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Betreuender Professor: Prof. Dr. Matthias Thulesius

Zweite Prüfende: Prof. Dr. Claudia Brumberg

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Abstract

As developed markets experience a phase of rising market saturation, emerging economies are increasingly brought into the focus of commercial activities. Despite their attractive business opportunities and chances due to young ambitious populations and yet untapped markets, there remain substantial challenges which impede efficient operations. This thesis aims to identify the most important risks by analyzing relevant emerging markets with regard to political, legal, economical, technological and social factors. Thereafter negative impacts of these conditions on inventory management activities are examined and structured in a logical framework. Based on the exploration of current technological and organizational innovations, application suggestions for the identified problem areas are presented. The most promising opportunities can be found in two different research areas: Firstly the 3D printing technology which enables the immediate printing of final products as well as needed parts and thus has the potential to shorten supply chains which are susceptible to disruptions. Secondly the Internet of Things principle which involves systems of smart interconnected objects. These can be used to optimize supply chain communication and continuously monitor products, manufacturing facilities and production processes.

Keywords: emerging markets, emerging market classification, inventory management, supply chain, optimization, 3D printing, Internet of Things

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List of Abbreviations

3DP	3D printing
AAL	ambient assisted living
AFTA	ASEAN Free Trade Area
ALM	additive layer manufacturing
AM	additive manufacturing
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
ACM	Arab Common Market
CAD	computer-aided design
CPS	cyber-physical system
DC	developed country
EBM	electron beam melting
EDI	electronic data interchange
EOQ	economic order quantity
EPS	electronic procurement system
EU	European Union
FDI	foreign direct investment
FDM	fused deposition modeling
GATT	General Agreement on Tariffs and Trade
GCI	global competitiveness index
GDP	gross domestic product
GNI	gross national income
GPS	global positioning system
IEA	International Energy Agency

IMF	International Monetary Fund
IoT	Internet of Things
LDC	less developed country
LLDC	least developed country
LPI	logistics performance index
LSP	logistics service provider
MERCOSUR	Mercado Común del Sur (= Southern Common Market)
MNC	multinational company
MRP	material requirements planning
NAFTA	North American Free Trade Agreement
NIC	newly industrializing country
NATO	North Atlantic Treaty Organization
OECD	Organization for Economic Co-operation and Development
PPP	purchasing power parity
RFID	radio frequency identification
RM	rapid manufacturing
SLS	selective laser sintering
TWh	terawatt hour
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America
USD	United States dollar
USSR	Union of Soviet Socialist Republics
WTO	World Trade Organization

1   Introduction

Globalization promotes the development of supply chains that interconnect suppliers and customers located further apart from each other than ever before. Major enterprises are more and more outsourcing parts of their design and production processes to national but also foreign companies in order to reduce lead times and costs as well as being able to concentrate on core tasks. For instance Boeing outsources up to 70% of its development and production activities for the Boeing 787 program to about 50 different manufacturers and strategic partners across 135 sites located in four different continents (cf. Mejía and Velasco, 2012, p. v). The leading German car manufacturer Volkswagen group has 118 production sites in more than 30 countries across Europe, America, Africa and Asia (cf. Volkswagen AG, 2014). In this regard, emerging markets gain increasing significance as locations for manufacturing purposes yet also as key centers of demand. There are certain push and pull factors which are causing the centers of commercial activity to shift heavily. Developed economies are characterized by mature markets, continually growing competition and thus diminishing profits which are virtually "pushing" western companies to look for new opportunities to constitute business activities. Current developments in former underdeveloped countries such as the liberalization of economic structures and the formation of global and regional trading blocs have induced an increased contribution of emerging countries in the international marketplace. Hence these striving economies from Asia, South America or Africa are "pulling" foreign investment, as this is usually also accompanied by transfer of know-how and technological progress. Many emerging markets have large, further growing populations and a developing middle class with rapidly expanding consumer needs and rising disposable income. Overall living standards are increasing and new hubs of dynamic economic and consumer activity arise.

As a consequence of increasing outsourcing and offshoring activities, trade in raw materials, intermediate and final goods has increased substantially. Due to considerable progress in standardization and efficiency enhancements, transport and logistics costs are generally decreasing. In 2013, global merchandise exports were growing 2.5% in terms of value (cf. World Trade Organization, 2014, p. 14) resulting in an overall merchandise trade value of $18,301 billion (cf. ibid., p. 23). However, only 52% of world merchandise exports originated from developed economies (cf.

ibid., 2014, p. 13) which is proving the growing economic importance of emerging und developing countries. However, economic growth causes also rising economic inequalities which have to be defeated throughout the world. Just one percent of the global population owns almost half (46%) of the world's wealth and they are continually increasing their share (cf. Fuentes-Nieva and Galasso, 2014, p. 5). Developed nations are responsible for including poorer regions in the global process of growth.

Production networks with such enormous dimensions as mentioned above require supply chains to perform flawlessly in order to ensure the preservation of competitive advantages and satisfied customers. Responsible is the logistics function which involves the flow and the storage of materials, information and money. In developed economies, comprehensive transportation systems (roads, rivers, rail networks) and conveyances (trucks, container ships, trains) as well as extensive warehouse systems are taken for granted. Furthermore, the flow of goods is coordinated by intelligent information networks and sophisticated banking systems manage the corresponding money flows. Optimizations and improvements concentrate generally on how to make these flows more efficient, e.g. through innovative information technologies. Yet in other less developed parts of the world, considerable challenges exist which draw the attention more on achieving the proper functioning of simple supply chains than on cost savings or service improvements. These challenges can be caused by several factors such as poor infrastructure, political instability or obstructive business practices. Particularly in rural areas substantial problems can arise due to insufficiently developed or non-existent transportation networks.

To overcome these and other barriers, it is crucial for emerging and developing nations to build and expand the manufacturing sector, in order to raise incomes and provide the materials, machines and tools to create adequate infrastructure and housing. In the process of developing their economic activities, emerging countries can benefit from increasing research and development endeavors in western organizations and centers of excellence. Driven by short product life cycles, growing individualization trends and environmental aspects, innovation cycles are shorter than in the past. Thus the manufacturing world is shaped by permanently new developments regarding materials, information technology and production processes. Optimization and research efforts are also changing traditional supply chain design and manufacturing perspectives greatly. With the use of additive manufacturing for

example, it is possible to drastically simplify and shorten the production process, and thus, in some cases, render whole factories and transport routes unnecessary.

This thesis addresses the question how some of the most relevant technological and organizational innovations can be utilized in order to surmount various difficulties in emerging markets so that supply chain networks are optimized with a focus on inventory management.

Chapter 2 will introduce the concept of emerging markets within global classification systems of countries and by comparison of these identify 17 core emerging markets. Furthermore challenging conditions in emerging markets are examined regarding their influence on manufacturing efforts and supply chains of domestically and internationally acting companies located in these countries.

Afterwards, chapter 3 focuses on inventory management in emerging markets which is determined by unsteady demand and tough supply and transport circumstances. A general introduction on the principles of stock-keeping and warehouse management is followed by the identification of significant risks, which are structured according to their influence on relevant inventory management activities.

In chapter 4, current technological innovations will be introduced to convey an idea about functional principles and application areas. Thereafter chapter 5 presents, based on the presented innovations, concrete solution possibilities for the identified problem areas regarding inventory management in emerging markets.

2 Business Chances and Challenges in Emerging Markets

2.1 The Emergence of a New Group of Countries

A major restructuring of the global economy took place over the last few decades. A new category of countries in addition to developed and developing ones appeared which is characterized by a phase of transition, the endeavor to become market-oriented economies with a multiparty parliamentary democracy, thus being able to participate in the global marketplace and eventually raise prosperity and living standards (cf. Kvint, 2009, p. 2 f.; Meyer, 1998, p. 3). Denotations for this group of countries as well as membership definitions are diverse and ambiguous but they all have "a legacy of political, social and economic problems from their recent history as developing countries" (Kvint, 2009, p. 3). This thesis will refer to these economies in general as "emerging markets" and will focus on chances but also on problems and risks that arise when operating in these countries, especially from a logistics perspective.

At first, a short outline will be given regarding the formation of the new country category "emerging markets" and how these economies influence the global economic order. The increasing global economic cooperation, involving almost all regions of the world, began with the fall of the Iron Curtain towards the end of the last century. Prior to this, global economic integration was impeded due to major political conflicts and wars (cf. Kvint, 2009, p. 5; Meyer, 1998, p. 3). During the time of the Cold War, many of the future emerging markets acted under "a policy of economic autarky" (Meyer, 1998, p. 3), where investment from abroad was strictly constrained or even not possible at all. There were primarily three groups of countries which the world was divided into. These were developed, command economy dictatorships, and developing countries (also denoted as First, Second and Third World) (cf. Kvint, 2009, p. 161). After the fall of the Berlin Wall and the collapses of most dictatorships, this classification ceased to make sense. Moreover, as Kvint (ibid., p. 5), expressed it,

> "the widespread utilization of new technological achievements in transport and telecommunication, and the increasing liberalization of international trade and other cross-border economic relations led to continuous cooperation of almost all countries in the world economy".

For the purpose of comprehending this tendency away from dictatorships and oriented towards free-market economies, it is important to understand why command economies failed at last. Kvint (ibid., p. 77) provides an insightful explanation: In order to have a high standard of living, a country needs to produce high-quality and variable goods and services which require also a high quality of labor. A fundamental principle of command economies is on the other side the equality of all remuneration basically independent of the worker's output level. But with this assumption, there aren't any incentives for employees to work hard and efficiently and no motivation regarding innovation or leadership, thus resulting in low-quality goods, and consequently a lower quality of life. This is one of the main reasons why most economies strive to introduce free-market principles (cf. ibid., p. 77).

As more and more countries succeed in this development, they form a new group of economies called emerging markets. They are certainly not homogeneous but "share many important social, political, economic, and technological characteristics" (ibid., p. 3) and are united by their goal to achieve prosperity via free-market structures. While Kvint's view focuses mostly on former command economies, other systematic approaches to classify emerging markets are based on different criteria as described in section 2.2.

Terms like "emerging stock markets" and "emerging markets" appeared already at the beginning of the 1980s in financial areas. Antoine van Agtmael is considered as the inventor of the phrase "emerging markets". He started the "Emerging Markets Growth Fund" in 1981 after having no chance in raising money with the name "Third World Equity Fund" (cf. Authers, 2007; The Economist, 2008).

Today, few decades after the initial economic developments in emerging markets, their importance in the global network is higher than ever before. At first, foreign activities in these countries were mainly limited to making advantage of low-cost labor and raw material resources and exporting. Policy changes and economic liberalization together made multinational companies (MNCs) look for additional outlets since developing economies are struggling with an ongoing saturation caused by economic stagnation and changing demographics (cf. Nakata and Sivakumar, 1997, p. 461). They began to see emerging countries as convenient locations for manufacturing operations as well as sales markets. Thus foreign direct investment (FDI) inflows to emerging markets are increasing until today (cf. Arnold and Quelch,

1998; Kouznetsov, 2009, p. 375). According to the United Nations Conference on Trade and Development (cf. UNCTAD, 2014, p. ix), FDI inflows to all transition and developing economies rose in 2013 to an all-time peak of $886 billion, which accounts for 61% of the total $1.45 trillion flows globally.

FDI, which is defined as the net inflows of capital from one country into another, usually carried out by companies rather than governments, with the objective to establish operations, acquire tangible assets such as buildings or stakes in a foreign enterprise (cf. Financial Times, n.d.), has plenty of positive effects which were studied in many publications. Havránek and Iršová (2010, p. 25) for instance found out that it can increase the productivity of domestic operations significantly. FDI may often be connected with a lot of knowledge transfer, as new management methods and modern production technologies are introduced in the host market (cf. Meyer, 1998, p. 3).

Not only the amount of FDI but also intention of it changes over the years. Thus the division of the economic sectors evolves, so that poorer countries are less dependent on extractive industries. Up to 90% of the value of new investments carried out as greenfield projects belong to the secondary and tertiary sector, i.e. manufacturing and services (cf. UNCTAD, 2014, p. ix).

The advantages and opportunities in emerging markets are numerous: Due to a rising population and increasing disposable incomes, the middle-class in these countries is growing, resulting in a growing number of young consumers "with the ability to pay for a broad range of goods and services" (Nakata and Sivakumar, 1997, p. 462; Sakarya et al., 2007, p. 213 f.). Customers can be attracted quite easily because the increasing reach of international media and marketing have made them aware of all kinds of consumer goods which they weren't able to attain before (cf. Arnold and Quelch, 1998; Meyer, 1998, p. 4; Nakata and Sivakumar, 1997, p. 461). Moreover most markets are still untapped and therefore less competitive while the labor costs are relatively low (cf. Meyer, 1998, p. 4; Sakarya et al., 2007, p. 213 f.).

In 1996, Coca-Cola had great ambitions in the Southeast Asian countries of China, Indonesia and India. They were forecasting that sales in these markets would double every three years after an overall investment of $2 billion should have been completed in 2002. These predictions seem very profitable compared to a sales growth of 4.2% annually in the United States market up until then. Along with the

investment activities, companies like Coca-Cola are also trying to improve conditions which they come upon when arriving in the new markets. For example, Coca-Cola has offered training programs for employees of all levels or has enhanced electricity supply in certain areas so that a higher number of stores can install coolers (cf. Clifford and Harris, 1996).

The partnership of Nokia with China Mobile, one of the world's biggest mobile operators is another example of the opportunities that emerging markets hold for companies from developed countries. In 2012, Nokia partnered with the Chinese firm to offer a version of its Lumia smart phone, adjusted to the Chinese consumer needs. The sales in this large market were a chance for Nokia to regain global market share which it had lost in the previous years to its competitors Apple and Samsung (cf. Rosendahl, 2012; Nokia, 2012). The follow-up deal came at the end of 2014 when Nokia Networks and China Mobile settled on a framework agreement worth $970 million concerning the rollout of 4G wireless broadband network (cf. Nokia, 2014).

So all in all, emerging economies are growing significantly stronger than developed countries. For example, the average annual GDP growth rate from 2003 to 2013 was 10.2% for China and 7.6% for India, both countries are considered as emerging markets. On the other side, their developed counterparts such as the United States of America (USA) and Germany could achieve 1.8% respectively 1.1% on average (cf. The World Bank, 2014c). The share of gross world product on the basis of purchasing power parity (PPP) of traditional developed economies was 62% in 1990 whereas by 2013 it is less than 50% (cf. Loser, 2014, p. 97). But, to a certain extent, these developments are not extraordinarily surprising, because it is simply easier to grow fast from a lower than from a higher level of economic maturity (cf. Kvint, 2009, p. 88).

Despite all the vast opportunities and chances, the set-up of a company's business in emerging markets is also always a risky project. Coca Cola had to face several problems during its endeavors in Asia. The company experienced that it is more complicated to get the local distributors and merchants to follow the rules regarding product display or pricing policies, this is because of the fact that Coca-Cola has to engage independent wholesalers in these large countries. Also the primitive infrastructure hampers an effective distribution of products and large transfer of food-processing technology is required (cf. Clifford and Harris, 1996).

2.2 Global Country Classification Systems

Throughout history, the classification of the countries in the world was always based on certain criteria, mainly of political, economic, social, geographical, cultural or religious nature or combinations of them. The twentieth century was shaped by political conflicts resulting in different classifying structures. The events of World War II divided the world mainly between the Allies and the Axis powers, while the division during the Cold War looked quite differently, with basically the three groups of capitalist, socialist and neutral countries. Neutral countries were often denoted as the "Third World" and were seen as non-developed countries. After the Cold War had ended around 1990, there was a need for a new classification due to different political and economical developments especially among these developing countries (cf. Kvint, 2009, p. 160 f.).

There are three criteria which are commonly used to describe the economy of a country. The most frequently used is the absolute level of economic development, which is mostly indicated by the average GDP per capita but sometimes also by the relative balance of agrarian and industrial/commercial activity. Another criterion is the relative pace of economic development, which may be deduced from the GDP growth rate. Hereby it seems easier to classify emerging markets because "emerging" implies a sense of change which may be better reflected by the GDP growth rate than by the current GDP. The third criterion is related to the system of market governance and tries to measure the thorough and solid implementation of a free-market system (cf. Arnold and Quelch, 1998).

Regarding these indicators, it is important to note the difference between the usage of GNI per capita and GDP per capita to classify countries. The gross domestic product (GDP) is the total market value of all goods and services produced by labor and property within a country's borders during some time period, mostly a year. The gross national income (GNI) on the other side is the value produced by all citizens of a country, regardless of location, hence GDP plus net income obtained from other countries such as dividends and interest minus debt paid to other countries. Per capita means dividing the GDP or GNI of a country by its population (cf. Bureau of Economic Analysis, 2007; Griffin and Pustay, 2010, p. 28).

