses its competitive advantage. The competitive advantage is now transferred to less developed countries (Ietto-Gillies, 2012, p. 59-60).

Summing up it can be said that technological advantages lead to competitive advantages. As mentioned in the paragraph before, competitive advantages of a country change during the phases of a product and shift from the developed country to the developing country (Ietto-Gilles, 2012, p. 61). As one can quickly recognize the results of the technological gap theories are not contrarious to the approach of the PLC. In fact, they confirm it. What is not explained with the technological gap theory is the reason why some nations have advantages referring technology. However, the technological gap theory and the PLC theory share some identical findings. The technological gap theory can be seen as an important and supportive theory concerning the PLC (Wells, 1979, p. 25).

4.2.5 Diffusion of innovations

The basis for the traditional product life cycle theory goes back to the theory of diffusion and adoption of innovations (Dandekar, 1987, p. 45). Everett Rogers introduced the 'Diffusion of innovations theory' and showed how a product develops among its users. Roger identified five different stages of a product that shows different user groups and their acceptance level of the product (Van Vliet, 2012).

1. When a product gets newly introduced to a market, the first consumers who are interested are so called trendsetters and defined by Roger as *innovators*. Thus, those innovators are the first who will buy the product. As shown in the graphic below, the group of innovators is very small (Van Vliet, 2012).
2. The second group of consumers are the *early adopters*. Similar to the innovators they also like to try out new things and do not hesitate to invest in new products. As Figure 1 clearly shows, the size of the group is much higher than the one of the innovators. In this stage already a lot about the product is known. Early adopters therefore have a key role in word-of-mouth advertising. Their valuable advertising leads to a higher perception of the new product and thus, leads to an increase in sales (Van Vliet, 2012).
3. The third group is represented by the *early majority*. As it can be seen on the graphic, this group counts a big share of consumers. It includes consumers who are interested in trends but still rather wait for a certain time before buying the product. However, in this phase the product gets totally popular and thus, demand will rise even more (Van Vliet, 2012).
4. 'Late *majority*' defines the next group of consumers. Those consumers are only willing to buy the new product after many others have bought it before. At this stage the popularity of the product is already diminishing. The

consumers in this group need to be certain in their choice. Hence, they wait until most people have bought and tested the product so that they can be absolutely sure in it (Van Vliet, 2012).

5. The last group of consumers is presented by the so-called '*laggards*'. Those consumers do not like innovation or change. Laggards buy the product when the demand sinks and thus, price decreases (Van Vliet, 2012).

Firms recognized the importance of serving different types of consumers and therefore offer similar products to different groups. Companies are able to reach more consumers, thus generate a higher demand and also, spread risk (Van Vliet, 2012).

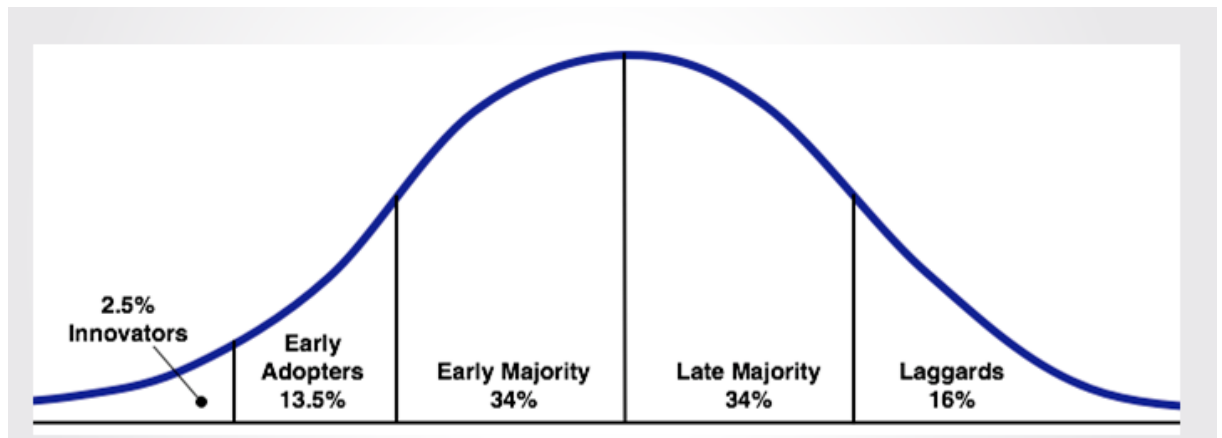


Figure 1: Diffusion of Innovations by Rogers (Van Vliet, 2012)

4.2.6 Potential of the models and its limitations

The related models of the PLC represent good tools for analyzing and deciding if a product should be exported. Generally said products that have following characteristics might be suitable for international trade: high-tech products, goods that tend to be attractive for high income consumers and also products that are labor saving. Products that promise increased returns to scale and do not demand high shipping costs are also attractive for trading internationally. A further motivation for international trade are low tariff rates in foreign countries (Wells, 1972, p. 25).

The potential of the listed models is manifold. They can be very useful for foreign investment decisions as they help to explain the patterns of FDI. Furthermore, the models give hints about which goods could possibly get exported from less developed countries. Generally said, standardized products that have long production runs promise a raise in exports. Of course, also developed countries benefit from the existence of these models. Multinational companies are able to reduce the time between introducing a product in a further market with the information gathered through certain trade models (Wells, 1972, p. 26).

However, although the models are of huge help, there is still a need of improvement. A lot of tests that have been completed in the past are limited. Often they only investigate the life of a product with certain characteristics. Thus, researches about the topic mostly just include a certain industry, a specific country or only one product line. There is still a need of further research in order to explain international trade in general and not only certain parts of it (Wells, 1972, p. 26).

4.3 The Product Life Cycle (PLC) by Vernon

Raymond Vernon is the father of the International Product Life Cycle theory. In 1966 he tried to explain the internationalization patterns of organizations. His model about the PLC represents the basis for all further studies in the field of the PLC. He investigated and analyzed how US companies transformed from local firms into multinationals (MNCs) (ProvenModels, 2005-2017).

The PLC has been a leading theory in international business and probably it still is (Rao & Krishna, 1984, p. 122). It is for sure one of the most quoted and most frequently used, but also misused in the research and study about international trade patterns (Ietto-Gillies, 2012, p. 68). Vernon's research is about firms in the US who set feet abroad. At that time the United States had the highest per capita income in the world (ProvenModels, 2005-2017).

Vernon's paper with the title "International Investment and International Trade in the Product Cycle" was published in 1966. Instead of focusing on comparative costs, Vernon analyses *"the timing of innovation, the effects on scale economies, and the roles of ignorance and uncertainty in influencing trade patterns"* (Vernon, 1966, p. 190).

Vernon assumes that companies in all developed countries mostly have the same opportunities in regard of access to knowledge and science. However, these nations may offer the same access to scientific principles but firms in those countries may not make the same advantage of the offered knowledge. But what is for sure is that the probability that producers that are located in one certain market will notice the possibility of introducing a new product to the market is higher for those producers than producers that are physically located somewhere else (Vernon, 1966, p. 192).

Vernon aims to explain why the United States is a pioneer in new product developments. He states numerous reasons which are presented in the following paragraph. He characterizes the United States as a nation with the highest

average income. Furthermore, he states that the US has high unit labor costs and unrationed capital in comparison to any other country. Also, the United States differentiates itself by a higher spending for new product developments than competitors abroad. The reason for a lead in this area is because the country profits from a better communication between the potential market and the potential supplier of the market (Vernon, 1960, p. 192-193).