In the following two sections, several classification approaches will be presented, firstly these from major organizations and institutions and secondly, financial-sector

based classifications. Most of the groupings are regularly updated, for example the International Monetary Fund (IMF) publishes each year its World Economic Outlook where it reviews all classifications and allocations (cf. International Monetary Fund, 2015).

2.2.1 Attempts of Major Economic Institutions

2.2.1.1 World Bank

The World Bank divides the economies of the world into four income groups based on the World Development Indicators database. The thresholds are determined using gross national income (GNI) per capita, in USD, and are based on the following figures:

- GNI per capita of $1,045 or less in low-income economies;
- GNI per capita of $4,125 or less in lower-middle-income economies;
- GNI per capita of $12,746 or less in upper-middle-income economies;
- and GNI per capita of $12,746 or more in high-income economies

(cf. The World Bank, 2014a; The World Bank, n.d.).

Regarding the income of the population of a country is important when assessing emerging markets particularly because of the "threshold effect". Due to a small increase in disposable income the consumer passes a certain threshold so that he is suddenly able to purchase specific additional goods (e.g. consumer durables). This relatively small increase in wealth may therefore lead to considerably large overall increases in demand. In this regard, the availability of consumer credit is also an important factor because it enables the people to receive financing for slightly pricier items for instance televisions, refrigerators or cars (cf. Arnold and Quelch, 1998).

2.2.1.2 IMF

The income of a country does not necessarily reflect its development status, thus not all nations in one income group are undergoing the same level of development. However, the IMF provides another method to classify countries. The development status is the basis for its hierarchy of advanced economies, countries in transition and developing countries (cf. Central Intelligence Agency, 2013). Countries in

transition are accordingly "in the process of economic liberalization from a command economy" (Arnold and Quelch, 1998).

2.2.1.3 CIA World Factbook

The World Factbook which is published by the Central Intelligence Agency (2013) groups countries mainly by GDP per capita, thus classifying countries with per capita GDP of generally more than $15,000 as developed countries (DCs) and countries with a value of less than $5,000 GDP per capita as less developed countries (LDCs). Between these two groups, countries which belong to the former Union of Soviet Socialist Republics (USSR) are positioned. An analogous hierarchy is represented with the divide of the world into "First World", "Second World" and "Third World" which is however based more on global distribution of power than on economic status. Having lost their popularity today, these expressions became widely known in the time of the Cold War, where First World referred to countries aligned with the United States and the North Atlantic Treaty Organization (NATO), the Second World comprised the former Soviet Union and its allies and the remaining non-aligned countries belonged to the Third World (cf. Aridas and Pasquali, 2010; Central Intelligence Agency, 2013).

A subgroup of the less developed countries was originally labeled by the United Nations General Assembly in 1971 (cf. United Nations, n.d.) and is called least developed countries (LLDCs) since they show no sign of significant economic growth and generally have per capita GDPs of less than $1,000 and furthermore extremely low literacy rates. They can also be described as undeveloped countries, in contrast to underdeveloped countries which have a high potential for above-average economic growth due to reasonable domestic economic policies and foreign direct investment (cf. Central Intelligence Agency, 2013; Griffin and Pustay, 2010, p. 28).

2.2.1.4 UNCTAD

The United Nations Conference on Trade and Development (UNCTAD) uses in their World Investment Report a classification dividing countries into developed countries, transition economies and developing economies. Developed countries are hence the member countries of the Organization for Economic Co-operation and Development

(OECD) (except for Chile, Mexico, the Republic of Korea and Turkey), plus the new European Union member countries which are not OECD members (Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta and Romania), plus Andorra, Bermuda, Liechtenstein, Monaco and San Marino. Transition economies comprise South-East Europe, the Commonwealth of Independent States and Georgia and developing economies include all economies not specified in the other two groups (UNCTAD, 2014, p. ii).

2.2.2 Approaches of Leading Rating Agencies and Other Financial Institutions

Based on specific needs with respect to financing and investment activities, there are several private rating agencies or market index providers that create country classifications. These differ from the previously presented grouping among other things in that they mostly do not include all countries in the world but mainly those being of interest for potential investors. Another difference is that these classifications actually use the term emerging market to denote a certain group of countries, leading to the assumption that emerging markets share characteristics that are primarily interesting in financial and business contexts.

2.2.2.1 MSCI

MSCI Inc., a major provider of market indexes and other investment decision support tools worldwide presents in his 2014 Annual Market Classification a list which groups economies into Developed Markets, Emerging Markets and Frontier Markets (cf. MSCI, 2014a). This classification is used to create special indices which shall represent the development of the stock markets in the respective countries. The groupings are therefore based on investment-related criteria like economic development, size and liquidity and market accessibility (cf. MSCI, 2014b).

2.2.2.2 FTSE

The British stock market index provider FTSE conducts an annual review and classifies markets as Developed, Advanced Emerging, Secondary Emerging or Frontier. The objective is to provide investors with information about market

structures and risk factors (cf. FTSE, 2014a). The classification is similar to the MSCI Indices though there are some differences in the allocations.

2.2.2.3 Dow Jones

Another resembling example is the Dow Jones Indexes Country Classification System. In addition to the classification, there are the following category descriptions provided: "**Developed markets** are the most accessible to and supportive of foreign investors. Generally, there is high degree of consistency across these markets. **Emerging markets** generally have less accessibility relative to developed markets, but demonstrate some level of openness. **Frontier markets** are typically much less accessible to foreign investors, exhibit notable limitations in their regulatory and operational environments, and support a smaller investment landscape. Markets tend to be much less robust and in the earlier stages of development." (Dow Jones Indexes, 2011, p. 2)

2.2.3 Summary and Diverging Views

Figure 1 gives an overview of the different classifications and notations which are used to group the countries of the world according to their economic power and developmental status. The boxes should give an idea about the different hierarchies and the respective amounts of countries pertaining to the groups. It should be noted that the positions of the boxes should not necessarily create the impression that there are the same countries belonging to adjacent groups because they are overlapping in parts and not every classification covers all countries existing. Especially countries in transition are sometimes grouped with developing countries with reference to their rather low levels of income per capita, but based on their high industrialization, they also could be grouped with developed countries.

World Bank	IMF	UNCTAD	CIA World Factbook					MSCI/FTSE/ Dow Jones
High-income Economies	Advanced Economies	Developed Countries	Developed Countries	Industrial Countries	First World	North		Developed Markets
Upper-middle-income Economies	Countries in Transition	Transition Economies	Former USSR/ Eastern Europe		Second World			Emerging Markets
Lower-middle-income Economies	Developing Countries	Developing Economies	Less Developed Countries	Under-developed Countries	Third World	South		Frontier Markets
Low-income Economies			Least Developed Countries	Un-developed Countries				

Figure 1: Classification of countries by economic strength according to different institutions.

A complete listing of all countries that are included in the different classification publications can be found in Appendices 6A.1 to 6A.6.

This overview makes it obvious that a lot of different terms are used to classify countries and there is no common understanding about which countries are in similar phases of economic development. Kvint (2009, p. 79) points out that it is not sufficient to classify countries merely based on financial aspects such as the GNI per capita like e.g. the World Bank does it. This approach doesn't explain the fundamental differences between non-developed economies that exist apart from average income levels. Blurring the lines between them or even considering emerging-market, developing and underdeveloped countries as belonging to one big category can distort many statistical reviews. In contrast to emerging markets, developing countries are still only at the beginning of a process of opening up for international business activities, and underdeveloped countries are not at all ready yet due to "economic and business agendas that are not conducive to international business activity whatsoever." (ibid.) Countries belonging to these two categories still need massive support from multilateral institutions as well as aid associations to fight

against problems like starvation, mass diseases, and to improve e.g. education systems and political stability (cf. ibid.).

Another problem with the World Bank approach arises out of the positioning of the threshold which has to be adjusted due to increasing standards of living and inflation. But the changing of the ranges entails for instance that a high income in the year 1987 is suddenly just considered middle income in 1990. Thus it is hard to state whether a changing status of a country according to these thresholds is because of real economic growth or inflation (cf. ibid., p. 163).

A special group which lies somehow in between the presented classifications are newly industrializing countries (NICs) because these economies cannot yet be completely attributed with advanced or developed status but have clearly outpaced other developing economies due to a rapid industrialization process (cf. Aridas and Pasquali, 2010). Included in this intermediate category are according to the Central Intelligence Agency (2013) the so called Four Dragons or Four Tigers, which comprise Hong Kong, South Korea, Singapore and Taiwan, and also Brazil. On the other side, some economists believe that countries like Hong Kong, Singapore and South Korea have already matured so far that they can be allocated to developed markets (cf. Kuepper, n.d.).

2.3 Definition and Classification of Emerging Markets

When it comes to the definition and classification of emerging markets, there are some different approaches to be found. Although some people find the term "emerging markets" outdated according to The Economist (2008), it is still widely used in the economic literature. A rough overview is presented in the following.

Albán et al. (2014, p. 8) define emerging markets as "geographical areas in which the population has an average or low per capita income, but are on a development path to a more stable economy". Kvint (2009, p. 75) provides this comprehensive definition: "An emerging-market country (EMC) is a society transitioning from a dictatorship to a free-market-oriented-economy, with increasing economic freedom, gradual integration with the GMP [global marketplace] and with other members of the GEM [Global emerging market], an expanding middle class, improving standards of living, social stability and tolerance, as well as an increase in cooperation with

multilateral institutions". Based on this definition, Kvint (ibid., p. 100) states that as of 2008, all in all 83 countries classify in general as emerging-market countries (see Appendix 6A.7). However, based on the attractiveness for FDI flows, he narrows this circle down to 20 Top emerging-market countries (cf. ibid., p. 110). Blanco (2009, p. 3) proposes this loose definition: "an emerging market is defined as an economy with low-to-middle per capita income that is in transition to a more developed economy, characterized by stable and sustained economic growth and high standards of living". Previous notations, which were already described, like "newly industrializing countries", "less developed countries" or even "Third World countries" emphasize the fact that these are sources of cheap labor and raw materials, while the phrase "emerging markets" sets the focus more on the markets which exist in these countries and gain increasing attention (cf. Arnold and Quelch, 1998).

Particularly investment banks have begun in the last two decades to label certain groups of countries according to what they thought would be countries with extraordinary good economic development prospects. Although they are not using the phrase "emerging markets", they still are addressing the same kinds of countries showing extraordinary high growth.

The term BRIC was established in 2001 by Jim O'Neill, previous Chairman of the Goldman Sachs Asset Management. When considering GDP development for the next ten years, O'Neill came to the conclusion that some of the larger emerging markets where growing significantly faster than others and would have larger shares of world GDP than even part of the G7 (cf. O'Neill, 2001, p. 3 f.). Since 2010, the aspiring economy of South Africa is included into the group, extending the acronym to BRICS. However, the claim exists that this inclusion happened merely because of the prior negligence of the African continent (cf. The Economist, 2013).

The term Next Eleven was also coined by Jim O'Neill in 2005, four years after his concept of the BRICs. The group includes Bangladesh, Egypt, Indonesia, Iran, South Korea, Mexico, Nigeria, Pakistan, the Philippines, Turkey and Vietnam. When it comes to economic development, these countries are very diverse and also geographically widely dispersed. According to Goldman Sachs, the property which brings them into focus is the strength of their fast-growing and young populations which drive the development of their economies and will lead to rising levels of income and demand. Goldman Sachs offers their investors to participate in the GS

N-11 Equity Portfolio which currently is excluding Iran due to legal and regulatory restrictions regarding investment in this country (cf. Goldman Sachs Asset Management, 2013, p. 3 ff.).

EAGLEs is an acronym for "Emerging and Growth Leading Economies" which was developed by the Spanish Bank BBVA in 2010 designated to the world's key emerging economies currently including China, India, Indonesia, Russia, Brazil, Turkey and Mexico. They calculated for these countries to have an incremental GDP based on growth over the next ten years to be higher than the average of the G6 economies (G7 excluding the USA). Incremental GDP refers to the GDP level in ten years minus the current GDP level (cf. BBVA Research, 2014, p. 7 f.; Wassener, 2010). Along with the EAGLEs construct, the NEST were introduced as another group of countries whose expected incremental GDP is lower than the average of the G6 economies but higher than that of other non-G7 developed economies (cf. ibid., p. 8).

The CIVETS is an acronym combined from the emerging countries Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa, which was first introduced by HSBC Global Asset Management. They coined this term when launching the HBSC GIF CIVETS fund at the beginning of the current decade but it was already closed again in mid 2013 due to only limited interest from investors (cf. Blewett, 2013). The reasons for having targeted especially these countries were mainly their large and young populations, their fast-growing dynamic economies and also rising levels of FDI (cf. Greenwood, 2011; Reuters, 2010).

Goldman Sachs stated in 2011 that the "traditional Developed/Emerging market country divide no longer reflects the fundamental nature of the global economy today" (Jim O'Neill et al., 2011, p. 4). The investment bank suggests to call countries which have at least 1% of global GDP "Growth Markets" because they are likely to experience rising productivity and have favorable demographics, thus are going to have a faster growth rate than the world average. This would comprise the BRIC countries and the four largest Next 11 countries Mexico, South Korea, Turkey and Indonesia (cf. ibid., p. 4). This group in turn closely resembles the EAGLEs presented above.

It is important to stay skeptical when looking at economic research conducted by investment banks. Heese (2009, p. 24) points out that these institutions still simply

want to sell their financial products related to emerging markets and other, thus they will strive to present the economic situation in the respective countries in a favorable light.

As depicted above, there is little consistency among emerging market definitions, thus for this paper, a rather broad definition is applied, whereas the focus is on countries that have remarkably high rates of economic growth and already some characteristics of developed markets but are still showing certain risks and deficiencies which obstruct their economic attraction.

In order to sort the different views regarding which countries are part of the emerging markets group, Table 1 shows an overview of 44 potential emerging market countries according to the opinion of eight different sources.

Table 1: Emerging market countries according to different sources.

Country	IMF[1]	O'Neill[2]	BBVA[3]	MCSI[4]	FTSE[5]	S&PDJ[6]	The Economist[7]	Kvint[8]
Argentina	✓		✓				✓	✓
Bangladesh			✓					
Brazil	✓	✓	✓	✓	✓	✓	✓	✓
Bulgaria	✓							
Chile	✓		✓	✓	✓	✓	✓	
China	✓	✓	✓	✓	✓	✓	✓	✓
Colombia	✓		✓	✓	✓	✓	✓	
Czech Republic				✓	✓	✓	✓	✓
Egypt			✓	✓	✓	✓	✓	✓
Estonia	✓							
Greece				✓		✓		
Hong Kong							✓	
Hungary	✓			✓	✓	✓	✓	✓
India	✓	✓	✓	✓	✓	✓	✓	✓
Indonesia	✓	✓	✓	✓	✓	✓	✓	
Iran			✓					
Iraq			✓					
Israel							✓	✓
Kazakhstan			✓					✓
Latvia	✓							
Lithuania	✓							
Malaysia	✓		✓	✓	✓	✓	✓	
Mexico	✓	✓	✓	✓	✓	✓	✓	✓
Morocco					✓	✓		
Nigeria			✓					

Table 1: Emerging market countries according to different sources (cont.)

Country	IMF[1]	O'Neill[2]	BBVA[3]	MCSI[4]	FTSE[5]	S&PDJ[6]	The Economist[7]	Kvint[8]
Pakistan	✓		✓		✓		✓	
Peru	✓		✓	✓	✓	✓	✓	
Philippines	✓		✓	✓	✓	✓	✓	✓
Poland	✓		✓	✓	✓	✓	✓	✓
Portugal								✓
Qatar			✓	✓		✓		
Romania	✓							✓
Russia	✓	✓	✓	✓	✓	✓	✓	✓
Saudi Arabia			✓				✓	
Singapore							✓	
South Africa	✓		✓	✓	✓	✓	✓	✓
South Korea		✓		✓		✓	✓	✓
Taiwan				✓	✓	✓		
Thailand	✓		✓	✓	✓	✓	✓	
Turkey	✓	✓	✓	✓	✓	✓	✓	✓
Ukraine	✓							✓
United Arab Emirates				✓	✓	✓		
Venezuela	✓						✓	
Vietnam			✓					✓

[1] Emerging Economies according to the International Monetary Fund, 2012

[2] Growth Markets by O'Neill et al., 2011, p. 4

[3] EAGLEs and NEST countries by BBVA Research, 2014, p. 8-10

[4] Emerging Markets according to MSCI, 2014a

[5] Advanced and Secondary Emerging Markets according to FTSE, 2014b, p. 2

[6] Emerging Markets according to Dow Jones Indexes, 2011, p. 2; S&P Dow Jones Indices, 2013, p. 1

[7] Emerging Markets according to The Economist (Michigan State University, 2013)

[8] Top 20 Emerging-market countries by Kvint, 2009, p. 110

Countries which were mentioned at least in 75 % of the sources, are marked as follows:

■ 8 out of 8 sources classify this country as an emerging-market country

■ 7 out of 8 sources classify this country as an emerging-market country

■ 6 out of 8 sources classify this country as an emerging-market country

This analysis identifies the following 17 countries, which are denoted comparatively often as emerging markets:

Brazil	India	Poland
Chile	Indonesia	Russia
China	Malaysia	South Africa
Colombia	Mexico	Thailand
Egypt	Peru	Turkey
Hungary	Philippines	

In the following chapters of this thesis, they will be referred to as "**core emerging markets**". Figure 2 shows the location of these selected emerging markets on the world map. Apparently most of the countries are located in Asia and Latin America, with a few also in Africa and East Europe.

Figure 2: World map showing selected emerging market countries. Source: Visited Countries (2011).

Notwithstanding their classification, these markets still differ to a large extent, certainly regarding their economic and political development.

It has to be noted that generally all country classifications presented are subject to change frequently. An example is the possible demotion of Greece from Developed to Emerging Markets within the FTSE country classification due to recent financial problems (cf. FTSE, 2014b, p. 1). The S&P Dow Jones Index which is also quite similarly constructed already degraded Greece in 2013 and cited the consistent market recession and the constrained market accessibility as their reasons (cf. S&P Dow Jones Indices, 2013, p. 1). Another country subject to reassessment is Morocco which in 2014 was demoted by FTSE to the Frontier markets group "due to the continued decline in broad market liquidity, below the level sufficient to support sizeable global investment" (FTSE, 2014b, p. 1).

2.4 Country Conditions in Emerging Markets

There are certainly some commonalities, most importantly the very favorable growth rates, but generally emerging markets show major differences when it comes to size, population, political, economic and legal regime, and many more other attributes. All can on the one hand "provide opportunities for investors and [on the other hand] possess a significant number of threats" (Kouznetsov, 2009, p. 376). In the following section, multiple country conditions are examined systematically. They can appear as chances as well as risks but all of them more or less have an impact on the economic development and growth of a country. The higher the economic strength the more money is available in the country for further improvements in infrastructure and standard of living.

2.4.1 Organizing Framework for Emerging Market Conditions

An adequate instrument to analyze prevalent conditions in countries determining the general environment of organizations is the PEST analysis. As the acronym implies it concerns factors regarding **P**olitical, **E**conomic, **S**ocio-cultural and **T**echnological aspects of the environment. In extended variations of PEST, other factors are added, such as environmental, legal, natural or demographic aspects. Examples are provided by Richard Lynch (2006, p. 84) who suggests the PESTEL analysis by

adding separate environmental and legal sections; Matthias Sander (2004, p. 289-292) includes the natural environment while Kotler and Keller (2009, p. 114-127) add on top of that the demographic environment resulting in six "major forces" (ibid., p. 114) that a company has to monitor when acting in a global environment.

But normally those additional aspects can be attributed to at least one of the four main perspectives as well. The main objective is to analyze general environmental factors and developments that have an impact on current and future organizational activities in a certain region (cf. Niermann and Schmutte, 2014, p. 117 f.)

Nakata and Sivakumar (1997, p. 463) who examined the impact of emerging market conditions on first mover advantages have used a similar categorization. They have grouped the conditions in their study as economic, technological, socio-cultural, legal-political, and competitive-marketing. Other tools to analyze the relevant market conditions of countries are Porter's five forces analysis (cf. Porter, 2000, p. 28 ff.) or the dimensions to measure cultural distance by Hofstede (see chapter 2.4.4).

For the purpose of this thesis, the conditions are grouped according to the PEST scheme with legal issues being included in the political section and environmental issues belonging to the economical part.

2.4.2   Political and Legal Conditions

The political and legal environment of a country has a great influence on organizations as well as individuals. Laws, government agencies and also pressure groups may pose several restrictions on commercial activities in a certain country, especially in emerging markets, where political and economical structures are still evolving (cf. Kotler and Keller, 2009, p. 126).

In many emerging markets, especially in East Europe and Russia, the **political system** is still influenced by their communist history. The level of governmental ownership of companies plays a crucial role and is strongly linked with the general attitude towards monopolies and competition (cf. Lynch, 2006, p. 84). Former centrally planned economies may still have mainly governmentally controlled market structures and limit the opportunities for big multinational companies to enter the market. An example is China which has imposed a restriction on the number of companies originating from developed countries to which it issues joint-venture

permits in a lot of industries (cf. Arnold and Quelch, 1998). Such **restrictions on foreign investment** can limit the possibilities of establishing business operations in an emerging market. Foreign companies may be required to conduct research and development activities in China, transfer technology or abide by certain exportation or local content requirements (cf. USTR, 2014, p. 64). Being one of the most highly regulated markets in the world, there are small chances for MNCs to create national transportation and logistics networks (cf. Kerr, 2005, p. 64 f.). In many emerging markets, there are still a lot of state-owned monopolies which can dictate prices as they like and therefore cause unbalanced market structures and inhibit foreign investment inflows. Only recently, the Mexican government announced plans to privatize the two state-owned companies Petroleos Mexicanos (Pemex) in the oil industry and Comision Federal de Electricidad (CFE) in the electric power industry. This market liberalization will lead to increased competition and market development as well as entice new investment from outside the country (cf. Garrett Baldwin, 2014).

But precisely when **legislation** efforts are rising, the effects on businesses are increasing as well. Kotler and Keller (2009, p. 126) refer to the four main protecting purposes of commercial legislation which are "to protect companies from unfair competition, to protect consumer from unfair business practices, to protect the interests of society from unbridled business behavior, and to charge businesses with the social costs created by their products or production processes" but they add for consideration that legislation may also either intentionally or unintentionally slow down economic development and growth in a country (cf. ibid.).

An important issue are **trade barriers** which "may be broadly defined as government laws, regulations, policies, or practices that either protect domestic goods and services from foreign competition, artificially stimulate exports or particular domestic goods and services, or fail to provide adequate and effective protection of intellectual property rights" (USTR, 2014, p. 1). Doing business in an emerging market can be accompanied by significant uncertainty regarding these aspects, e.g. the Brazilian government frequently increases and decreases their relatively high tariff rates thus making related costs rather unpredictable. Moreover, high taxes and charges on imports are imposed and there are generally many import restrictions and prohibitions (cf. ibid., p. 33 f.).

The **restrictions on imports** to protect local industries lead often to a general shortage of consumer goods because the local capacities are not able to satisfy the demand of the population. This describes the situation of a seller's market, where the customers tend to buy the few available goods at any given price (cf. Goonatilake, 1984, p. 58).

Local content regulations require products to contain a specific percentage of their basic agricultural materials that is domestically produced (cf. OECD, 2001). Nearly all emerging markets have established some sort of local content policies, e.g. Brazil provides tax reductions and other benefits for those manufacturers who incorporate a certain minimum amount of regional and local goods (cf. USTR, 2014, p. 36).

Especially in the case when goods are sourced from outside a country, **customs regulations** play an important role because complex and time consuming customs requirements or mandatory product inspections impede efficient logistics heavily while they may increase direct logistics costs and cause the need for additional inventory (Maltz et al., 2013, p. 276).

In order to facilitate trade between countries, global **trade agreements** and regional **free trade zones** were formed. The World Trade Organization (WTO), established by 123 nations in 1995 as a successor to the General Agreement on Tariffs and Trade (GATT), aims to encourage trade and improve economic relationships around the world through different methods such as expanding quotas or lowering tariffs. This leads to an overall increase of economic efficiency due to comparative advantage (cf. Altmann and Kulessa, 1998, p. 283 ff., Krugman and Obstfeld, 2009, p. 230 ff.). Several regional free trade areas and cooperating organizations were constituted in order to simplify business transactions among the member states by reducing barriers to trade. Relevant examples are the North American Free Trade Agreement (NAFTA) (cf. Altmann and Kulessa, 1998, p. 148 ff.), the European Union (EU) (cf. ibid., p. 42 ff.), the Southern Common Market (MERCOSUR, from the Spanish language: Mercado Común del Sur) (cf. ibid., p. 144 ff.), the Arab Common Market (ACM) (cf. ibid., p. 11 f.), the Free Trade Area within the Association of Southeast Asian Nations (ASEAN) called AFTA (cf. ibid., p. 1) or the Asia-Pacific Economic Cooperation (APEC) (cf. ibid., p. 9 f.). Figure 3 illustrates the memberships of core emerging markets in the stated unions and free trade zones.
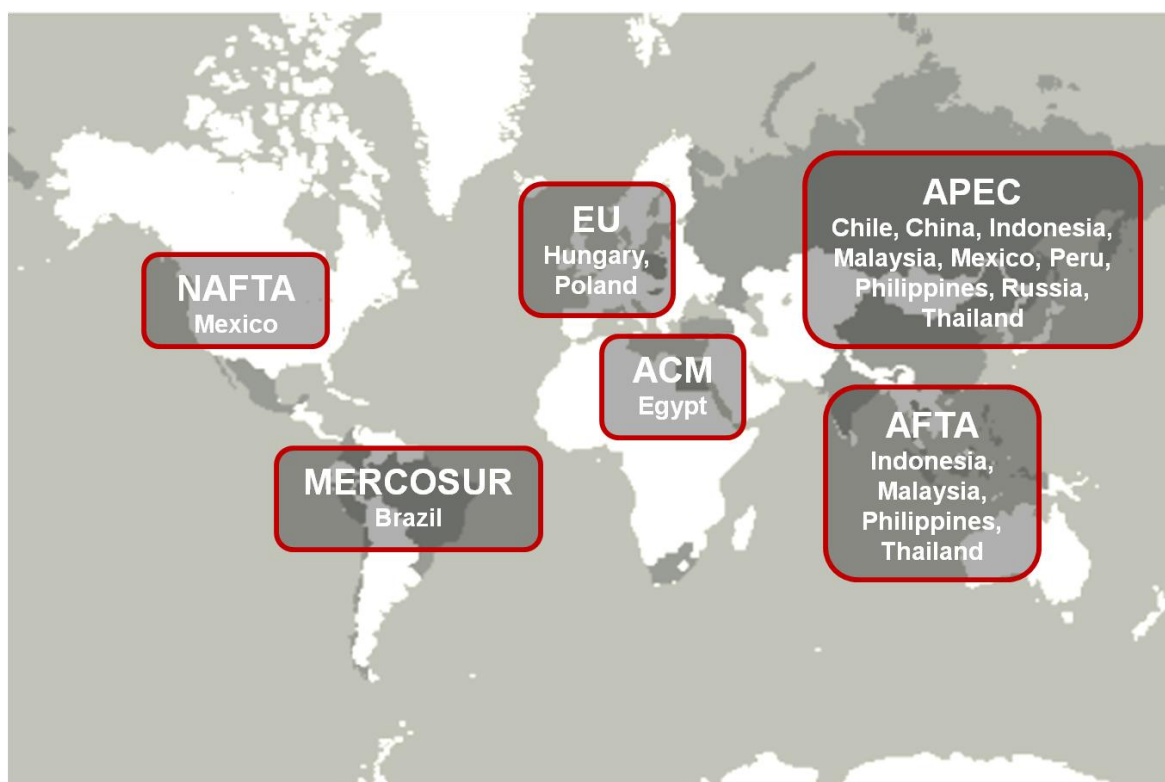
Figure 3: Core emerging markets as members of regional free trade areas. Source: Author's illustration based on Altmann and Kulessa (1998); USTR (2014).

Price controls can pose a problem to multinational companies as well as to local companies and may also lead to shortages of needed goods in the marketplace. An example is the Chinese government's policy of capping retail prices on medicines as a strategy to contain hospital drug expenditures. This resulted in companies cutting production costs drastically at the expense of quality or even halting production completely (cf. Hui and Jourdan, 2014).

Another problem is that the **protection of intellectual property** is often not on the same level as in western developed economies. Regulation regarding this topic is either nonexistent or only weakly enforced (cf. Blanco, 2009, p. 7). Brands and trademarks may be copied and sold without permission or highly complex patented technologies may be at risk of being illegitimately adopted. The willingness to enforce laws to control intellectual property related issues is rather low because governments believe that these would merely favor large multinational companies while exploiting the local cheap workforce (cf. Nakata and Sivakumar, 1997, p. 469). Especially in Asian countries such as China companies are faced with these kinds of problems because of a culturally different perception about the concept of intellectual property. Consequences may be loss of sales and market shares to illegal replications of their

products (cf. Köhler, 2011, p. 71; Nakata and Sivakumar, 1997, p. 469). Other negative implications relate to customer service "(e.g., liability and product identification) as well as long term supply chain competitiveness challenges." (Blanco, 2009, p. 7)

Delays caused by **bureaucracy** and generally complicated regulations are common problems for multinational as well as domestic companies (cf. Goodnow, 1985, p. 28). Especially in China, cronyism is dominating many business transactions creating the need to build strong relationships with government associates (cf. Kerr, 2005, p. 64 f.).

Another important issue is **corruption**, which is defined as the abuse of public power in order to realize private benefits (cf. Cuervo-Cazurra, 2006, p. 808). Generally corruption is widely seen as a negative impact on FDI activities because the costs of operation become more uncertain (cf. ibid., p. 807). On the other side, Habib and Zurawicki (2002, p. 291) observed that FDI flows into countries like Mexico, China, Thailand or Brazil are not obviously obstructed in spite of their relatively high perceived corruption. In countries with extreme regulation, it may even facilitate transactions (cf. Cuervo-Cazurra, 2006, p. 807). The idea of corruption itself includes not only bribery in public and private sectors, but also bureaucratic inefficiency and political instability (Habib and Zurawicki, 2002, p. 292 f.).

The Corruption Perceptions Index is provided by Transparency International and measures the perceived levels of public sector corruption worldwide on a scale from 0 (highly corrupt) to 100 (very clean). Countries with a poor score can be characterized by "widespread bribery, lack of punishment for corruption and public institutions that don't respond to citizens' needs" (Transparency International, 2014). The 2014's index comprises 175 countries which are ranked from high to low scores. At the top of the index are Denmark (score of 92), New Zealand (score of 91) and Finland (89), while the bottom is composed of Somalia and North Korea (both with a score of 8), Sudan (score of 11) and Afghanistan (score of 12). The global average score is 43 and that of the G20 countries is 54 on average (cf. Transparency International, 2014). Figure 4 depicts the performance of the 17 core emerging markets considered in this work, whose average score is 43 as well. Additionally Germany and the United States are shown as reference values.
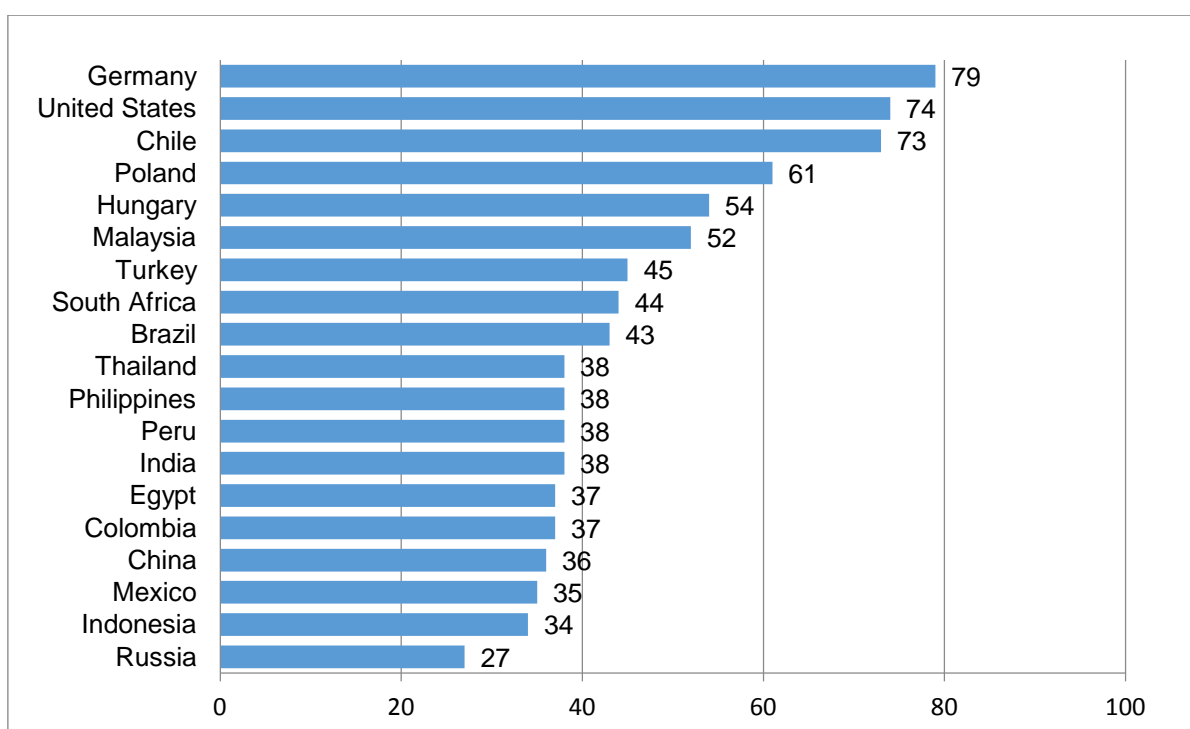
Figure 4: Corruption Perceptions Index in specific Emerging Markets. Source: Author's illustration based on Transparency International (2014).