In the 1960s most of newly invented goods have been sold in the United States. Also, most of them were developed by American companies. Examples for goods that have been developed, produced and sold firstly in the US market included televisions, computers, photocopiers, cameras and mass-produced automobiles. According to Vernon the United States profited from the size and wealth of the country. As already mentioned in this thesis, at that time labor was expensive in the United States (Hill, 1994, p. 133). Vernon argues that due to that fact, US companies were eager *“to develop cost-saving process innovations”* (Hill, 1994, p. 133).

Vernon argues that innovative companies from the United States were able to produce new goods in their country because newly invented products were not price sensitive. Thus, the demand of the goods did not depend on price factors. Another reason for keeping the production in the own country was the advantage of being close to the market. Also, companies benefited from having their center of decision making close to their production facilities (Hill, 1994, p. 133).

Countless studies in the past tried to explain the reasons and factors that affect the choice of the location of production. Earlier studies explained locational patterns in conventional cost-minimizing terms. In order to explain these patterns, researchers mostly referred to labor and transportation costs. Vernon contributed a lot to the research about the choice of the location of production. But he was one of the few who did not only consider labor and transportation cost. In his study he focused much more on other factors like technological advantages and a country's ability to innovate (Vernon, 1966, 190-191).

According to Vernon the United States profit from country specific advantages. Vernon's research shows that at that time, the country benefited from its technological lead compared to other countries in the world (Rugman et al., 2011, p. 756). During the time when the PLC was developed the United States represented the most powerful economy in the world (Rao & Krishna, 1984, p. 122).

The dynamics of comparative advantage played a central role in Vernon's work. He combined the knowledge about comparative advantage with the product life cycle in order to answer how international trade works and how it develops during different stages of a product (ProvenModels, 2005-2017). Innovation and its timing as well as the effects of scale economies were major factors that influenced Vernon's works (Vernon, 1966, p. 190).

The United States represent a strong economy due to its *"market size, ready acceptance of innovations, R&D resources, and well developed marketing information systems"* (Ayal, 1981, p. 91).

The model provides several advantages for multinational firms. *"It can aid a multinational firm in designing a dynamic, global production, export, and direct investment strategy; help a local firm to decide on product policy priorities for import substitution and potential export; and aid government agencies to make decisions regarding differential support schemes for industries"* (Ayal, 1981, p. 92).

Numerous economists tested Vernon's model by applying the theory to specific countries, industries or product groups. Hirsch analyzed international trade of the electronic industry and came to the conclusion that the United States *"exported growth products and imported mature products"* (Rao & Krishna, 1984, p. 122). Stobaugh concentrated in his research on the petrochemical industry. Wells found out that *"the U.S. exported high-income relatively price inelastic products and imported low-income relatively price elastic products"* (Rao & Krishna, 1984, p. 122). All these mentioned studies show that the IPLC does make it possible to

explain and predict international trade patterns (Rao & Krishna, 1984, p. 123).

The PLC theory ranks countries in different ways. Countries are listed by their ability to innovate. Also, a ranking of income per capita takes place (Ietto-Gillies, 2012, p. 69).

Transferring technological knowledge across borders is one of the positive effects of international production. Moreover, it helps to distract competitors to imitate products (Ietto-Gillies, 2012, p. 69).

Vernon's PLC model is a theory of international competition on a macro-level (Doh, 2005, p. 697). The theory describes the typical development of a product's life. It proposes that innovations that are capital intensive and advanced in technology usually get innovated in the United States. At the beginning the primary aim of these newly innovated products is to serve the domestic market. Throughout the time the product passes different stages. The production of the good transfers from the home country to other developed countries. Finally, the production takes place in developing countries and the product gets imported to developed countries (Doh, 2005, p. 697).

Table 3 shows important elements of the product life cycle:

Cycle Phase			
	Early	Growth	Mature
Demand Structure	Low price elasticity for aggregate demand and for individual firm. Nature of demand not well understood by firm.	Growing price elasticity for firm. Price competition begins.	Basis of competition is price or product differentiation through marketing techniques.
Production	Short runs, rapidly changing techniques dependent on skilled labor. Low capital intensity.	Mass production methods.	Long runs with stable techniques. Labor skills unimportant. Capital intensive.
Industry Structure	Small number of firms.	Large number of firms, but many casualties and mergers.	Number of firms declining.

Table 3: Important elements of the PLC (adapted from Wells, 1972, p. 10)

The next paragraphs should provide a detailed overview about Vernon's PLC and its stages.

4.3.1 Stage of innovation

One of Vernon's basic assumptions is that *"the entrepreneur's consciousness of and responsiveness to opportunity are a function of ease of communication; and further, that ease of communication is a function of geographical proximity"* (Vernon, 1966, p. 192).

In other words, entrepreneurs tend to be myopic. They firstly try to meet the needs and wants of consumers in the domestic market. The home market plays two important roles for innovating firms. In one hand, it represents a stimulus for the innovating company and in the other hand, it is also the preferred place for innovative firms to manufacture its product. Companies prefer setting up production facilities in their home countries because important resources like

know-how are located closely to the production (Borghoff, 2005, p. 89). Vernon states that companies tend to reflect the characteristics of the market they are located (Vernon, 1979, p. 256).

Typical characteristics of new invented products is that they are quite unstandardized at the beginning. This leads to the need of locational implications. At this stage of the PLC the price elasticity of demand is quite low. Producers need to act quickly in this phase. Communication between producer and consumer needs to take place within a short period of time (Vernon, 1966, p. 195).

According to Vernon, a US producer who sees potential for a certain product in the US market may choose the United States as the producing country because of national locational considerations. These national locational considerations include amongst others simple factor cost analysis and transport considerations (Vernon, 1966, p. 196).

4.3.2 Stage of exports

Regarding to Vernon at the early stage of a product's life demand is high in the United States, but not in other developed countries. Thus, demand in the United States grows rapidly whereas in other developed countries only high-income groups are interested in the new product. This scenario leads to the fact that production in other advanced countries besides the United States is not necessary (not yet) (Hill, 1994, p. 133). Also, at that time missing technological knowledge makes it difficult to set up production facilities in other countries (Borghoff, 2005, p. 90). However, although there is not much demand in other advanced countries, there still is some. Therefore, US companies start to export some of their goods to other developed countries in order to meet the limited demand of high-income groups in advanced countries (Hill, 1994, p. 133).

4.3.3 Maturing Product Stage

The most fundamental characteristic in the maturing product stage is that the demand for the product rises. Consequently, a certain degree of standardization already takes place in this stage of the product. However, this does not mean that producers stop seeking for product differentiation. But rather, they may strive even more for product differentiation to avoid a full extent of price competition. This leads to a high degree of specialization and an enormous variety of products may appear. In this stage customers get used to certain general standards. (Vernon, 1966, p. 196).

At this stage of the PLC mass production would allow economies of scale. Consequently, production facilities in other countries besides the home country become interesting. Thus, entrepreneurs start thinking about taking a step to foreign countries to set up a local producing facility. If we assume that economies of scale are being totally exploited, the only difference in terms of production costs is the costs of the labor force. Obviously, a firm will consider to shift the production to third-country markets to profit from cheap manpower. Vernon claims that threat is a good stimulus to act appropriately. In the PLC threat is given by local entrepreneurs and governments (Vernon, 1966, p. 200).