Remarkable is the extraordinary concerning score in Russia, which is the most corrupt large nation in the world. Perceived as being the most corrupt are public officials, civil servants and the police. According to a public survey, 50% of the people say that the level of corruption in Russia is still increasing and only 12% believe it to be decreasing (cf. Transparency International, 2013).

Another condition characterizing undeveloped markets is a high level of uncertainty in the area of **safety and security**. Safety concerns require adequate facilities for the protection of employees, while additional measures against theft might have be introduced to prevent stealing on a larger scale from happening. Furthermore product safety issues are important for companies who aim to deliver high-quality products (cf. Richard Lynch, 2006, p. 84).

A general **political instability** still prevalent in some emerging markets causes frequent changes in economic policies making it risky to perform business operations in such a country due to the possibility of lost assets or short-dated operations shut down (cf. Nakata and Sivakumar, 1997, p. 469). Quite volatile government policies can be found e.g. in China, where the government cancelled the lease of a property in the middle of Beijing right after a multi-million dollar investment there by

McDonalds (cf. ibid.). Arnold and Quelch (1998) reported in this context that there often is a "lack of regulatory discipline and a propensity to change business regulations frequently and unpredictably".

Wars and political conflicts can also have economical impact. An example are the latest developments as of the beginning of 2015 regarding the conflict between Russia and Ukraine. In response to Russia's illegal annexation of the Crimea, the EU has imposed several sanctions affecting Russia's economic situation, there are for instance restrictions on the export of high-tech goods or military-related and dual-use goods (cf. gov.uk, 2014). These sanctions also impact commercial transaction with foreign companies like for instance the German defense contractor Rheinmetall that is now demanding damage compensation amounting to about €120 million for a called-off deal (cf. Ott and Baars, 2015).

An index summarizing multiple issues regarding the **business perspectives** in countries is the Ease of Doing Business ranking published annually by the World Bank. The ranking combines the scores for the following indicators: Starting a Business, Dealing with Construction Permits, Getting Electricity, Registering Property, Getting Credit, Protecting Minority Investors, Paying Taxes, Trading Across Borders, Enforcing Contracts and Resolving Insolvency, so all in all factors which are connected with the starting and operation of a local firm. According to the last ranking published in June 2014, the country with the most accommodating regulatory environment is Singapore, followed by New Zealand, Hong Kong and Denmark. The lowest ranks are occupied almost exclusively by African countries with the Central African Republic, Libya and Eritrea at the very end of the list comprising 189 countries. Among the core emerging markets, the best rankings have Malaysia (18) and Thailand (26) while Egypt (112), Indonesia (114), Brazil (120) and India (142) reveal rather bad conditions for setting up a business (cf. The World Bank, 2015a).

2.4.3   Economic Conditions

Analyzing the economic environment is on the one hand important for marketing and distribution purposes and on the other side for the manufacturing process.

In order to predict potential sales, it is advisable to analyze the market size of a country, which is determined by factors like the GDP per capita and the size of the population. Despite of a high overall GDP a country can nevertheless have a

relatively low GDP per capita which is likely to equal a low amount of disposable income in comparison to populations with a higher GDP per capita. India and Malaysia are valid examples for this discrepancy, based on their total GDP and per capita values (see Table 2), they are attractive for different products, especially for disposable income dependant goods and services.

Table 2: Comparison of GDP and GDP per capita for India and Malaysia as of 2014. Source: International Monetary Fund (2014).

	India	Malaysia
GDP (PPP)	$7,277 billion	$747 billion
GDP (PPP) per capita	$5,777	$24,520

As described earlier, the majority of emerging markets is characterized by high GDP growth rates. Whenever this growth rate exceeds the population growth rate, the GDP per capita rises accordingly.

Very large emerging economies like Brazil, China, Russia or South Africa often have to face the problem of very different levels of economic development among their domestic regions. The basic economic factors labor, natural resources, and production facilities may be located in completely different regions, while great distances and a lack of appropriate infrastructure separates them to a great extent (cf. Kvint, 2009, p. 93). When considering China as an example, the natural resources can be found mainly in the northwest, while the production and commercial facilities are concentrated in the southeast, and the cheap labor resources are in the central region in between (cf. ibid.).

Another factor that has to be considered when talking about marketing activities is the level of urbanization. Metropolitan areas enable efficient ways to sell, advertise and distribute to customers. Furthermore the population of cities is mostly characterized by a higher amount of disposable income (Arnold and Quelch, 1998).

Additionally the distribution of the GDP is an important factor for determine the demand for certain goods, as it is an average value. Even a relatively low GDP per capita might result from an uneven distribution and therefore does not reflect the

population's disposable income. If this is the case in high population countries, such as in India or China, this constellation reveals vast marketing opportunities.

Another important factor for a company that seeks to achieve high sales numbers is the **purchase power** of a country which is generally determined by factors like current income levels, prices, savings, debt, and credit availability in an economy (Kotler and Keller, 2009, p. 119).

An informative figure regarding the **income distribution** in countries is the Gini index. It "measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. … [A] Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality." (World Bank, 2013) The highest score among the emerging markets has South Africa with a Gini index of 65.0 (as of 2011), followed by Colombia (53.3 as of 2012) and Brazil (52.7 as of 2012). On average, all 17 countries have a Gini index of 42.6 (concerning the years from 2008 until 2012), which is close to the US-American score of 41.1 (as of 2010) (cf. World Bank, 2013).

Unemployment levels are mostly higher in emerging markets. One of the reasons for this is the rapid growth rate of labor productivity in these countries (cf. Kvint, 2009, p. 97).
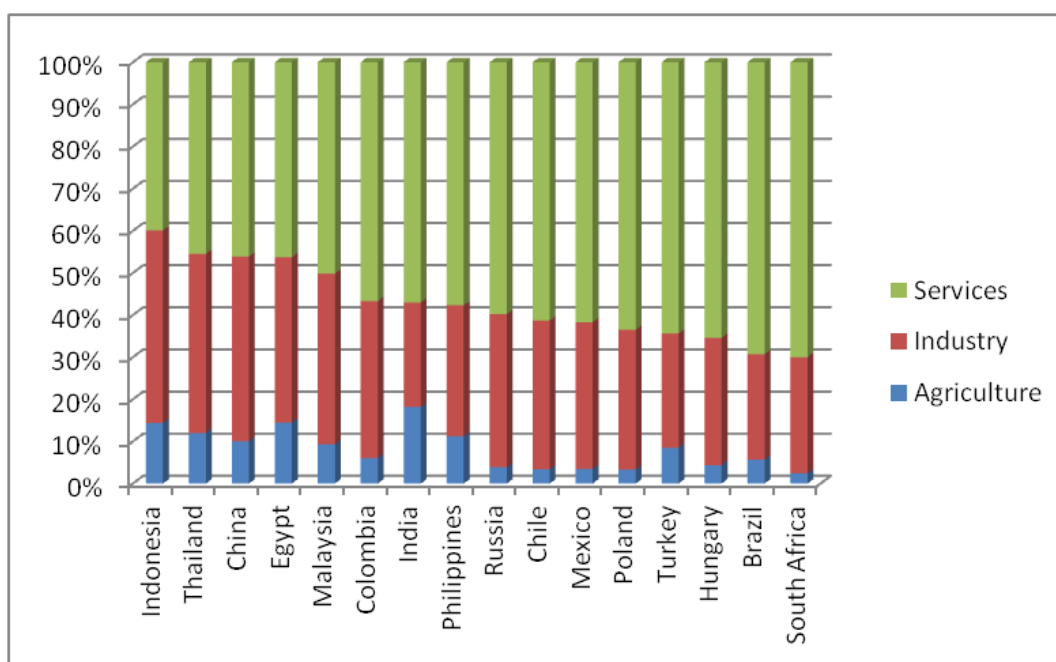
Figure 5: Breakdown of economic sectors in core emerging markets as of 2013. Source: Author's illustration based on The World Bank (2013a); The World Bank (2013b); The World Bank (2013c).

Figure 5 illustrates the percentage of the GDP made up by the different economic sectors in the core emerging markets. The three-sector theory says that with growing economic development, there is a shift of economic focus from the primary sector (agriculture) through the secondary sector (industry) and finally to the tertiary sector (services) (cf. Gabler Wirtschaftslexikon, n.d.). Many of the emerging markets still rely to a great extent on the first two sectors. Active in the primary sector are especially India and Egypt, whereas China and Thailand focus heavily on the secondary sector. Indonesia is the country with the least activity in the services sector among the core emerging markets, Brazil and South Africa for example generate about 30% more of their GDP in this sector.

A very important condition is the **still-evolving economy** itself. Market structures are in most parts of the industry not fully developed, new competitors can arise overnight. This leads to uncertainty regarding the potential demand. In many emerging countries, there are many small local competitors, which are better accustomed with the domestic conditions. Furthermore Kvint (2009, p. 88) points out that "**economic crises** and downturns happen more frequently in non-developed economies than in developed economies".

Besides macro-economic factors, the **availability of resources** (regarding both material and labor) plays an important role. According to Lorentz et al. (2013, p. 224), the low availability of high quality raw materials has a restraining impact on an efficient supply chain. Nakata and Sivakumar (1997, p. 473) as well observe in their study on emerging market conditions a rather low quality of available goods and services due to "low-grade inputs, antiquated production methods and equipment, poor managerial and human capital skills, captive markets offering no incentives to upgrade quality, and the lack of enforced quality standards within industry and by government bodies". So skilled labor and professionals are rather scarce, moreover relatively high amounts of the population are still illiterate and have never been to school (see also chapter 2.4.4).

Other important factors are **inflation** and the development of **interest rates** (cf. Lynch, 2006, p. 84). The negative effects of price controls were already mentioned among the political factors chapter, but on the other side, liberating prices can cause a severe rise in inflation levels (cf. Meyer, 1998, p. 13). Non-developed countries

mostly have higher interest rates at which firms may borrow capital than developed countries, therefore higher levels of inventory lead to even more holding costs (cf. Guasch and Kogan, 2001, p. 10; Koumanakos, 2008, p. 361).

Fluctuations of **exchange rates** pose certain risks, as it results in a change of foreign trade prices. This affects the value of revenues and costs and hence the overall profits arising from buying and selling in emerging markets. This can also be problematic in case of long time frames between the actual buying or selling activities and the payment date (cf. McDonald and Burton, 2002, p. 109 ff.).

Geographic factors like the climate and the soil quality can have a crucial impact on the economic development. Gallup et al. (1999, p. 5) found out that for instance tropical regions have to face higher disease levels and disadvantages in agricultural productivity. The geographical location is also relevant regarding the access to the sea and other markets, which in turn influences significantly transport costs for imported goods (cf. ibid., p. 6 ff.).

Regarding the rising interest in **environmental aspects**, Kotler and Keller (2009, p. 122) describe four major trends affecting the natural environment. Raw materials resources, especially water in certain regions, are shrinking, this in turn results in increased costs of energy resources such as oil. Increased pollution causes severe damage to the natural environment and the role of governments is changing in that richer nations are somehow responsible for the protection of the environment domestically and also by helping the poorer nations.

2.4.4   Socio-cultural Conditions

Social factors have a great influence on the business opportunities of multinational companies because "society shapes the beliefs, values, and norms that largely define consumer tastes and preferences" (Kotler and Keller, 2009, p. 120).

The total **population** of the 17 core emerging markets adds up to almost 4 billion people with China (approx. 1.4 billion), India (approx. 1.25 billion), Indonesia (approx. 250 million) and Brazil (approx. 200 million) among the top five most populous countries in the world. Already these four countries account for more than 40% of the world population of above 7 billion people, all core emerging markets together represent approx. 55% (cf. United States Census Bureau, 2013c).

The average **population growth rate** is about 0.8% in these countries, with Egypt having the highest growth rate (1.84%) and South Africa at the bottom of the list with a negative rate of -0.48%. Compared to the country with the fastest growing population worldwide, which is Lebanon (9.37%), these growth rates are rather low (cf. Central Intelligence Agency, 2014). Generally, the population increases faster in less-developed regions, although these countries can least afford it. In fact, a growing population does not necessarily imply an equally fast growth of markets, because the markets need sufficient purchasing power as a result of an adequate level of income (cf. Kotler and Keller, 2009, p. 116). Accordingly Gallup et al. (1999, p. 6) pointed out that "population growth across countries in the recent past is strongly negatively correlated with their relative potential for economic growth."

Figure 6 and Figure 7 compare the average **age distribution** in the core emerging markets and in developed markets predicted for 2015. It is obvious that the biggest part of the population in emerging markets is less than 40 years old while in developed markets the distribution is almost the other way around with many people being 50 and older. Thus the main type of consumer is completely different in emerging markets while there is also a much higher proportion of young potential employees.
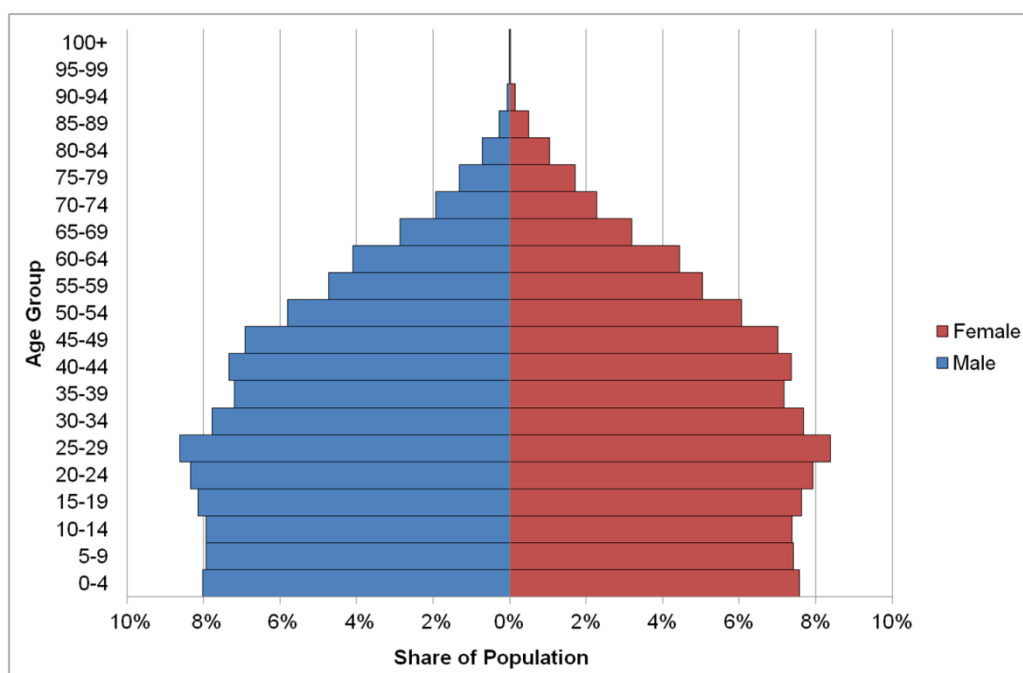
Figure 6: Age Distribution in Emerging Markets in 2015. Source: Author's illustration based on United States Census Bureau (2013a).
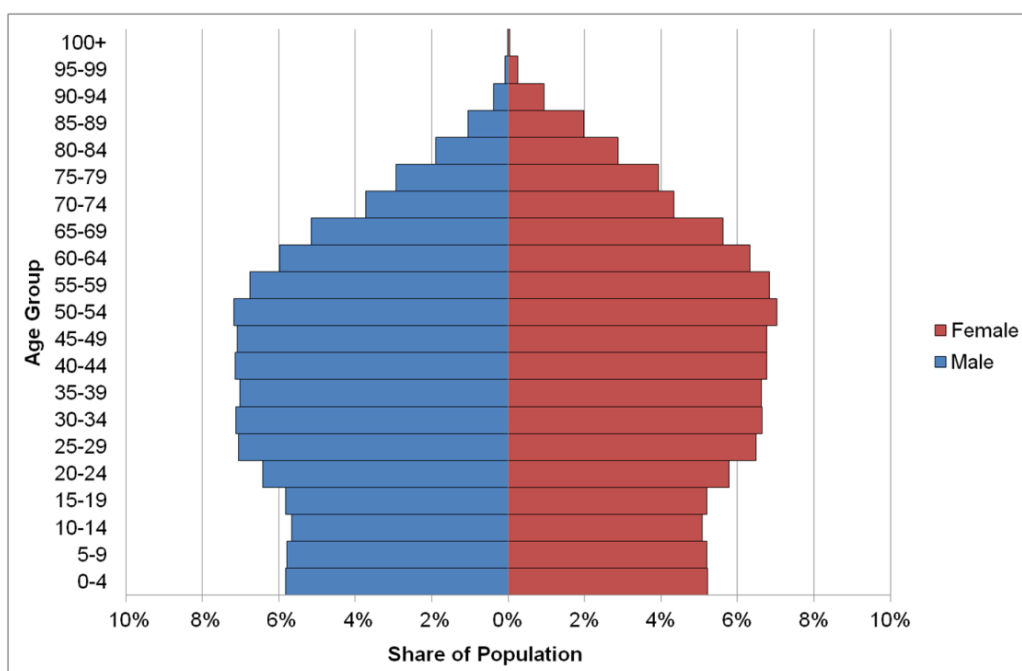
Figure 7: Age Distribution in Developed Markets in 2015. Source: Author's illustration based on United States Census Bureau (2013b).

In any society, the population can be divided into five **educational** groups. These are illiterates, high school dropouts, high school diplomas, college degrees, and professional degrees (cf. Kotler and Keller, 2009, p. 118). Regarding adult illiteracy, which is defined as "the percentage of the population 15 and older who cannot , with understanding, read and write a simple statement about their everyday life" (The World Bank Group, 2004), the most alarming data among the core emerging markets is coming from India where 37.2% of the population were illiterate in 2006. Other worrisome figures can be attributed to Egypt with 26.1%, Peru (10.4%) and Brazil (9.6%). An fact worth mentioning regarding the global distribution of illiteracy is that almost 75% of the 775 million illiterate adults in the world can be found in only ten countries, including five of the core emerging markets (India, China, Egypt, Brazil, Indonesia) (cf. Central Intelligence Agency, 2012).

According to Kvint (2009, p. 96), there are substantial differences among emerging markets regarding the **education level**. Eastern Europe and Russia show high levels of professional and general education while India and South America are rather weak in this regard. Total tertiary school enrollment rates, meaning the percentage of high school graduates who enroll into university, are for particularly low in South East

Asian countries. For example had India in 2012 a rate of 25% and China a rate of 27% (cf. The World Bank, 2012c).

Problems in the industrialization process like low productivity compared to developed markets may refer to lacking knowledge in the field of production management which also includes the usage of inventory control methods (cf. Goonatilake, 1984, p. 58). Yi and Gershon (1988, p. 60) emphasize as well that it might be difficult to implement relevant methods to optimize the inventory levels or to increase the overall efficiency when the educational level and expertise in inventory management is rather low.

Cultural differences can be a source of organizational problems. Hofstede et al. (2002, p. 34) define culture as "what distinguishes one group of people from another." Many of a nation's norms and values are represented by the five cultural dimensions that Geert Hofstede identified a few decades ago. The five dimensions with their respective extremes are Identity (Collectivism vs. Individuals), Hierarchy (Large Power Distance vs. Small Power Distance), Gender (Femininity vs. Masculinity), Truth (Strong Uncertainty Avoidance vs. Weak Uncertainty Avoidance) and Virtue (Long-Term Orientation vs. Short-Term Orientation) (cf. Hofstede et al., 2002, p. 40). Power distance for example describes "the extent to which a society accepts that power in institutions and organizations is distributed unequally" (Tayeb, 2000, p. 320 ff.) while uncertainty avoidance relates to the "lack of tolerance in a society for uncertainty and ambiguity" (ibid.).

2.4.5 Technological Conditions

Globally, new ideas and innovations are spreading faster and faster. The time frames between the emergence of new concepts or designs and their implementation and also between introduction phase and peak production are becoming smaller than ever (cf. Kotler and Keller, 2009, p. 125). There are nearly unlimited opportunities, also in the logistics industry, where research is growing in domains like transportation, telecommunication, automatics, telematics, sensors, robotics.

Kotler and Keller (2009, p. 125) identified four trends in technology which may also have a considerable effect on emerging markets. These trends are: "the accelerating pace of change, the unlimited opportunities for innovation, varying R&D budgets, and the increased regulation of technological change" regarding safety issues.

Government investment in research and development is different in emerging markets. While the expenditures in China are relatively high with 1.98% of GDP in 2012, Latin American countries like Colombia (0.17% in 2012), Chile (0.42% in 2010) or Mexico (0.43% in 2011) spend significantly less money on research activities, thus tend to lag behind in technological progress (cf. The World Bank, 2012d).

Nakata and Sivakumar (1997, p. 473) discovered that local firms in emerging markets use few product, process or organizational innovations. Reason could be found in a rather limited capital endowment and the endeavor of the government to maximize employment rates.

An older study suggests the following reason for the troubles of industrialization in developing and emerging markets: Developed countries may be hesitant when it comes to the transfer of technology and know-how evolved over many years to a developing country which is likely going to act as a competitor in the future. This is one of the main reasons for the lack of success that industrialization policies had in developing economies (cf. Goonatilake, 1984, p. 58).

Less developed technological conditions and infrastructure is also a chance to leapfrog for those countries. They don't have to proceed through the "generations of technology that have characterized industry evolution elsewhere", but rather can install state-of-the-art technology from the beginning (cf. Arnold and Quelch, 1998). An example are wireless communications which have been introduced much faster in many areas because basic telecommunication systems were not implemented everywhere (cf. Blanco, 2009, p. 7).

Regarding the emphasis of this thesis, a core theme of this country condition analysis are **logistics industry** related issues. Pope and Prasad (1998, p. 382) in their analysis of critical issues in inventory management identified infrastructure as the factor with the greatest impact on logistics and inventory systems. The following aspects play an important role in this area: "quality and availability of roads; railways, communication and transport services; labor pool; and level of industrialization in the region" (ibid.). Thus a certain level of infrastructure is required for a firm to be able to operate efficiently.

Indicators that tell something about the availability and quality of **infrastructure** in the **transport** context are the proportion of paved roads in relation to all roads in a certain country or the total length of the rail network in relation to the total area.

Regarding the percentage of paved roads, the emerging countries Brazil, Peru and South Africa perform rather poorly with values below 20% (cf. The World Bank, 2011). When it comes to the density of the rail network, relatively small European countries like Hungary and Poland are well developed with a ratio of 1:11[1] (Hungary) and 1:16 (Poland), comparable to Germany (1:10). The weakest ratios in the comparison of the core emerging markets can be found for example in Peru (1:664), Indonesia (1:387), the Philippines (1:300) or Brazil (1:280) (cf. The World Bank, 2012a; The World Bank, 2012b). However, this high discrepancy also originates in the topographical nature of these countries being marked by mountains, jungle and islands.

Transport networks are mostly better developed in regions with more urban areas and commercial traffic. For example China's transport system is mostly focused on the eastern part of the country where big near shore cities are connecting China's economy via gigantic ports with the global marketplace (cf. Hoyle and Knowles, 2001, p. 70). West of this coastal economic zone there is only weak integration and connection of transport networks, serviceable information technology, storage and distribution facilities. A consequence of this unequal distribution of infrastructure networks is the unilateral flow of goods from the east to the west which makes it hard for forwarding companies to find backhauls and return empty containers (cf. Kerr, 2005, p. 64 f.).

Concerning access to **electricity**, there are great differences between the core emerging markets. For most of them, almost 100% of their population have full access to electricity, but in Peru, the Philippines and South Africa, these are only about 85% of the population and in India even only 75% (cf. The World Bank, 2010).

The availability of electric power is not as reliable as in developed markets, this could at worst cause production facilities to shut down or disrupt the cold chain of food.

A very interesting figure in this context is the percentage of sales lost due to power outages. As of 2013, this problems pertained to 4.7% of sales in Turkey which is a remarkable value. Also the Philippines (3.9% as of 2009), Brazil (3.4% as of 2009) and Mexico (3.4% as of 2010) suffer relatively often from outages (cf. The World Bank, 2014).

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[1] To compare the railway infrastructure, the total length of the railway network in a country in km is brought into relation with the country's total area in sq. km.

The availability of **logistics service providers** is included in this subsection due to its connection to infrastructure. The operations of third party logistics providers may not be as efficient as in developed markets. One reasons for this is also the insufficient pervasion of information and communication technology. Information technologies are sometimes still lagging e.g. "electronic data interchange (EDI) is still in the process of development for many logistics partners" (Chen and Lee, 2013, p. 18).

In general, all factor groups influence each other, for instance legislation may be affected by certain economic developments (e.g. unemployment) or technological innovations influence the general economic situation by improving overall productivity and efficiency (cf. Sander, 2004, p. 291). Negative impacts are for example that explosive population growth causes more resource depletion and pollution which in turn results in the need for extensions in legislation (cf. Kotler and Keller, 2009, p. 114).

2.4.6 Consolidating Indicators

There are various sources, including multilateral institutions or research organizations who publish ratings, indices and other data that assess certain developments and maturity aspects of countries.

An example is the Global Competitiveness Report which is published annually by the World Economic Forum, "an annual meeting of political and economic leaders and experts from a number of fields" (Kvint, 2009, p. 81). Aiming to assess the competitiveness landscape of 144 economies, it is providing an insight into the drivers of their productivity and prosperity (cf. World Economic Forum, 2014a). The main focus in the report is the Global Competitiveness Index (GCI), which measures each country based on 12 pillars which are presented embedded in an overall structure in Figure 8.
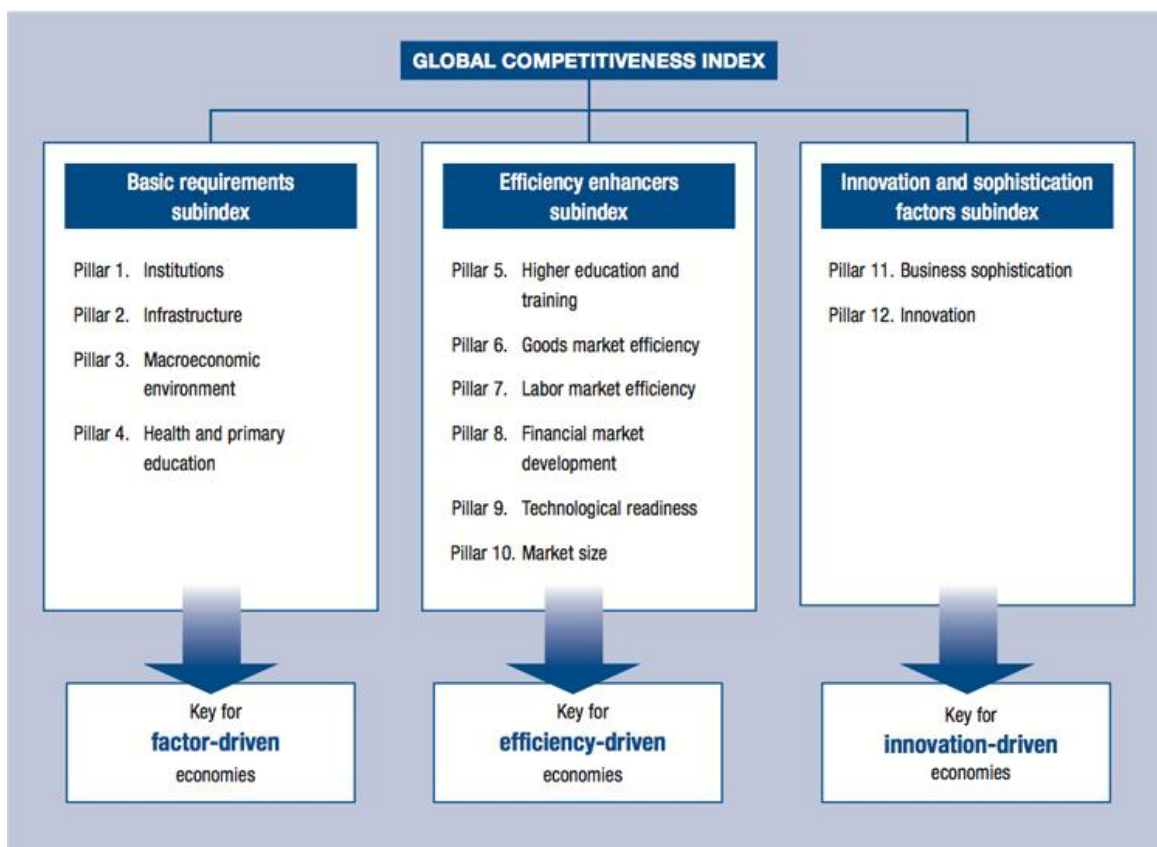
Figure 8: The Global Competitiveness Index framework. Source: World Economic Forum (2014b).

The top three ranked countries according to the GCI 2014 are Switzerland, Singapore and the United States while the least competitive countries comprise Guinea, Chad and Yemen (World Economic Forum, 2014c). Figure 9 shows a comparison of the GCI ranking some of the core emerging markets (Peru, Malaysia and China) and Germany as an additional reference value. Among the core emerging markets, Malaysia is the most competitive being in some categories comparable with or even better than Germany, while Egypt can be found at the bottom of the list.
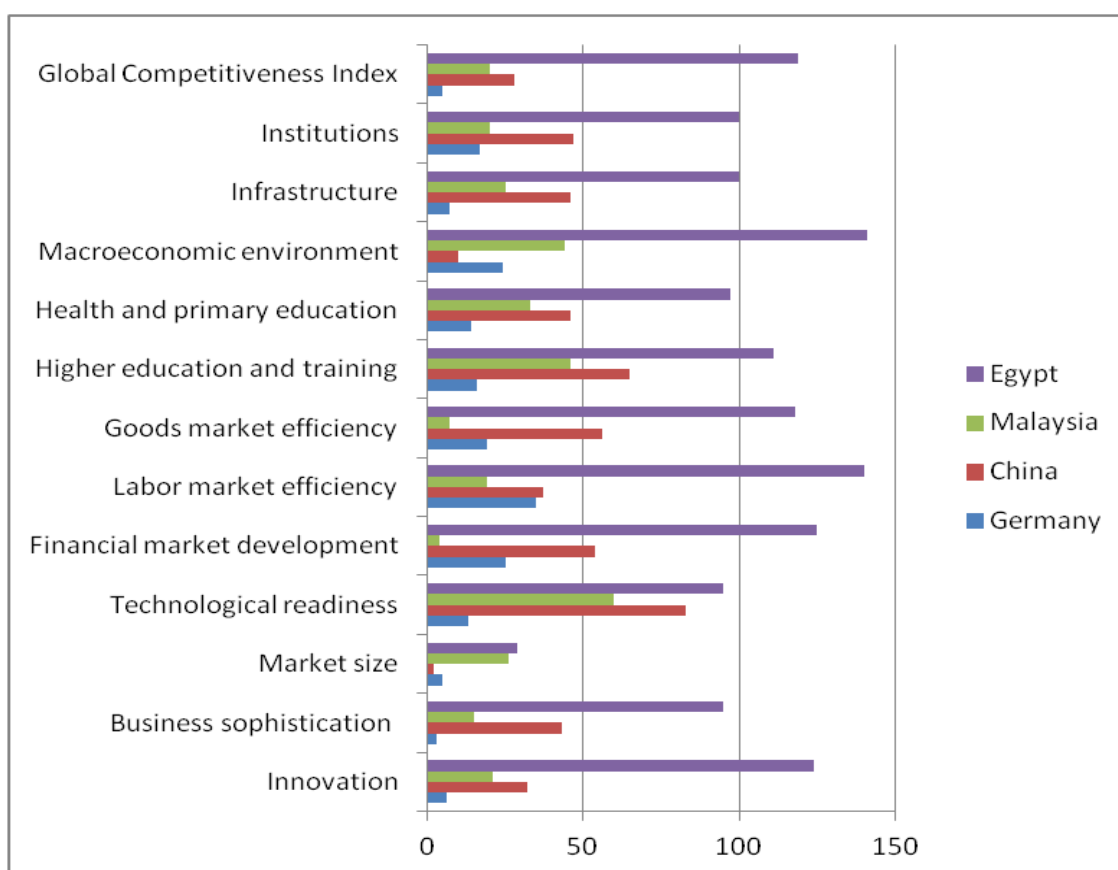
Figure 9: GCI ranking comparison of three emerging markets and Germany. Source: Author's illustration based on World Economic Forum (2014d).