According to Vernon the United States will export high-income and labor-saving products as soon as they get on the market. Later, when the product is known and the demand rises, the United States should import the products from countries that provide cheaper labor force. In the early stages of a product the labor costs are much higher than in the later stages. The reason is not a need of skilled workers, but rather because the standardization process in the production of the good has not been established and so firms cannot profit from quick and cost efficient manufacturing (Vernon, 1966, p. 201-202). *“If the product has high income elasticity of demand or if it is a satisfactory substitute for high-cost labor, the demand in time will begin to grow quite rapidly in relatively advanced countries, such as those of Western Europe”* (Vernon, 1966, p. 197)

Consequently, as time passes, demand in other advanced nations begins to rise. Therefore, foreign producers consider to start producing for their domestic markets. Also, US firms start to produce in these developed countries where demand is increasing. Hence, exports from the US to advanced countries are shrinking (Hill, 1994, p. 133).

4.3.4 Standardized Product

After some time, the demand in the United States and other developed countries is maturing. The new product gets standardized and consumers are becoming price sensitive. Consequently, production costs and price begin to play an important role for producers (Hill, 1994, p. 133).

According to Vernon low labor cost is a factor that attracts companies to produce in developing countries (Vernon, 1960, p. 203). Labor costs are not the same in all advanced countries. Nations with lower labor costs than others now profit from being able to charge lower prices for their produced goods. Thus, developed countries like for example Spain or Italy now might be able to export their products to the United States (Hill, 1994, p. 133).

Over time, cost pressure becomes even more intense. Consequently, developed countries that might had a cost advantage over the United States now lose it to developing countries. Thus, production now shifts to developing countries like e.g. South Korea or Thailand (Hill, 1994, p. 133).

Hence, the United States who at first were exporters, at a later stage of a product's life transfer into importers. Thus, the US starts to import goods that they used to produce in their domestic market from developing countries (Hill, 1994, p. 134).

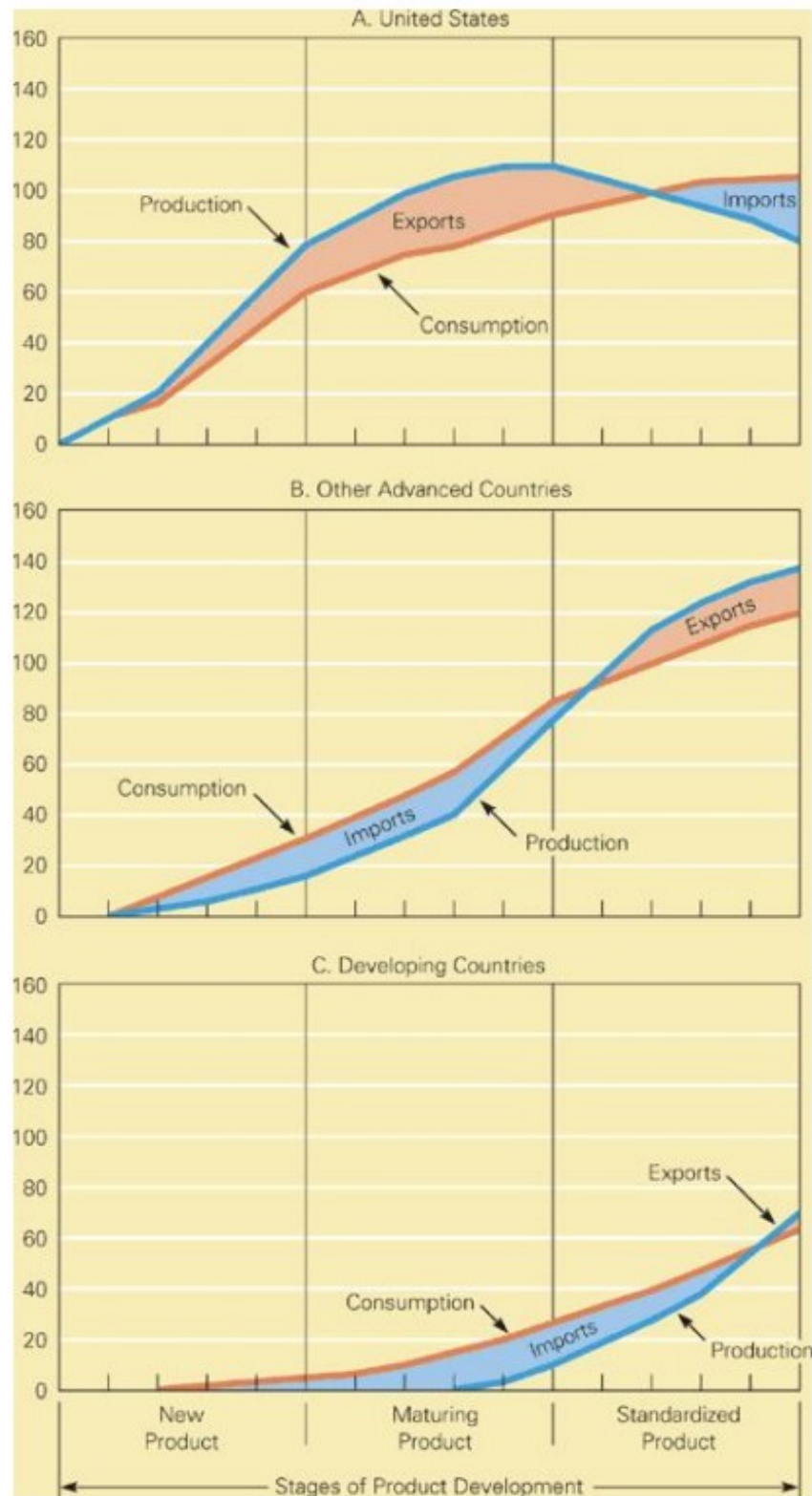


Figure 2: The Product Life Cycle (by Vernon) (Hill, 1994, p. 135)

4.4 Strengths of the PLC model

Although a lot of points of the PLC model are subject of criticism, it definitely has its strengths. It is right that MNCs became more and more global scanners. However, they are not the ideal scanners. Thus, even though multinationals are able to discover opportunities and exploit them in the international marketplace, the PLC model still is a tool that can possibly help multinationals and predict the life of certain products (Ietto-Gillies, 2012, p. 68).

But not only big MNCs can benefit from the PLC theory. Most notably smaller companies that do not have a lot of international experience profit from the PLC theory. The PLC model shows exactly how small, innovative firms with non-standardized products may enter foreign markets. As small companies are not global scanners, the PLC model represents a helpful approach for them (Ietto-Gillies, 2012, p. 68).

The PLC model was the first that took important factors like consumer's taste into consideration. Before the PLC theory no other international trade theory considered the fact that tastes of consumers are not the same in every country (Rao & Krishna, 1975, p. 123).

Another important difference to other classical trade theories is that the PLC model takes into consideration that production economies do not stay the same during the whole life cycle of a product. The theory emphasizes that it changes during a product's life (Rao & Krishna, 1975, p. 123).

Vernon was the first to establish a theory that includes international production and trade in one. The PLC model considers an *"incorporation of oligopolistic elements as well as comparative costs in the various locations"* (Ietto-Gillies, 2012, p. 68).