Another helpful tool to assess especially the logistic conditions in emerging markets is the Logistics Performance Index (LPI) which was published by the World Bank for the first time in 2007. The index summarizes the following six components (Arvis et al., 2014, p. 7):

- Customs: The efficiency of customs and border clearance
- Infrastructure: The quality of trade and transport infrastructure
- Ease of arranging shipments: The ease of arranging competitively priced shipments
- Quality of logistics services: The competence and quality of logistics services - trucking, forwarding, and customs brokerage
- Tracking and tracing: The ability to track and trace consignments
- Timeliness: The frequency with which shipments reach consignees within scheduled or expected delivery times

The data is mostly collected through surveys among freight forwarders and express carriers. The rating is in each case on a scale from one (worst) to five (best). In 2014,

160 countries were analyzed with Germany as the best performing country with a score of 4.12, and Somalia as the worst with 1.77 (cf. Arvis et al., 2014, p. 1). Among the core emerging markets, Malaysia (global rank: 25) and China (rank 28) deliver the best logistics performances while Russia (rank 90) and Colombia (rank 97) have the most deficiencies. But all in all, for each component of the LPI, almost all core emerging markets reach scores better than the global average (cf. The World Bank, 2015b).

3 Inventory Management in Emerging Markets

3.1 Theoretical Background on Inventory Management

### 3.1.1 Definition and Relevance of Inventory Management

Inventory Management is defined as "the branch of business management concerned with planning and controlling inventories" (Toomey, 2000, p. 1). Another adequate definition by Urgeletti Tinarelli (1983, p. 2) states the following: "controlling inventory means assuring its accessibility, its quality, the time and place of its storage, and all this at the lowest possible cost."

Inventory management has a lot to do with customer service. Both the internal and of course the external customer have to be able to obtain their requested item where and when they need it, otherwise, either the production process may has to stop or the unsatisfied customer will most likely look for a competitor that can provide the respective product or service in time (cf. Gourdin, 2006, p. 63).

Gourdin (ibid.) states furthermore that the essential problem of inventory management is to balance "the cost of holding inventory on one hand with the cost of not holding it on the other". The costs of holding inventory comprise insurance, tax, storage, and obsolescence costs plus the capital tied up. In a situation where the supply is significantly higher than the demand, excess inventory can result in the need to offer discounts which ultimately reduce the sales revenue. Moreover, higher inventory levels increase also the amount of working capital and therefore, the return on investment will be lower. But on the other side, holding insufficient amounts of inventory can lead to the inability to satisfy the customer which may cause production stoppages, poor customer service and eventually lost sales. This could in the end result in even higher costs (ibid., p. 63 f.).

The significance of inventory management for the company shall be illustrated with the aid of Porter's Value Chain (see Figure 10). According to Porter (2000, p. 69), the value chain activities can be categorized into primary and support activities. The five primary activities can be found in any enterprise and describe the physical process of manufacturing the final product followed up by sale and distribution to the customer plus service activities. The support activities provide for the employment of purchased inputs, human resources (workforce and management) and technology. They are supporting the value chain as a whole as well as certain primary activities

individually. In order to gain competitive advantage over its opponent, a firm has to strive to execute each activity more efficient or with greater differentiation than others (ibid.). Inventory management plays a vital role in the endeavor to perform each of the primary activities as efficiently as possible. It is kind of a trigger for the activities of inbound logistics and a prerequisite for smooth processes within operations and outbound logistics. Furthermore there has to be close cooperation with marketing & sales departments and service activities like the supply of spare parts rely on efficient inventory management.
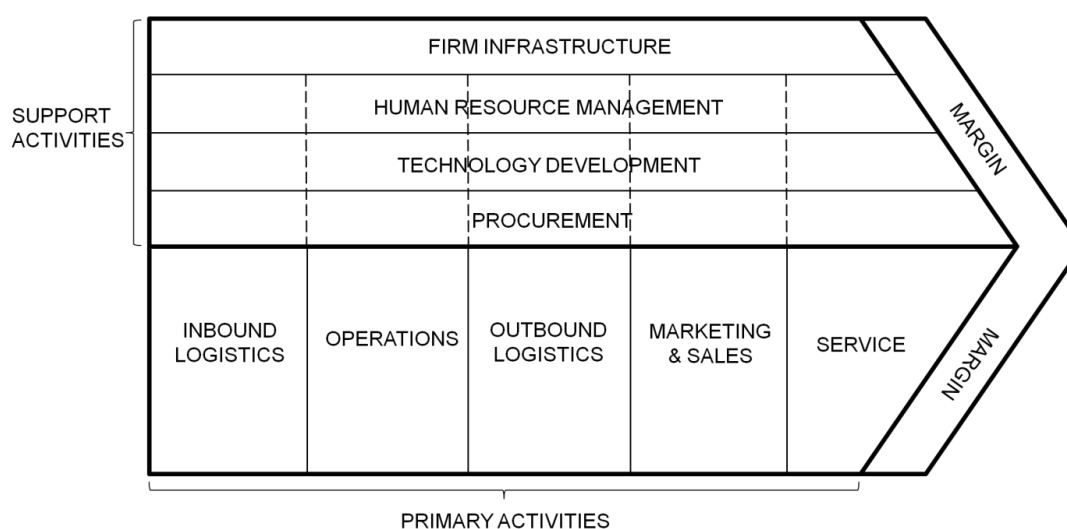
Figure 10: The value chain. Source: Porter (2000, p. 66).

Generally, inventory is defined as "any resource that is left in storage awaiting use" (Urgeletti Tinarelli, 1983, p. 2). Functionally it can be classified into raw materials inventory, goods-in-process inventory and finished goods inventory (Guasch and Kogan, 2001, p. 11). Another classification by Gourdin (2006, p. 64 f.), which is more based on the purpose of the inventory, lists normal inventory, safety stock, in-transit inventory, speculative stock, seasonal inventory and dead stock. Inventory designated for example as safety stock has the function to serve as a buffer in case of demand inconstancies, forecast mistakes or supply shortage (cf. Toomey, 2000, p. 3). Seasonal products as well as vacation shutdowns or plant expansions require naturally higher than normal levels of inventory (cf. ibid., p. 4).

The most important **purposes of inventory holding** are (1) balancing of supply and demand, (2) the facilitation of economies of scale and (3) the avoidance of stock-outs.

(1) Demand is usually variable over time, but the production amount is meant to be hold rather constant throughout the year to efficiently utilize fixed investment in facilities and machinery. Therefore the finished goods are stored until they are needed due to higher seasonal demand. There is a trade-off of storage and capital costs against the potential savings from constant production (cf. Gourdin, 2006, p. 64; Guasch and Kogan, 2001, p. 7).

(2) There are several possibilities how inventory can act as a mean to save costs in other parts of the logistics system. Purchasing larger batches may result in granted discounts, shipping larger quantities reduces the amounts of shipments and there are less set-up events required when production runs are longer. All these measures reduce costs (fixed costs of order placing, transportation costs and manufacturing costs) through economies of scale which simply means that fixed costs can be spread over a larger number of units (cf. Gourdin, 2006, p. 64; Guasch and Kogan, 2001, 8).

(3) Another important purpose of inventory is to protect from uncertain demand or other occurrences which are not foreseeable like the failure of transport vehicles or manufacturing lines or late deliveries by suppliers (cf. Gourdin, 2006, p. 64). An optimal inventory level in this regard is determined by the equilibrium between holding costs and the likelihood of a stock-out (cf. Guasch and Kogan, 2001, p. 7).

In summary, it can be said that inventories "are used as flying wheels to smooth the imbalance between demand and offer, covering peaks and buffering during troughs" (Zavanella and Zanoni, 2009, p. 79). Hence an inventory manager must decide on the point in time, the amount of goods and the cycle in which inventory has to be replenished; these decisions have to match customer needs on the one hand and minimize the associated costs on the other hand (cf. Gourdin, 2006, p. 65).

The functions responsible for actual physical handling within the organization i.e. storage and materials handling must not be confused with the overall inventory management function. They are rather usually subsumed under the term warehousing which is distinguished from inventory management by Gourdin (2006, p. 5) as follows:

> "Inventory management deals with balancing the cost of maintaining additional products on hand against the risk of not having those items when the customer wants them (i.e. the cost of lost sales). [..] Storage and materials handling addresses the physical requirements of holding inventory. Storage encompasses the tasks

necessary to manage whatever space is needed; materials handling is concerned with the movement of goods within that space. Thus, the former would consider issues related to warehouse number, size, layout, and design; the latter would focus on systems needed to move goods into, through, and out of each facility."

Clearly these two components of the logistics systems are closely interconnected as inventory policies directly impact the storage and handling requirements and also vice versa in that developments in materials handling effect inventory management related issues like inventory levels or order points. Consequently the optimization of warehousing issues contributes significantly to overall inventory management.

3.1.2   Inventory Costs and Management Techniques

Some consider the cost of maintaining inventory as a hidden cost which is nevertheless included in the product cost (cf. Toomey, 2000, p. 1). However, planning inventories and the related cost is dependent on the decision between production to stock, production to order and production partly to stock and partly to order (cf. Popp, 1965, p. 868). When inventory holding costs are very high in relation to setup costs (order costs), it would be advantageous to hold no stocks at all and to order each time when a demand occurs. This is called policy of direct delivery (cf. ibid., p. 870).

Companies make decisions always out of an economic perspective, therefore the primary goal is to minimize inventory investment while still meeting the functional requirements. The inventory system is affected by the following types of costs:

The **unit costs of the purchased goods** play a vital role in the case of offered discounts, but mostly they are independent of the quantity ordered. Besides, unit prices may change due to seasonal fluctuation or economic trends (cf. Urgeletti Tinarelli, 1983, p. 2).

The **ordering costs** are the expenditures for placing one order and comprise personnel in the purchasing department and communication and information systems. Normally these costs are expressed as a monetary value per order (cf. Gourdin, 2006, p. 65 f.; Urgeletti Tinarelli, 1983, p. 2).

Holding costs (sometimes also referred to as carrying costs or conservation costs) are composed of costs for storage facilities and buildings, handling, insurance, taxes, obsolescence, deterioration, shrinkage, theft and interest on the capital financing the

goods. The amount of expenses is dependent on the inventory level and is commonly expressed as a percentage of unit value which shall cover all of these costs jointly since e.g. per-unit costs for theft are normally difficult to determine (cf. Gourdin, 2006, p. 65; Urgeletti Tinarelli, 1983, p. 2; Zavanella and Zanoni, 2009, p. 76).

Stock-out or shortage costs occur when an either internally or externally demanded item is not available. There are several immediate and future effects of such an out-of-stock situation, like lost sales, costs of back-ordering or for having to stop production lines (cf. Gourdin, 2006, p. 66; Urgeletti Tinarelli, 1983, p. 2).

Very important regarding the endeavor to be economically competitive is the implementation of methods and systems for inventory control and materials management (cf. Yi and Gershon, 1988, p. 63). Suitable inventory management can on the one hand reduce the cost of holding and ordering and on the other hand also reduce stock-outs and improve the satisfaction of the customer to a considerable extent. Thus, reduced costs and increased sales lead to an overall improvement of the profitability of an organization (cf. Prasad, 1994, p. 209).

The Classic EOQ Model

The inventory manager has to decide for every item whether to order the full requirement for one period once at the beginning of the period or in a number of small batches throughout the period. The economic goal is as in every other case to reduce the cost, which is in the simple case the sum of the cost of stock holding and the cost of purchasing. Optimization of the function towards minimum total cost results in the Economic Order Quantity (EOQ) also referred to as the Economic Batch Quantity (cf. Goonatilake, 1984, p. 61). The development of this model is accredited to varying persons depending on the source. Mentioned are e.g. Wilson (cf. Urgeletti Tinarelli, 1983, p. 3) or Andler (cf. Schulte, 2013, p. 411). The number of units to be ordered i.e. the EOQ is calculated as follows (cf. Gourdin, 2006, p. 67):

$$EOQ = \sqrt{\frac{2 \times ordering\ costs\ \times\ annual\ demand}{annual\ holding\ costs\ \times\ unit\ costs}}$$

The different cost components are explained above, while the annual holding costs are given as a percentage of the unit costs.

The simple EOQ model has to be extended and/or modified to overcome its limitations, e.g. the assumption that demand and lead-time are constant and known, or that the price is independent of the order size. Moreover, stock-out situations and potential in-transit inventories aren't considered (cf. Gourdin, 2006, p. 68).

Inventory Management Strategies

In order to answer the fundamental questions when and how much material to order, there are a few inventory management strategies to adopt. The selection of the appropriate inventory strategy is dependent on the service level and the cost for shortages. The service level determines which portion of the customer order of a certain period is going to be covered by the available inventory. Thus, a higher service level requires a higher safety stock. Shortage costs occur when a company is not able to satisfy all customer orders. Consequently a low service level will lead inevitably to higher shortage costs (cf. Oeldorf and Olfert, 2013, p. 169-171).

Oeldorf and Olfert (cf., p. 172 ff.) differentiate the following inventory strategies (definition of variables: T = constant intervals with the length T; S = base stock, up to which the inventory is replenished; s = reorder point; Q = certain order quantity):

- (S, T)-strategy: the inventory level is checked after constant intervals with the length T and as appropriate, the necessary amount to stock up to the base stock S is reordered;
- (s, S)-strategy: when the inventory has fallen to the reorder point s, the necessary amount to stock up to the base stock S is reordered;
- (s, Q)-strategy: when the inventory has fallen to the reorder point s, the specific quantity Q is reordered (Q should be at optimal costs → EOQ) → also called fixed order point/fixed order quantity model in Gourdin (2006, p. 68);
- (s, S, T)-strategy: the inventory level is checked after constant intervals with the length T, if the reorder point s is reached, the necessary amount to stock up to the base stock S is reordered;

- (s, Q, T)-strategy: the inventory level is checked after constant intervals with the length T, if the reorder point s is reached, the specific quantity Q is reordered (Q should be at optimal costs).

Similar versions of these inventory strategies with sometimes different terminologies are described e.g. by Popp (1965, p. 869), Prasad (1994, p. 214) or Urgeletti Tinarelli (1983, p. 5 f.).

The application of appropriate inventory systems is certainly subject to a lot of conditions like the type of planning and production set-up, the characteristics of the product and the market and the arrangements with the supplier (cf. Prasad, 1994, p. 211). Depending on the kind of material considered, it is recommended to use a (s, S)-strategy for material which is needed on a regular basis and is therefore stocked always. Material which is related to specific customer orders may rather be managed with (s, Q) strategy because the order quantity Q is determined accordingly to the customer order (cf. Oeldorf and Olfert, 2013, p. 174). When following these strategies in general, it is important to pay attention to the replenishment time which is the time between the order point and the point of availability of the material in the warehouse and comprises the actual time for delivery as well as time for administrative activities regarding order processing and admission into warehouse and additionally a certain buffer time subject to the reliability of the supplier (cf. ibid., p. 175).

3.2 Risks Related to Inventory Management in Emerging Markets

As already described in the second chapter, business activities in emerging markets are affected by certain obstacles. These also have an impact on efficient inventory management. The following sections seek to identify all relevant problems and risks which shall be analyzed for optimization opportunities. Optimizing the supply chain is a necessary process for several reasons. To gain profits in economic environments, it is desirable to achieve a competitive advantage. This can stem either from the ability to provide comparable goods or services at lower costs or by offering certain superior benefits to customers for the same costs which is called differentiation (cf. Porter, 2000, p. 27). While in developed markets, the focus is more on the differentiation aspect with provision of superior customer service or faster delivery than the competition, in less-developed or emerging markets on the other side customers

might already value "the ability to get the product to that customer on a regular basis at some reasonable cost" (Gourdin, 2006, p. 9) rather than rapid delivery for higher costs. Thus the goal is to reduce inventory costs and simultaneously increase the service by reducing stock-outs.

In the following, a framework will be developed which shall subsequently help to identify risks that interfere with these goals.

3.2.1 Framework for Inventory Management Risks

Related to different inventory management activities, multiple sources of uncertainty may pose problems that require higher levels of inventory or accelerated response time. These can be volatile customer demand, unreliability concerning the external supply of goods and fluctuating lead times between facilities. In order to identify and structure these risks systematically, a classification framework has to be developed.

Table 3: Risks in the supply chain. Source: Based on Manuj and Mentzer (2008, p. 138).