4.5 Examples of products

Probably the most frequently asked question regarding the PLC is how applicable it is. The following subchapter provides a couple of examples to show the accuracy of the PLC model.

The United States has been and still is a nation with an immense number of highly innovative companies. Looking back in the history, a wide range of products that went exactly through the life stages suggested by Vernon exists. The photocopier is one of many examples. The product was invented and developed by the company Xerox in the United States. At the early stage of the product's life it was only sold in the domestic market. After some time, demand in other advanced countries rose and Xerox began to export its photocopiers to Japan and some developed countries of Western Europe. The demand in these developed countries continued rising. Consequently, Xerox set up production facilities in Japan and Great Britain by creating new joint ventures. Eventually, Xerox's patents expired and competitors entered the market. Exports from the United States automatically fell and US users began to buy photocopiers from producers that offered the goods at lower prices. In this case, US consumers primarily began to buy Japanese goods. However, after some time Japanese companies recognized that their own country is too expensive and that other countries offer cheaper production facilities. Therefore, manufacturing of photocopiers shifted to developing countries like Thailand. Consequently, countries that at the beginning acted as exporters of photocopiers now started to import those. Apparently, the evolution of the production location of photocopiers obviously follows the ideas of Vernon's PLC (Hill, 1994, p. 134).

Hence, all these examples above show that the product life cycle theory explains international trade patterns (Hill, 1994, p. 134). However, it cannot be applied to every product. The global economy changed drastically since the introduction of the PLC model by Vernon. Chapter 4.6 Limitations of the PLC model will give more insight into this topic.

4.6 Limitations of the PLC model

Right after the publication of the PLC model, the theory was seen as a very important work in the research of international trade patterns. However, the initial enthusiasm in the 70s seemed to go back slowly. Several researchers found limitations of the PLC model (Rao & Krishna, 1984, p. 123). Vernon's theory became questioned and criticized a lot in the last decades. Researchers like Cantwell (1995) argued that the PLC is not valid (Doh, 2005, p. 697). Even Vernon himself questioned his model in 1979 (Rao & Krishna, 1984, p. 123).

As already mentioned, Vernon himself criticized his work almost fifteen years after publishing the PLC model. He claims that the model might lose its utility as the environment changes rapidly and international trade is something that is very dynamic. The complexity of international trade leads to the fact that the PLC model might not help to predict the process of a product's life as Vernon thought it would in 1966 (Doh, 2005, p. 697). In 1979 Vernon analyzed the hypothesis of the PLC model because of the changing international environment. In his paper he explores *"the degree of internationalization and its relation to new products diffusion; and changes in the European macroenvironment"* (Ietto-Gillies, 2012, p. 67).

The PLC model expects the whole process to happen slowly and consecutively. Some researchers criticize this aspect. According to them international trade is too dynamic to follow the steps suggested by Vernon. They argue that the internationalization process of MNCs is rather uneven or accelerated and not sequential at all as emphasized by Vernon (Doh, 2005, p. 697).

Another point that has been criticized is Vernon's view of domestic demand. He emphasizes that domestic demand has a strong influence on the decision if a product gets exported or not. In his opinion commoditization of goods is a reason for FDI (Doh, 2005, p. 698).

Some researchers do not agree with this assumption. Examples like film

production, programming, back office as well as call center activities show that Vernon's prediction is weak. In order to conduct these services local demand does not have any impact (or only little impact). In this case other factors like for example land, labor and infrastructure of the country play a much more important role (Doh, 2005, p. 698).

"The original technological gap theories emphasized the cumulative aspects of technological advantages deriving from cumulative production and/or the length of time for which the firm has been engaged in the production of the new product(s)" (Letto-Gillies, 2012, p. 69). Vernon concentrates in his analysis mostly on shifts in advantages between nations and does not consider cumulation of the elements mentioned above. This represents a weakness of the PLC model because cumulative innovations lead to the arise of new products. Thus, the company as well as the country and the industry benefits from these cumulative advantages. This assumption is missing in the explanation of the PLC model (Letto-Gillies, 2012, p. 69).

Rao & Krishna criticize one of the basic assumptions of the PLC model. The theory suggests that information between countries is restricted. This leads to the fact that US businessmen are 'forced' to introduce a new invented product initially into their domestic country and only afterwards export it abroad. In this case the export activity is only seen as an extension to the American market (Rao & Krishna, 1984, p. 123).

Levy (2005) states that *"the development of communication technologies and the requisite mobility of labor have allowed for an accelerated internationalization of production"* that does not accord with the PLC perspective (Doh, 2005, p. 697).

More and more economists agree that companies nowadays do not have to surpass all these phases presented in the past because they are so-called 'born globals'. Thus, the traditional internationalization process as it was common back in the time when multinational companies arose seems to be out of date and obsolete (Doh, 2005, p. 698).

The term 'born global' plays an important role in the world of international trade. Therefore, it is going to be explained in detail in subchapter 4.9. Today, multinationals do not have to conquer restrictions in order to let information flow. MNCs have subsidiaries in foreign countries and do not have these problems with restrictions as assumed by Vernon in 1966. Multinational companies are able to watch the world's markets through their established information systems and recognize and exploit opportunities in various parts of the world. Firms like these are not dependent on their domestic market as suggested by Vernon. Products of MNCs are not anymore designed for only one market. At the very beginning a majority of goods is designed for the world market (Rao & Krishna, 1984, p. 123).

Ayal criticizes that Vernon's research only enfolds the export performance of the United States and therefore he tested to which extent the PLC model is applicable for other countries. To be more precise, he investigated Israel's potential in exporting. According to Vernon's PLC model a nation as Israel is only able to be successful after the United States loses its initial relative advantage (Ayal, 1981, p. 91-92). However, the results of Ayal's research are converse to Vernon's findings. Due to Ayal *"successful Israeli export performance frequently coincides with successful U.S. export"* (Ayal, 1981, p. 95).

Additionally, Ayal notes that serious competition can appear much earlier than forecasted by the PLC theory (Ayal, 1981, p. 96).

According to Rao & Krishna the PLC was and probably still is an important theory for international trade. However, they state that there is a necessity of a more general model. A universal model that is able to *"to explain and predict today's international flow of trade and investment"* (Rao & Krishna, 1984, p. 122). Vernon himself agreed that a more general model of the PLC is needed (Rao & Krishna, 1984, p. 123).

In 1990 Johanson and Vahle introduced a model that presents a complement to Vernon's PLC (Doh, 2005, p. 697). They *"developed a model of sequential internationalization on a firm level that emphasizes incremental*

internationalization through acquisition, integration, and use of knowledge of foreign markets” (Doh, 2005, p. 697).

Although Vernon’s PLC model had a strong influence in the past regarding the research of international trade and production shifts between countries, scholars today criticize the model. Reddy states that “... *especially in the light of globalization of R&D, the relevance of the model to the new global environment is increasingly being questioned*” (Reddy, 2000, p. 177).

In 1979 Vernon published a paper where he takes questions his model by taking in account the increasing spread of MNCs and its geographical network. MNCs had global approaches and this made it possible to reduce the time when a product gets introduced in the United States and the time when it gets diffused in other countries (Reddy, 2000, p. 177).

Many years have passed since the PLC model has been introduced. International trade is dynamic. A lot of things regarding international trade have changed. Back in the 60s the United States was the world’s number one regarding innovation. Today, this has changed. Other developed countries have technological capabilities and therefore are able to invent innovative products (Rao & Krishna, 1984, p. 123). Nowadays Asian and European countries play an important role in the development of new, innovative products. For example, products like high-definition television or digital audio tapes were first introduced in Japan. Today’s interconnected economy makes it possible for companies to introduce products simultaneously in different countries around the world. Companies follow the theory of comparative advantage and produce different. Thus, Toshiba is able to introduce its laptops into several countries at the same time. Obviously, Toshiba’s laptops do not follow the typical product life cycle suggested by Vernon (Hill, 1994, p. 134). “*Globally dispersed centres of competence with global strategic responsibility (also for innovation) now contradict the idea of a centralized source of innovation at the home-based headquarters*” (Borghoff, 2004, p. 91). Hence, the IPLC model cannot be applied in today’s economy. Its strong predictive power was limited to the first decades after WWII (Borghoff, 2004, p. 90).

Another fact that has changed is the income gap between the US and other developed countries. In former times this gap was huge. However, today the difference is not worthy of mention. Income is spread in numerous countries around the world (Rao & Krishna, 1984, p. 123). Different events in the time between 1960 and 1980 had influence on closing the gap between the United States and Europe. Various differences between European countries and the US regarding cost of labor, per capita income, size of markets and also the taste of consumers almost disappeared (Ietto-Gillies, 2012, p. 68).

Today, American, Japanese and European MNCs are in direct competition in the world of international trade (Cantwell, 1989, p.58). Hence, the PLC model became less applicable as it was in the beginning (Ietto-Gillies, 2012, p. 68).

Additionally, countries that are rich with oil added a whole new dimension to world markets. All these factors have impact on international trade. Because of these changes in world's economy products nowadays get introduced to different markets and countries simultaneously. Demand of goods is growing much faster than it used to. Another difference to note is that a majority of products nowadays gets designed for a world market rather than for one single market (Rao & Krishna, 1984, p. 123). Goods like computers and pharmaceutical products get standardized (Ietto-Gillies, 2012, p. 68). The trend of making products like this globally standardized lead to the fact that the PLC model is seen as less applicable as it was in the beginning (Reddy, 2000, p. 177).

Products do not pass the phases with the same speed as assumed by Vernon in the PLC model. The cycles today are much shorter. Due to global competition companies are not able to wait for too long to export their products and introduce them into new markets abroad. Nowadays products are introduced in markets across borders more rapidly than they used to (Rao & Krishna, 1984, p. 123).

Vernon's research in 1979 showed that the US does not prefer countries like Canada and the UK for exporting as it did at the very beginning. His study showed that the percentage of choosing a Canadian location instead of before and Asian

location decreased rapidly. This phenomenon is easy to explain. MNCs engage more and more in international trade and global planning. The number of their operations all over the world raised significantly. Consequently, the time lag between the introduction of a product in the US and the introduction in a foreign market declined enormously. Vernon's findings conformed with findings of the OECD (1970). The OECD also came to the result that the time lag between the production of a good in the US and afterwards in a foreign country is decreasing (Ietto-Gillies, 2012, p. 67).

Another weakness of Vernon's theory is that it concentrates only on the product itself and not on the associated companies. This leads to the fact that the analysis does not include a company's possibility to spread and share its innovation and technological advantages among its products. Multi-product firms and diversification strategies play an important role in today's globalized world. Penrose recognized the power and benefits of diversification regarding the growth of a company and its gained benefits in terms of innovation (Ietto-Gillies, 2012, p. 68-69).

Cantwell states that *"the mechanism and geographical patterns of innovation activity are different from the ones envisaged by the product life cycle"* (Ietto-Gillies, 2012, p. 69). He emphasizes that MNCs that have a leading character regarding innovation do not automatically make their home country *the* leader (Ietto-Gillies, 2012, p. 69-70).

Furthermore, Cantwell suggests that technology transfer works differently today than described in literature about international trade in the 1960s. Today, MNCs act innovative in many countries and learn from each other rather than transfer technology from the home country to its host countries. Huge internal networks allow MNCs to transport and interchange their knowledge and innovation capabilities. Another phenomenon that has arisen in the past is the establishment of clusters (Ietto-Gillies, 2012, p. 69-70). *"Agglomeration economies attract several companies to the same countries/locations and the innovation activity spreads externally as well as internally"* (Ietto-Gillies, 2012, p. 70). Thus, Cantwell

shows in his approach that innovation and technology transfer does not necessarily happen like suggested in the PLC model. He emphasizes that economy and international business has changed and the MNCs' activities have been adapted to this change (Ietto-Gillies, 2012, p. 70). Chapter 4.7 provides a detailed description about Cantwell's theory including differences between his theory and Vernon's PLC theory.

Vernon's PLC model assumes that the home country of a company is where technological development happens and where R&D is managed. However, due to globalization the process of development and production of a product changed. Nowadays demand and technologies do not have to be located in the same country. Thus, demand of a product can be present in one country while the needed technologies come from another country. This means that the PLC can start also in other nations besides the home country (Reddy, 2000, p. 178).

A more detailed view of critical summaries of the PLC are presented by Cantwell in 1987, Giddy 1987 and Buckley and Casson (1976). The PLC model assumes that R&D is mostly done in the home country of the MNCs. This assumption is based on the fact that it may be necessary to do R&D in one country. Thus, to have one single center for R&D. Also, it is seen as essential for a company that the R&D, manufacturing and customers enjoy a close interaction. Innovation plays another important role in the PLC model (Reddy, 2000, p. 177). The PLC model is based on the hypothesis that innovation is a process that is led by demand *"where the special demands of sophisticated consumers and skill-intensive downstream facilities in the home countries are seen as providing stimulus for innovation"* (Reddy, 2000, p. 177).

The PLC model received critiques because changes of MNCs may lead to a compression of the product cycle. Those changes can be caused by internal or external pressures from affiliates or governments (Reddy, 2000, p. 177).

In the 1950s the United States were technological leaders. However, throughout the time Europe and Japan became also leaders in technology. As a result, Japan

now enjoys regular trade surplus. Furthermore, Japanese companies are strongly investing in US manufacturing (Cantwell, 2000). The gap between the United States and Europe was getting smaller and smaller because of numerous changes in the macro environment in Europe by the end of the 1970s (Reddy, 2000, p. 177).

4.7 Cantwell

Cantwell's critique about Vernon's PLC model has already been mentioned in the previous chapter. However, this subchapter aims to highlight the differences between the researches conducted by Vernon and Cantwell.

Cantwell argues that even at the time the PLC model got introduced, it was not correct. Cantwell used US patent data that was collected for 100 years to prove his statement. The data indicates the location of technological activity at the corporate level and shows that US electrical companies and European chemical companies internationalized their technological activities already during the inter-war period. Furthermore, the data demonstrates that the number of industries as well as firms that internationalize their activities has been rising recently (Reddy, 2000, p. 177).

Cantwell analysed the behaviour of MNCs and focused especially on their technological innovation activities. He criticized Vernon's PLC model and considered certain elements of the OLI paradigm within a time pattern in his analyses. Cantwell argues that it is not possible for MNCs to transfer necessary knowledge and specific learning fully from one subsidiary to another. In order to be innovative companies cannot outsource R&D completely. Consequently, establishing in-house R&D departments is an essential part for MNCs (Uzundis & Boutillier, 2012, p. 31-32).