Type of risk	Source
Supply Risks	Disruption of supply, inventory, schedules; quality issues
Operational Risks	Breakdown of operations; insufficient processing capabilities
Demand risks	Variations in demand; new product introductions
Security Risks	Regarding information systems and infrastructure; terrorism, vandalism, crime, sabotage
Macro Risks	Economic shifts in wage rates, interest rates, exchange rates, and prices
Policy Risks	Actions and sanctions of governments; changes in legislation
Competitive Risks	Uncertainty about competitor's activities and moves
Resource Risks	Unanticipated resource requirements

The literature proposes different classifications regarding supply chain risks. A more elementary differentiation is the classification of quantitative (including stock-outs, overstocking, or obsolescence) and qualitative risks (including decreased reliability

and less quality of the materials in the supply chain) (cf. Manuj and Mentzer, 2008, p. 137).

Another more comprehensive approach by the same authors differentiates eight risks (see Table 3), where the first four risks are directly associated with the supply chain because they interfere with the supply chain objective of matching supply with demand. They are interconnected with each other, as for instance a security risk like theft results in the disruption of the supply. The four latter risks are more related with the environment but they certainly affect the supply chain-linked risks in many ways. For example, wage rate shifts have an impact on the demand by rising potential spending levels and also on the operational are by rising the manufacturing costs (cf. ibid., p. 138).

Especially concerned with global sourcing decisions, Köhler (2011, p. 69 f.) introduces another division of supply chain risks. He distinguishes between risks that are either exogenous or endogenous to the supply chain. Endogenous risks pertain to the supplier and the customer and include supply risks, information risks, financial risks and legal or contractual risks. Exogenous risks are furthermore differentiated as specific to the sourcing market (including political, legal, economical, technological and socio-cultural risks) and independent of the sourcing market (comprising natural hazards like environmental disasters).

These different classifications imply that it is important to differentiate between risks that are specific to the environment in emerging markets and risks that emerge consequently with respect to the supply chain and eventually also concerning inventory management.

In order to develop a framework that suits the underlying objective to detect problems related to inventory management throughout the whole organizational process, a comprehensive structure of the functions in the organization has to be considered. Christopher (2011, p. 11) proposes the Logistics management process (see Figure 11) which is conceptually quite similar to the economic process of goods transformation ("Güterwirtschaftlicher Prozess") presented by Olfert and Rahn (2013, p. 38).

Materials flow
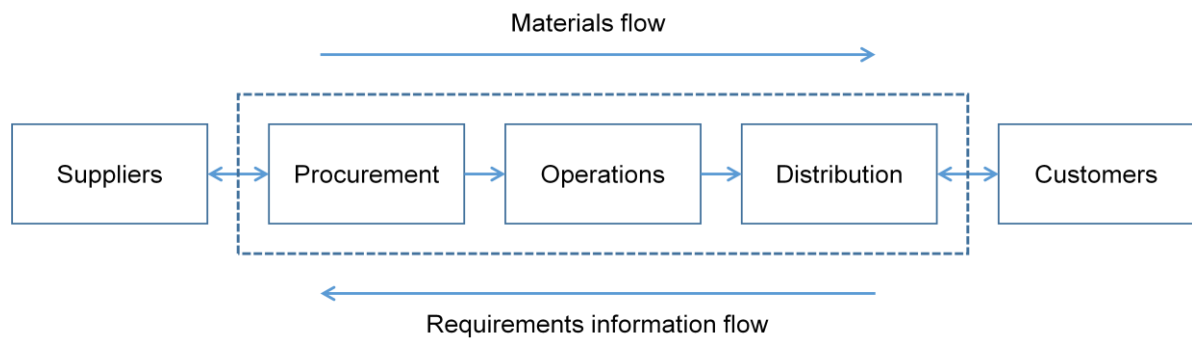
Figure 11: Logistics management process. Source: Christopher (2011, p. 11).

As there would be no need for all these managerial process steps without the initial demand of the customer, the chain of activities displayed in Figure 11 will be examined firstly from the back to the front along the requirements information flow and then again in the context of the flow of materials from front to back.

Relevant is also the order cycle (see Figure 12) which encompasses all steps from the placement of an order by the customer until the final delivery of the product.
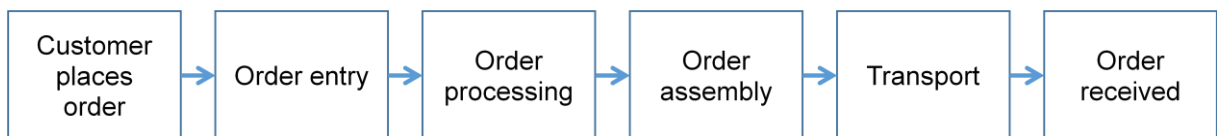
Figure 12: The order cycle. Source: Christopher (2011, p. 125).

As an additional input in order to identify all relevant activities which play a vital role in this context, the value chain by Porter, 2000 (p. 64) introduced in chapter 3.1 is considered.