Vernon's research about the PLC and Cantwell's studies have some things in common. Both scholars recognized the importance of innovation and technology

in regard of MNCs and put those terms in the centre of their analyses (Uzundis & Boutillier, 2012, p. 32).

However, the researches of the both economists differ in some essential factors. Vernon concentrates on the life cycle of a product and based his model on the technological and economic gaps between nations. By contrast, Cantwell pays attention to the firm as an organization and based his researches on innovation and technological accumulation theory (Uzundis & Boutillier, 2012, p. 32).

Uzundis & Boutillier explain Cantwell's viewpoint as follows: *"MNCs are thus comprehended as active players that are capable of creating their technological benefits through their international innovation activities. In that context, the various modes of international exploitation such as exports, license selling or the setting up of subsidiaries are complementary but not substitutable. The technological leading MNCs often follow these three modes, and become more dynamic in terms of multinationalization, compared to their competitors in the same field"* (Uzundis & Boutillier, 2012, p. 32).

Probably the biggest difference between the researches of Vernon and Cantwell is their point of view towards innovation. Vernon's PLC model suggests that innovation always takes place in the home country of a MNC. He argues that the home country (in this case the United States) dominates other nations in regard to technology. Cantwell, by contrast, does not agree with this statement. His empirical analysis in 1995 about innovation of MNCs shows that innovation activities take place in numerous nations and not only in the home country of a company (Uzundis & Boutillier, 2012, p. 32). Cantwell states that *"knowledge and technologies circulate within the MNC's huge internal network"* (Uzundis & Boutillier, 2012, p. 32).

"Vernon's technology transfer model based on the product life cycle is no longer compatible with a model of hierarchical capitalism as it used to be" (Uzundis & Boutillier, 2012, p. 33). Cantwell's empirical study about the innovation activities of multinationals and their internationalization offers a better understanding of the

development of MNCs in the past few decades. His model of technology creation shows benefits created by MNCs through their strategic behaviour. Without doubt, innovative products and processes allow MNCs to be competitive. As already mentioned, parent companies that are located in home countries are not the only source for technological progress anymore. Combining skills of all existing subsidiaries allows MNCs to broaden its knowledge. The circulation of knowledge through subsidiaries in different countries makes it possible to make synergies and create benefits for the whole MNC. Hence, combining skills, sharing knowledge and building up technology and innovation in different countries allows a MNC to grow and to become stronger (Uzundis & Boutillier, 2012, p. 33).

In his research in 1966 Vernon focused on US MNCs and showed that the consumers' income per capita plays a significant role since a high income per capita means a high potential demand for new products. He assumes that in the PLC consumers' demand leads to technological innovation. However, Cantwell – by contrast – focused in this study on innovation and production (Uzundis & Boutillier, 2012, p. 33). Hence, he showed *“the important part played by the accumulation of scientific and technological knowledge in the radical or incremental development of firms' technological skills”* (Uzundis & Boutillier, 2012, p. 33).

Another huge difference between Vernon's and Cantwell's researches is their view on technological spillovers. Vernon focuses on products and does not take account into possible technological spillovers. Cantwell, on the other hand, stresses the importance of technological spillovers. He argues that companies benefit from improved skills and broader knowledge through spillovers (Uzundis & Boutillier, 2012, p. 33).

Summing up, the most important aspect of Cantwell's theoretical and empirical analyses is that R&D of MNCs does not happen only in the parent firms in home countries. Cantwell points out that R&D activities happen in different countries. Thus, in the home country as well as in several foreign countries (Uzundis &

Boutillier, 2012, p. 34). However, although Cantwell stresses the importance of R&D activities in all countries of a MNC, he *“does not openly explain how to reach R&D globalization”* (Uzundis & Boutillier, 2012, p. 34).

4.8 Extensions of Vernon’s model

Vernon’s IPLC theory describes trade patterns between developed and developing countries. Thus, international trade that happens between countries of the North and the South. The PLC model considers the production transfer of MNCs from advanced countries to developing countries. Vernon’s research is known as the pioneering work in this field. Countless scholars studied international trade patterns afterwards, using Vernon’s work as basis (Hung, 2004, p. 2).

The interest in international trade patterns is increasing. Researchers like Vernon tried to explain international trade by considering production transfer between countries. However, although the interest in this field is enormous, there is still very little literature available about the role of MNCs in view of the product life cycle, production and technology transfer (Hung, 2004, p. 3). MNCs play a major role in the technology transmission process. Thus, MNCs transfer their technological knowledge by establishing production facilities abroad (Hung, 2004, p. 4).

Krugman (1979) expanded Vernon’s PLC theory by creating a more dynamic model. He *“built first a model of product cycle with exogeneous rate of innovation and imitation”* (Hung, 2004, p. 2). Krugman’s model is based on the fact that Northern countries keep inventing and introducing new products to the market. By contrast, Southern countries try to imitate those products continuously. The outcome of this scenario is that the North produces certain goods while the South produces other goods after the products got imitated. Thus, Krugman explained international trade patterns by taking a close look at the innovation and imitation

of products. Krugman's theory confirms the PLC model of Vernon in view of introduction and exportation of goods. Regarding Krugman, the North manufactures products at the beginning of their life and export them shortly after. However, when the imitation process from the South starts, the North eventually becomes an importer of the 'old' goods. Another finding of Krugman is that there is *"a typical inverse relationship between the relative size of labor supply and relative wage"* (Hung, 2004, p. 2).

Grossman and Helpman (1991) were two further scholars who created another formal product cycle based on Vernon's PLC model. The research is based on the assumption that labor is necessary for manufacturing and R&D as well. The underlying assumption results in seeing innovation and imitation rate as endogenous factors. They come to the result that the South can learn and benefit from the technology of the North by imitating it. However, the research does not describe the exact transfer of the technology transmission from North to South within the product cycle (Hung, 2004, p. 2-3).

Summarizing the previous paragraphs, it can be said that Vernon's PLC theory describes international trade between Northern and Southern countries. Krugman's model extends Vernon's model by considering exogenous innovation and imitation assumptions. Grossman and Helpman managed to successfully endogenize the innovation and imitation rates in their model. However, they did not consider technological transfer in detail. Hung considered all the factors mentioned (technology transfer, pattern of world trade, North-South relative wage rate). This factors has also been considered by Krugman as well as by Grossman and Helpman. Hung extended those models by additionally taking account of the production rate of MNCs (Hung, 2004, p. 17).

Hung examines in his paper the role of MNCs in the PLC. Regarding him, MNCs are the major reason for technological transfer because of their FDI in foreign countries. Southern developing countries profit from FDI of MNCs by getting access to new technology. Also, the labor force benefits from the education it gets (Hung, 2004, p. 3). Hung considers in his paper *"the role of Foreign Direct*

Investment (FDI) by MNCs to analysis the Product Cycle mechanism and re-examine the effects of North-South labor supply size changes on technology transfer, production transfer, world trade pattern, and world distribution of income” (Hung, 2004, p. 3).

Knickerbocker was a student of Vernon and he used Vernon’s PLC model as a basis for his research *“with the aim to develop an explanation for locational ‘bunching up’ of foreign direct investment”* (Ietto-Gillies, 2007, p. 5).

Recent studies show different views regarding innovation than Vernon. Those studies confirm the increasing importance of developing countries like China in the innovation process. Developing countries are welcoming local as well as foreign countries to innovate and develop its products. Advanced countries begin to lose importance in the phase of idea generation and product development (Archibugi & Filippetti, 2015, p. 231).

Table 4 shows the shift in the international flow of innovation and the literature available that contributed to this topic.

Quadrant 1 (local, top) represents the initial phase of Vernon’s PLC model. This is the period when the innovation and production process of a product takes place in an advanced country. In Vernon’s model this advanced country is the US. After the product gets marketed in the United States, it is marketed in other international markets. Thus, in other advanced countries. In Vernon’s model these advanced countries are represented by European countries (Archibugi & Filippetti, 2015, p. 231).

“Quadrant 2 (global, top) also represents innovation developed by subsidiaries of MNCs that are located in advanced countries (Cantwell 1995), a trend which paved the way for different contributions regarding subsidiary autonomy and capacity for innovation (Birkinshaw and Hood 1998)” (Archibugi & Filippetti, 2015, p. 231).

Quadrant 3 (local, bottom) shows more recent scenarios. Locals as well as

MNCs generate innovative products in emerging economies. These innovations arise by the input of markets in emerging economies. Frugal innovation (Zeschky et al., 2011), and innovation for the bottom of the pyramid (Prahalad, 2004) are major studies that represent this phenomenon (Archibugi & Filippetti, 2015, p. 232).

Quadrant 4 (global, bottom) shows scenarios that only have been noticed in the past years. The authors of the book explain quadrant 4 as follows. *“Companies operating in emerging economies source the inputs for innovation which are initially commercialized only in local markets but which, along with their evolution, find their way to advanced markets either by disrupting existing technologies or opening new market segments”* (Archibugi & Filippetti, 2015, p. 232).

The shifts between the quadrants represent geographical shifts but also the changes regarding the role of the headquarters of MNCs and its subsidiaries. Headquarters located in the home countries benefit from the innovation generated in foreign subsidiaries and are able to create new value for the whole organization and to compete in the global market (Archibugi & Filippetti, 2015, p. 232)

		OUTPUT	
		Local	Global
INPUT	<i>Advanced Economies</i>	- Vernon's Product life-cycle Theory (1966: first phase)	- Vernon's Product life-cycle Theory (1966: following phases, 1979) - Cantwell, 1995 - Birkinshaw & Hood, 1998
	<i>Emerging Economies</i>	- Frugal Innovation (Zeschky et al. 2011) - Innovation at the Bottom of the Pyramid (Prahalad, 2004)	- Reverse Innovation (Immelt et al. 2009; Govindarajan & Trimble, 2012)

Table 4: The shift in the international flow of innovation (adapted from Archibugi & Filippetti, 2015, p. 231)

4.9 The era of born globals

“Born globals are small, technology-oriented companies that operate in international markets from the earliest day of their establishment” (Knight/Cavusgil, 1996, p. 11, cited by Borghoff 2004, p. 79). As a contrast to other companies, a born global company intends to benefit from a global niche from day one of its operations (Tanev, 2012, p. 5).

Borghoff (2004) explains born globals as follows: *“Born globals dispose of access to global networks, knowledge, and markets right from the start while traditional firms need a development process to explore such global resources”* (Borghoff, 2004, p. 82). The term “born global” was introduced in 1993 by Michael Rennie who investigated competitive companies that operate in a global market, which coordinated and shared its resources between different nations. In our globalized world born globals become more and more important (Tanev, 2012, p. 5).

Companies that develop a global presence in the first few years after their establishment do not count as born globals. The big difference is that true born globals operate globally and try to reach and satisfy a global niche from the first day of its operations. Born globals are mostly small in their size and have limited access to financial, human and tangible resources. Although most born globals are technology firms, they can also be found in industries like e.g. metal fabrication, furniture, processed food and consumer products. Important characteristics of born globals is their willingness to compete, take risks and be innovative. Managers of born globals are rich in creativity, knowledge and resourcefulness. Born globals distinguish from common MNCs by concentrating on unique needs of their customers and thus, stimulating customer loyalty. The demand for highly personalized products is rising. Therefore, niche markets present huge opportunities for small born global firms (Tanev, 2012, p. 5-6). Born globals are known for exploiting business opportunities by distinguishing themselves with unique product design, high quality and innovative technology. Usually they are highly specialized (Borghoff, 2004, p. 80)

Born global companies are rising and getting more and more important due to our highly globalized economy. The successful growth strategies of born globals could provide useful lessons for other companies that operate in the global market (Tanev, 2012, p. 5).

The following table shows a summary of characteristics of successful global start-ups:

1. A global vision exists from inception.
2. Managers are internationally experienced.
3. Global entrepreneurs have strong international business networks.
4. Pre-emptive technology or marketing is exploited.
5. A unique intangible asset is present.
6. Product or service extensions are closely linked.
7. The organization is closely co-ordinated worldwide.

Table 5: “Characteristics of successful global start-ups” (adapted from Borghoff (2004), p. 82)

The reason why born global companies are important in the context of Vernon’s PLC theory is easy to explain. Products of born global firms do not pass the phases suggested by Vernon through their lives. Thus, the PLC model is not applicable and not valid for products of born global companies. Hence, this is another proof of the obsolescence of Vernon’s PLC model (Doh, 2005, p. 698).

5 Future research

Multinational companies are complex and it is not easy to explain their activities by simple theoretical approaches (Ietto-Gillies, 2007, p. 12).

Probably the most discussed and criticized limitation of Vernon's PLC theory is that it only includes one single country. In order to apply the theory to more than one country future research should investigate the theory for more countries. Furthermore, a lower level of aggregation would be of usefulness (Ayal, 1981, p. 96).

In the past, several researches about different countries were conducted in order to test the applicability of the PLC model for them. However, research about several countries at the same time would be useful in order to generate a more general theory. A broader research would logically mean more findings. Thus, *"a more general model is needed to explain and predict today's international flow of trade and investment"* (Krishna, 1984, p. 122-125).

"The concentration on the consumers and on demand gives innovation activity a dependent role in relation to demand" (Ietto-Gillies, 2012, p. 68). Considering these two factors could possibly show the impact of innovation on productivity and growth. Vernon's research does not consider this cumulative process. An extended research in this field could show which role innovation plays when it is led by supply and demand and how it effects a company and its products (Ietto-Gillies, 2012, p. 68).

Further research in the field of the PLC should consider factors as innovation rate, production rate and imitation rate. Also, a differentiation of the kind of labor that is needed to produce a product should be considered. Hence, the PLC for goods produced with high-tech labor might not be the same as the PLC of a product that can be produced with lower technological input (Hung, 2004, p. 17).

6 Conclusion

Vernon claims that *“the economic and social environment of a high per capita income and capital abundant country – the USA – creates the conditions for new products to be developed”* (Ietto-Gillies, 2007, p. 3). The basic concept of Vernon’s PLC model follows following phases: the product gets innovated in the United States, which represents a developed country. The innovating firm enjoys its monopolistic position at the beginning but loses it when the product first gets imitated by other firms in the home country and in later stage by companies in other developed and developing nations. Thus, the product gets invented and produced in the home country. As demand rises the product gets exported to other developed countries. When the product reaches the maturation stage, production in other developed countries start to take place. In the last stage of the PLC the product gets more standardized and companies try to cut costs in the production. Therefore, production transfers to developing countries. By looking to the export activities following process is suggested by Vernon: First, the US acts as an exporter and exports the goods to other developed countries. At the end, the US transfers to an importer and imports the products from developing countries (Ietto-Gillies, 2007, p. 3-4).

A lot of scholars proofed the suggested PLC model by Vernon as not valid and it received a lot of criticism.

Today’s dynamic and global business environment changed international trade dramatically. The fact that a product is produced first in the innovating country before it gets exported to other nations is not valid anymore. The life cycle of a product suggested by Vernon can be considered as obsolete due to the changing nature of multinational companies in the past decades. Thus, the first research question “Is the traditional product life cycle applicable in today’s modern economy?” can be answered with ‘no’. Chapter 4.6 gives a detailed insight into this subject matter (Reddy, 2000, p. 178).

Home countries still play a crucial role in the life of a product. In some cases

products and processes still get designed in corporate central laboratories in the innovating country. Nevertheless, nowadays innovation also takes place with affiliates abroad. MNCs are eager to share their available resources in order to profit from developed and improved ideas and reach global solutions. Global solutions make it possible for MNCs to save costs, to benefit from its workforce and knowledge in all countries it operates and to stay competitive. Multinationals nowadays do not only see their home base as a possible center of excellence. Today affiliates abroad are extremely valuable for multinational companies (Reddy, 2000, p. 178). *“Efficient manufacturing affiliates may be converted into ‘international production centres’ and the innovative R&D units of affiliates may be treated as ‘world-wide centres of excellence’ for a specific product or process development”* (Reddy, 2000, p. 178).

Vernon’s model suggests that all technological advanced activities happen in innovating, thus industrialized countries. However, global environment has changed since that and *“the same factors that made Vernon concede the relevance of the model to the new global environment are applicable in the emerging developments also”* (Reddy, 2000, p. 178). Hence, developing countries nowadays have the same possibilities regarding technological activities as developed countries. Transnational activities of MNCs resulted not only in technological progress in both, developed and developing countries. It also made it possible to educate and improve the knowledge of the global workforce which is now able to fulfill diverse technologically advanced activities also in developing countries. Hence, investment in science and technology education pays for multinationals. Also, MNCs today profit from advanced telecommunication technologies. That helps to improve and facilitate the global network of a company. Thus, today it is easier to link R&D, manufacturing and marketing activities due to major improvements in telecommunication technologies. Also, this fact leads to the fact that the initial phase of the product cycle, which Vernon suggests to happen in the home country, can also happen in developing countries (Reddy, 2000, p. 178-179).

MNCs changed the global environment with its rising global activities and its

global networks (Reddy, 2000, p. 178). The availability of technological resources made it possible that cities like Penang, Singapore and Taipei in developing countries become centres of technological breakthroughs even though the end-users of the products invented and produced are located in industrialized countries. Thus, Vernon's assumption that products are invented in the country where the end-consumer is located is not valid. For example, Motorola Inc. plant is located in Singapore. Local engineers develop innovative products in Singapore. The plant is also called the Motorola Innovation Centre. Another company that has its R&D center in Singapore is Hewlett Packard. The firm develops its portable ink-jet printers there. HP also has a facility in Malaysia where it develops components for its microwave products. These examples show that today products do not have to follow the cycle suggested by Vernon and answers the third research question ("Are there any examples of developing countries as an innovator"). Global economy is dynamic and changing and so are economic models. In our highly globalized and dynamic world it is clear that theories that have been established some decades before do not essentially have to be valid forever (Reddy, 2000, p. 178-179).

The conventional view suggested by Vernon is that developing countries are only able to fulfill activities that do not ask for high technological progress. Summarizing it can be said that this conventional view is obsolete. Although developing countries might not have reached the same status regarding technological progress as developed countries, examples show that it became possible for MNCs to fulfill activities related to the initial phase of the product cycle also in developing countries (Reddy, 2000, p. 179).

Different to some decades ago, companies today are able to introduce its products simultaneously in numerous different nations around the globe. For example companies like Toshiba introduce their laptops simultaneously in different countries. This answers the second research question "Can the PLC model can be applied to any product?". Obviously, it cannot (Hill, 1994, p. 134).

In conclusion, it can be stated that Vernon's research is impressive. The PLC

model for sure has been a helpful tool for predictions when it first got introduced. However, today's dynamic economic world and tremendous growth of international trade cannot be explained by a single, simple model. The number of born-global companies is rising and technology and telecommunication makes it easier for MNCs to operate internationally. All those aspects makes the world of multinationals and international trade complex and difficult to investigate. However, the interest in this topic is still extremely high and more explanations, models and theories regarding multinationals and their products is left to future researchers.

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Appendix

Abstract

Seit der Veröffentlichung des Artikels „International investment and international trade in the product cycle“ im Jahr 1966 zählt die von Raymond Vernon aufgestellte Theorie über den Produktlebenszyklus als eine der einflussreichsten und bedeutendsten Theorien im Forschungsfeld des internationalen Geschäfts. Vernons Theorie gibt aufschlussreiche Antworten auf die Frage, warum Unternehmen international agieren. Auch wenn Vernons Theorie über den Produktlebenszyklus und den internationalen Handel als eine der wichtigsten Theorien in diesem Feld gilt, wurde sie in den letzten Jahrzehnten von vielen Forschern kritisiert. In der heutigen Welt, wo Globalisierung die Wirtschaft prägt und unzählige Unternehmen grenzüberschreitend tätig sind, wird das Thema Internationalität in Bezug auf Wirtschaft immer wichtiger und präsenter. Die Anzahl an wissenschaftlichen Artikel und Bücher betreffend multinationale Unternehmen und den internationalen Produktlebenszyklus ist immens. Das Ziel dieser Masterarbeit ist nicht eine Sammlung und Zusammenfassung verschiedener Artikel darzustellen. Vielmehr wird hier Vernons Theorie über den internationalen Produktlebenszyklus kritisch hinterfragt und analysiert. Die Kritik über Vernons IPLC bildet den wichtigsten Teil dieser Arbeit. Weiters werden Modelle bzw. Theorien präsentiert, die auf Vernons Theorie aufbauen. Außerdem werden Vorschläge für zukünftige Forschungsarbeiten in diesem Bereich gebracht.

Der erste Teil der Arbeit befasst sich mit relevanten Definitionen, welche essentiell sind um die Thesis zu verstehen. Zum einen werden multinationale Unternehmen, deren Bedeutung sowie der historische Hintergrund und ihre Entwicklung detailliert erklärt. Außerdem wird der Begriff Innovation genauer erläutert sowie der Zusammenhang zwischen Innovation und multinationalen Unternehmen dargestellt. Der zweite Teil bildet das Kernstück der Arbeit und beschäftigt sich mit einer detaillierten und kritischen Analyse von Vernons

Produktlebenszyklus Theorie. Neben allgemeinen Informationen zu Vernons Theorie und dem Hintergrund des Modells, wird das Modell auch mit anderen Theorien verglichen. Außerdem werden die Stärken und Schwächen der Theorie ausführlich beschrieben und die Forschungsfragen der Arbeit beantwortet. Die Beantwortung dieser fundiert auf einer gründlichen, tiefgehenden Literaturanalyse. Vorschläge für zukünftige Forschungsarbeiten runden die Arbeit ab. Unter anderem wird eine Entwicklung eines allgemein gültigen Modells, welches multinationale Unternehmen von mehr als nur einem Land betrachtet, dringend empfohlen.