As a result the following structure is developed which serves as a framework to analyze all inventory management related activities in the following sections to identify risks arising due to the special conditions in emerging markets described in chapter 2.4.

```
┌─────────────────────────────┐
│ Determination of demand     │
│                             │
│ • dependent demand          │
│ • independent demand        │
│ • Final consumer            │
│ • Other companies           │
└──────────────┬──────────────┘
               │
               ▼
┌─────────────────────────────────────────────────┐
│            Satisfaction of demand                │
│                                                  │
│   ┌──────────┐  ┌──────────┐  ┌──────────┐      │
│   │ External │  │ Internal │  │ Stored   │      │
│   │ supply   │  │production│  │inventory │      │
│   └──────────┘  └──────────┘  └──────────┘      │
│                      │                           │
│                      ▼                           │
│   ┌──────────────────────────────┐              │
│   │ Distribution                 │              │
│   │ • Packaging                  │              │
│   │ • Outbound logistics         │              │
│   └──────────────────────────────┘              │
└─────────────────────────────────────────────────┘
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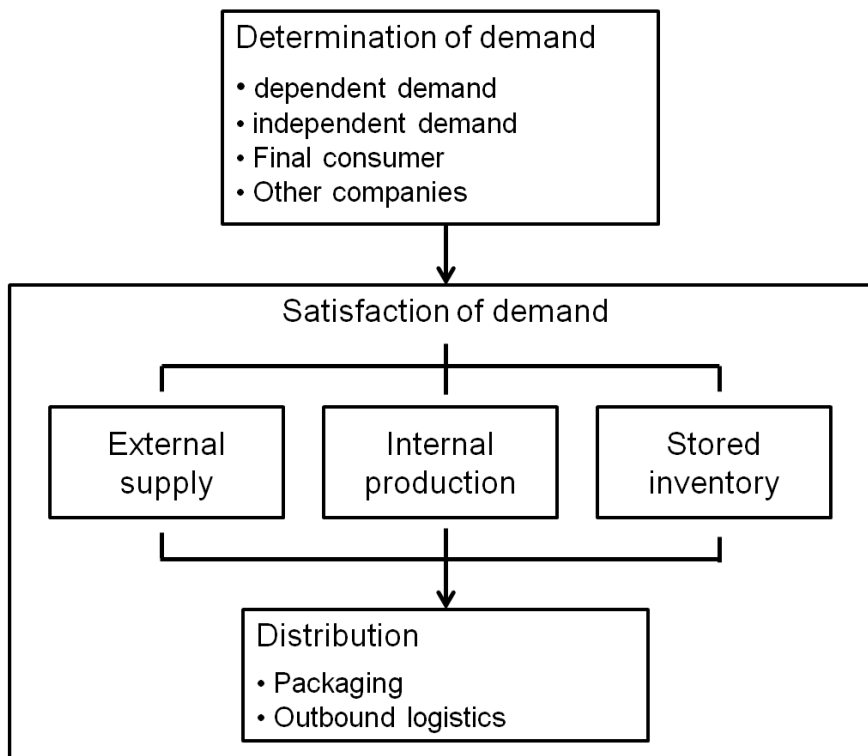
Figure 13: Framework for inventory management steps in the demand fulfillment process

The inventory management related steps in this process are accordingly the following:

1) Firstly the demand of the product has to be determined, specifically how much and when it is required. It can be based on different sources that act differently in the ordering process. These can be on the one hand the final end consumers and on the other hand companies on the next-tier level of the supply chain. The demand can be generated through direct orders (make-to-order) or forecasting activities (make-to-stock). These are both types of independent demand, which is based on the requirements of the marketplace, thus is generated by the customers of a company. Within the company itself dependent demand emerges which is determined by the requirements of superior parts in the manufacturing process while their relationship is specified in the bill of material. A dependent demand of a component or a raw material can in turn be viewed as the independent demand of its supplier (cf. Toomey, 2000, p. 7). To decrease the complexity of the calculation of these quantities, it is common practice to use a material requirements planning (MRP) system for the dependent demand, which is able to break down the timing and need for components based on the schedule regarding the final product. This is useful

because for instance all components could have different lead times (cf. Gourdin, 2006, p. 77).

2) The currently known or forecasted future demand then has to be satisfied. Three different possibilities exist.

2a) Goods may be ordered directly from external suppliers. In this regard, the procurement division is responsible for the selection of reliable suppliers and has to issue and monitor orders (cf. Toomey, 2000, p. 196).

2b) Another possibility is the internal manufacturing of the required products. For this step, there is most certainly also the need to order external raw materials. Both a and b therefore involve the determination of order/production quantities and inbound logistics activities. The manufacturing process includes often internal transport of material and inventory holding of in-process- and final inventory.

2c) There is already inventory available to satisfy the demand. The inventory was either purchased or produced beforehand thus this option incorporates also decision about the required inventory levels.

In reality, there is often a combination of all three possibilities, but for the purpose of clarity and structure, each will be observed individually.

3) In order to complete the processing of customer orders or the distribution to the point of sale, the products have to be prepared for distribution. This comprises order assembly, packaging, outbound logistics activities and transport scheduling. The actual distribution of the goods is not considered here. The activities of the third part doesn't necessarily fall within the scope of inventory management, but effective inventory management involves making final product inventory available on time and this is the prerequisite for the successful completion of orders respectively the supply of the point of sale.

Consequently the following risk categories will be considered:

- Risks related to demand
- Risks related to external supply
- Risks related to internal production
- Risks related to inventory holding
- Risks related to distribution

In the assessment of risks that arise out of business activities in emerging markets, two different perspectives have be taken into consideration. These depend on the kind of company and how its supply chain is structured. The company can on the one hand be a multinational company with a global supply chain and on the other hand a domestic company based in an emerging market having either a national or also a global supply chain. Domestic companies may have certain advantages with regard to their knowledge of local business practices.

3.2.2   Risks Related to Demand

A common problem in emerging markets may be uncertainty regarding the consumer demand. Future demand is generally determined according to forecasts. There are three forecasting methods: The "quantitative-intrinsic" method is based on historical patterns of the product data. The "quantitative-extrinsic" method is based on patterns of external data which indicate changes in demand. The third is the "qualitative" method which is based on intuitive or judgmental evaluation (cf. Toomey, 2000, p. 31).

Reliable market research data is often unavailable in emerging markets (cf. Arnold and Quelch, 1998). A reason for this can be that the product was only recently introduced in the respective market thus there is no historic data regarding the consumption in that country.

General market conditions have a crucial impact on the demand. Prevalent volatility e.g. with regard to the governmental restrictions on imports can lead to a sudden rise as well as a downturn in demand. The impact of long established local competitors plays an important role as well (cf. Blanco, 2009, p. 7). On the other hand, new competitors can emerge out of the blue due to the increasing investment activities taking place in emerging markets.

Political instability is another important factor in this regard. Changing government policies for instance can lead to completely new economic situations which are impossible to foresee.

Large income gaps and a highly fragmented market make it harder to predict demand levels. Especially in big cities for example in Brazil or India, the differences between poor slums and prosperous quarters are immense (cf. Blanco, 2009, p. 3).

People with lower income levels are demanding affordable products while having possibly lower expectations regarding quality and style. Very important is mostly high durability and practicability. The product design and functionality may have to be adjusted beforehand thus adding another source of complexity (cf. ibid., p. 3).

Countries with weak intellectual property legislation pose the risk of competitors duplicating products and stealing customers with lower prices.

In areas that are prone to the occurrence of natural disasters like earthquakes or floods, very high demands for items like food or medical treatment resources can arise unexpectedly and these areas may not be well prepared. Additionally this poses a risk for the demand of other products, as in times of crisis only the very essentials will be needed and no disposable income will be available for most other product groups.

Computational projection methods to calculate forecasts require a certain technological endowment which may not be available everywhere.

Moreover, information regarding inventory levels and demand is often not enough shared between partners of the supply chain. Responsible for this is a different business culture in emerging markets, a lack of forward-looking planning and insufficient diffusion of information and communication technology (cf. Lorentz et al., 2013, p. 224).

Implications

In the case of uncertainty about the demand, it is consequential that a company has problems to make exact statements about the order lead times towards their customers. Furthermore, the risk of stock outs arises. In an out of stock situation, according to Urgeletti Tinarelli (1983, p. 4) there are two possible cases: Mostly in monopoly situations, backorders exist. This means the customers will accept the late delivery and wait. More probable in a competition market is the case of lost sales where the clients are neither willing nor prepared to await the delivery which would in the meanwhile slow down their processes accordingly (cf. ibid.).

Stock-outs do not only affect the processing of customer orders but also the supply needed for the internal manufacturing activities. With missing raw materials and

parts, temporary production downtimes or even staff lay-offs may occur, resulting in overall low capacity utilization and low productivity (cf. Goonatilake, 1984, p. 62).

In order to prevent stock-out situations, high buffer inventories are being hold (cf. Toomey, 2000, p. 2). These consume more physical space and need more capital investment. Furthermore the possibility of damage, decay or loss increases. All in all, the overall costs for holding inventory rise. The permanent existence of excess inventory may be used to compensate inefficient processes in multiple areas such as forecasting, scheduling and general management procedures (cf. Koumanakos, 2008, p. 356). Some of the relevant literature describes significantly high inventory levels in emerging markets. Moreover it can be stated that capital costs in developing countries are usually much higher than in developed countries, so that the negative impact of these high levels of inventories on accounting is even more rigorous (cf. Guasch and Kogan, 2001, p. 23).

When companies react to sudden increases in demand in such a way that they are ordering even more than is needed in order avoid shortages in the future but without sharing any real demand information with their suppliers, the so-called "bullwhip effect" emerges (cf. Christopher, 2011,p. 165). It causes the orders to increase further as they move up the supply chain which results in unnecessarily high inventory levels. The initial fluctuating demand which induces the Bullwhip effect can in fact have the same reasons described in section 3.2.2.

In summary, it can be stated that too little inventory can cause poor customer service or disrupt manufacturing operations, but too much inventory is responsible for unnecessarily high costs. This is the general dilemma of inventory management but in emerging markets the problem is intensified due to prevalent uncertainty regarding sales and supply (cf. Koumanakos, 2008, p. 356). Sudden increases in demand can also lead to transports with less than truck load quantities. This involves higher transportation costs. Kerr (2005, p. 64 ff.) states that overall logistics costs in China can account for about 20% of a company's earnings which is more than twice as much as the average in developed countries.

3.2.3   Risks Related to External Supply

The procurement of required material from suppliers can be hampered either by government induced restrictions, by problems concerning the supplying company itself or by risks related to the transport and receiving of the goods.

Governmental hindrances

Goonatilake (1984, p. 59) stated that many companies in less developed countries rely massively on imported basic raw materials and parts for usage in their manufacturing plants. Thus a large amount of spare parts has to be stocked in order to prevent long disruptions of the production process while waiting for the delivery of new parts, which can take a long time dependent on the location of the supplier and possible import hindrances. So the process of importing the mentioned raw materials is often obstructed by long bureaucratic obstacles and "poor communication networks within the country as well as with the outside world" (ibid., p. 59 f.) which make procurement activities very time consuming. The bureaucratic procedures comprise for example the application for documents like import licenses, foreign exchange approvals and letters of credit (cf. ibid., p. 59 f.).

Due to these obstacles it is rather difficult to predict accurate order lead times when ordering supplies from abroad. Thus it can be assumed that a company would rather order the highest quantity possible, subject to the amount of working capital available, therefore resulting in high average inventory levels (cf. Goonatilake, 1984, p. 61).

Trade restrictions in a specific emerging market may prohibit the import of certain goods whose supply in the domestic market can on the other side be characterized by low quality und unreliability (cf. Lorentz et al., 2013, p. 224). Underdeveloped markets can be the reason for monopolistic structures in certain industry sectors where ruling suppliers of needed goods can impose high prices.

Corruption is another factor which produces bottlenecks, increases uncertainty, and causes higher transaction costs. Some firms are provided with preferential access to certain goods, therefore market distortions are created (cf. Habib and Zurawicki, 2002, p. 292). Multinational companies unfamiliar with the domestic conditions may fall behind, hence have to wait longer for supply or look for alternative resources,

since payments to country officials or other would raise the cost of goods anyway (cf. ibid., p. 293).

Radical price changes due to inflationary or deflationary developments can cause problems regarding capital investments and accounting. This issue impacts as well inventory management strategies like the calculation of the EOQ which normally assumes the price of purchasing to be constant over time (cf. Zavanella and Zanoni, 2009, p. 77). Related to this is the risk due to exchange rate fluctuations which is especially important for organizations with international supply chains.

Supplier problems

Unreliable suppliers may deliver goods too late or with quality defects (cf. Prasad, 1994, p. 214). This results again in uncertainties regarding the punctual provision of goods for production or distribution to customers. In this regard, a study concerning food supply networks by Lorentz et al. (2013, p. 224) identified that the primary actors in the supply chain like suppliers and distributors "may lack the capability to produce and transport inputs that meet the quality or quantity requirements of the manufacturer, or distribute outputs in a manner that supports product quality in terms of temperature control."

Blanco (2009, p. 7) implies that many suppliers from emerging markets export their products into developed markets and are therefore maybe not well accustomed to local consumption requirements, whose special characteristics regarding price and durability where already mentioned in chapter 3.2.2.

Cultural differences may impede contract enforcement when dealing with local partners. For example, in China and Latin America, many business activities are characterized by personal relationships and verbal contracts (cf. Blanco, 2009, p. 6). Moreover, Lorentz et al. (2013, p. 224) observed within their study a business culture which acts rather adverse to supply chain integrations.

Differences in the legal system pose special problems for multinational companies performing business in emerging markets. In their home markets, they have the secure opportunity of legal course against suppliers who fail to adhere to contractual agreements. But in an emerging market, this procedure may not exist at all or be too burdensome (cf. Maltz et al., 2013, p. 271).

Transport

There are several risks which may impede the proper execution of transport activities. The longer the distance between supplier and the manufacturing company, the higher is the probability of disruptions (cf. Lorentz et al., 2013, p. 224). The passing of borders can extend delivery times considerably, especially is the country enforces very strict import controls. But also the quality of the infrastructure plays an important role. Inadequate infrastructure, e.g. unpaved roads or insufficient road links between transport hubs may increase the time it takes for a shipment to arrive and thus the uncertainty about the delivery time (cf. Guasch and Kogan, 2001, p. 8; Lorentz et al., 2013, p. 224). The quality of the infrastructure depends very much on the area. It is more advanced in urban than in rural areas, but this comes along with higher pollution levels and congestion (cf. Blanco, 2009, p. 3). Congestion is a result of the incapability of urban transport networks to accommodate the amount of movements using them. The peak level of traffic overloading occurs generally during periods of commuting. Another problem is the condition of the streets in the cores of big cities in particular in India and South East Asia. The road network there is characterized by narrow streets that are often only accessible to non-motorized traffic which complicates commercial transports and deliveries (cf. Hoyle and Knowles, 2001, p. 136).

The activities related to product delivery are often outsourced to logistics service providers (LSP). LSPs offer mainly transport, warehousing, freight forwarding, and related logistics and information technology services, so that the manufacturing company can focus better on their core business (cf. Arvis et al., 2014, p. 32). But LSPs in some emerging markets may not be well experienced and efficient yet due to the fact that trade flows are still rising up to their full potential (cf. Guasch and Kogan, 2001, p. 8). According to Lorentz et al. (2013, p. 224), LSPs may not be able or willing to "develop such capacity so that they are able to handle products with high quality requirements or support local manufacturing operations." It is also conceivable that their ideas about the nature of quality service differ to a great extent from the view held by hiring company (cf. Gourdin, 2006, p. 245). Another related issue is that postal services may also be rather unreliable in certain areas of emerging markets (cf. Blanco, 2009, p. 5).

Unforeseen occurrences during the transport like theft, accidents caused by insufficient security measures or environmental disasters may happen with higher probabilities and thus act as additional sources for supply shortage.

The transport of fresh foods and other perishable goods is nowadays an ordinary operation. More than 100 years ago, industrial cold storage was introduced and the first transports of frozen meat from South America and Australia to Europe were accomplished. At the beginning of the twentieth century, private households were able to obtain the first refrigerators. Today, the possibility to store and also transport chilled and frozen food is taken for granted (cf. Zavanella and Zanoni, 2009, p. 86). There is a difference between the fresh product chain and the frozen product chain. The fresh one has shorter product lives and needs faster transportation and lower energy input, whereas the frozen product chain has rather longer product lives and needs slower transportation but higher energy input to preserve the low temperature (cf. ibid., p. 87). In emerging markets, the maintenance of the cold chain may still pose a problem due to extreme weather conditions, limited availability of special equipped vehicles and insufficient temperature control mechanisms.

Inbound Logistics

The inbound logistics function has to handle the incoming material and the related information processing. It is crucial for ensuring that the correct products have arrived in the right quantity and condition at the right time (cf. Richards, 2011, p. 44 f.; Toomey, 2000, p. 197). Associated activities like receiving, checking of the material and the accompanying paper and storing may be inefficient and time consuming due to manual procedures, insufficient employee experience and ill-equipped handling devices. On the one hand, there is the need to accelerate processes to increase throughput but on the other hand, thorough quality controls are very important considering security risks and the potential unreliability of suppliers. Otherwise possible quality defects may not be detected resulting either in lower quality of final products or delays in subsequent handling.

Implications

Uncertainty about punctual supply of raw material and components leads eventually to the same problems as uncertain demand. Stock-outs shall be avoided, but in order to be able to still meet the customer demand in case of late delivery, high buffer stock are accumulated (cf. Guasch and Kogan, 2001, p. 8). These result again in high inventory costs. For example Goonatilake (1984, p. 61) observed in his study regarding inventory policies in underdeveloped countries that "orders were placed well in advance of actual need to safeguard against uncertainties" and this led of course to higher operating costs.

Another example is provided by Koumanakos (2008, p. 358), who analyzed operational data from more than 1,000 Greek[2] firms for the years 2000 to 2002. The firms needed on average 150 days to sell their inventory and, as a consequence, these firms with higher inventory levels ranked lower in terms of accounting ratios like gross and operating margins. The author stated that the high inventory levels are caused by the fact that Greek firms are mostly importing intermediate goods as manufacturing inputs and thus have to cope with "longer and more uncertain delivery times as well as greater transaction costs leading to larger and less frequent shipments." (Koumanakos, 2008, p. 358)

In their study, Guasch and Kogan, 2001, p. 9 f. came to the same conclusion that underdeveloped countries import a lot of raw materials and intermediate products. Due to the fact that these imports require larger and less-frequent shipments because of long lead times and higher transaction costs, overall inventory levels tend to be higher. Smaller shipment quantities pose also bigger problems on logistics service providers which may not be as efficient in emerging markets (cf. ibid., p. 8).

3.2.4   Risks related to Internal Production

Production facilities in emerging markets may be not state-of-the-art thus manufacturing processes may take relatively long which in turn prolongs the complete order cycle. Poor infrastructural conditions e.g. frequent power outages result in disruptions of the production line which may lead to significant losses. The

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[2] Greece is considered as an emerging market within several classifications, see Table 1.

educational and level and experience of local employees may also affect the productivity of manufacturing processes.

Facilities and machines that require complex set-up activities usually run as long as possible resulting in high lot sizes which increase the inventory levels and add to higher cost.

Furthermore, proper production management is one of the main problems in the industrialization efforts of less developed markets. Production management comprises production planning and control, quality control and inventory control. Many of the problems in manufacturing and distribution may be attributed to deficiencies in the production planning and inventory control methods employed (cf. Goonatilake, 1984, p. 58).

Implications

Long production processes have in fact the same effect as long delivery times. More inventory has to be held to be able to satisfy the customer demand which causes increased inventory costs.

3.2.5 Risks related to inventory holding

Inventory holding concerns the actual physical handling of raw material and components as well as finished goods. It may be needed at several stages within the process of value creation, e.g. during the manufacturing process to buffer work-in-progress goods while they are waiting for the processing step, but also after the receiving of procured material and at a later point for the finished goods in consolidation warehouses. Generally the function is responsible for the secure and efficient storing of the material and the complete monitoring of the inventory records (cf. Toomey, 2000, p. 197).

Available warehousing buildings in emerging markets may have several deficiencies regarding size, level of security, climate control or transport access. On the other side, building own facilities may be prohibited or restrained by the government, therefore either a way to optimize or at least compensate the existing discrepancies is found or longer and more frequent transportation is accepted to minimize the ultimate use for warehousing (cf. Gourdin, 2006, p. 141 f.).

Big cities in many emerging markets are expanding almost uncontrollably, as population is growing and at the same time the urbanization trend causes a massive moving from rural areas into cities. Examples are Shanghai and Beijing in China, New Delhi and Mumbai in India, Jakarta in Indonesia, Mexico City in Mexico, or São Paulo in Brazil. Renting scarce storage space in these big cities is expensive and a thus a considerable factor regarding the control of inventory levels (cf. Urgeletti Tinarelli, 1983, p. 5).

A low level of computer technology makes it harder to implement inventory management methods because many inventory systems are based on advanced technology. But there is often a lack of capital to invest in better computer as well as handling equipment (cf. Yi and Gershon, 1988, p. 60 ff.).

Modern information and communications technology is necessary to precisely track inventory levels but in emerging markets, required equipment is often outdated and only available in insufficient amounts (cf. Guasch and Kogan, 2001, p. 8 f.; Kerr, 2005, p. 64 ff.). Inaccurate inventory records can be a crucial problem regarding customer service levels as well as smooth manufacturing operations. Discrepancies between the recorded inventory and actual physically present inventory can be attributed to different causes like theft, misplacement or data collection errors. Theft can be internal or external and thus stem from either employees, shoplifting, or collaborations of staff members and customers (cf. Rekik et al., 2009, p. 189).

Poor equipped material devices handling such as forklifts, pallet trucks or conveyor belts increase the risk of damage to the goods and are mostly more time consuming and therefore inefficient. Furthermore, bad lighting conditions, poorly skilled management plenty of manual procedures may be responsible for high levels of loss and deterioration of inventory (cf. Kerr, 2005, p. 64 ff.)

For inventory holding activities of every kind, energy is required. Two types of energy consumptions can be classified, on the one hand fixed contributions and on the other hand variable contributions. The fixed component includes everything needed to support the stock keeping processes, without regard to the quantities stored, like e.g. lighting (especially for manual storage and commissioning activities), electricity (especially for refrigerated warehouses but also for sorting plants and other facilities). Variable energy contributions are e.g. the energy spent in the incoming goods area or the picking area (cf. Zavanella and Zanoni, 2009, p. 78). So it is obvious that

electricity failures can lead to sever delays and cause high costs. In order to avoid these outages, expensive back-up power supplies have to be kept.

The characteristics of products and raw materials in the food industry (e.g. perishability) require special configurations of the supply chain and especially regarding inventory holding activities (cf. Lorentz et al., 2013, p. 220). Holding inventory which has to stay cold and/or fresh e.g. food, drugs or blood is a bigger problem in emerging markets than in developed ones due to mentioned problems in electricity supply and control of the cold chain (cf. Zavanella and Zanoni, 2009, p. 77). Insufficient cooling results most probably in reduced quality of the products. A high proportion of spoiled goods increases waste or at least dissatisfies customers. In the end, costs will be significantly higher and more inventory is needed to compensate for poor quality products.

Food stocks may cause highly variable holding costs because the energy and relevant technical equipment to preserve it is largely dependent on external conditions like temperature or humidity which vary by seasons and geographic location (cf. Zavanella and Zanoni, 2009, p. 85). Furthermore, the price of energy is affected by speculation or global economic developments therefore it is highly susceptible to fluctuations within short periods of time (cf. ibid., p. 77).

Inventory levels which are higher than necessary (resulting from high uncertainties regarding demand and supply as described in sections 3.2.2, 3.2.3 and 3.2.4) increase the shelf life of a product. Missing control mechanisms lead to problems such as obsolescence or perishability may arise, while obsolescent products lose their value over time due to for instance technological innovations and perishability concerns the deterioration of products (cf. Prasad, 1994, p. 213). Obsolete products usually have to be sold with allowed discounts so that expected sales will decrease. High amounts of waste in turn require energy to be disposed of (e.g. by incineration) or could lead to an increasing pollution of the environment.

An incorrect application of inventory models can also lead to high additional costs. For instance the application of the EOQ model without due regard to obsolescence can result in the calculation of inappropriate order quantities and cause substantial losses (cf. Prasad, 1994, p. 216). Kerr (2005, p. 64 ff.) states that especially in China practical training and proper education in inventory management or IT skills is weakly established.

Regarding the apparent conditions in emerging markets, Goonatilake (1984, p. 63 f.) points out that it is questionable if conventional inventory control theory and techniques like EOQ and the replenishment models are useful in the industrial environment of those countries. He argues that the most important objective of inventory management is usually to ensure the availability of the inventory supply. But this efficiency objective is mostly taken for granted in the western-originated inventory theory, where more value is placed on how to reduce inventory costs. On the other side, cost targets play a less important role in some developing markets, due to the fact that many industries there have a monopoly status and can pass additional inventory costs on to the customer. Therefore he suggests to develop inventory control methods adjusted to the existing conditions.

3.2.6   Risks Related to Distribution

The outbound logistics function is responsible for the shipping of customer orders. Related activities are order picking, packaging and dispatching of goods (cf. Richards, 2011, p. 44 f.; Toomey, 2000, p. 197). Poor materials handling equipment and error-prone manual procedures result in delays and mistakes in the course of order completing. Insufficient packaging increases the risk of damage during manual handling as well as transporting goods (cf. Gourdin, 2006, p. 142).

Another issue regarding the adaptation of packaging requirements is related to environmental pollution. Nowadays, more and more people are becoming concerned with the environment and how it is adversely affected by commercial activities around the globe. Particularly there are problems in the area of transportation; transport vehicles pollute the air and create noise, traffic congestion is rising and scarce energy resources are consumed. Moreover product packaging produces extremely high amounts of waste which pollute the environment. In developing economies, customers may bother less about these issues because they are more concerned with raising their living standard and obtain the goods in the first place, thus they would rather not be willing to pay more for environmentally friendly goods. Therefore it is more the responsibility of the companies in these countries to find the trade-off between satisfied customers who are paying reasonable prices and a rational and sustainable management of natural resources and the environment (cf. ibid., p. 12 f.).

Many distribution channels in emerging markets differ to a great extent from those in developed countries. Due to less income and space restrictions people are buying smaller quantities but more frequently. Also the final points of sale and shops are often smaller, thus product purchase sizes and packaging have to be adapted to these conditions. For example in large cities, many products are sold in "small, hole-in-the-wall shops (i.e. paanwalla shops in India, tiendas de la esquinas in Mexico, or sari-sari stores in the Philippines" (Blanco, 2009, p. 5). Another possibility that requires a different distribution strategy is door-to-door sale which applies to 15% of all apparel sold in poorer neighborhoods in Brazil (cf. ibid., p. 4 f.).

Distribution networks are often sparsely elaborated in rural regions, e.g. in India. This requires delivery to more clients than usual with much smaller packages (cf. ibid., p. 5). For packaging design, a company has to consider also the length and quality of the transport to customers. Bad infrastructure requires investments in more sustainability (cf. ibid., p. 4). Long delivery times to the final customer due to problems with the transport (e.g. bad infrastructure, risk of theft) or inefficient dispatch and shipping procedures result again in the need for higher inventory levels since the whole order cycle is prolonged.

4 Innovative Technologies Transforming the Supply Chain

4.1 Definition and Origin of Innovation

Trott (2012, p. 15) defines innovation as "the management of all the activities involved in the process of idea generation, technology development, manufacturing and marketing of a new (or improved) product or manufacturing process or equipment." Thus it is a process beginning with the theoretical conception of an idea, followed by the technical invention of a product or process and eventually leading to its commercial exploitation and diffusion (cf. ibid.).

Innovations can contribute greatly to the growth of organizations and economies. All industrial revolutions in the history of economic development were propelled by technological innovations (cf. ibid., p. 6 ff.). The first industrial revolution began around 1750 and was driven by the invention of the steam engine by James Watt. It enabled mechanization and industrialization of production in the Western world and avoided hunger catastrophes. The second industrial revolution around 1870 was characterized by mass production based on the division of labor with the aid of electric power. This development reduced the costs of production and caused a rise in overall wealth for the further growing population. The third industrial revolution around 1960 made it eventually possible to automate production by the use of electronics and IT. Serial production with many variants and globalization fueled universal economic development (cf. Bauernhansl et al., 2014, p. 5 ff.; Trott, 2012, p. 6 f.).

The current research developments which focus on aspects like decentralization, modularity and interoperability are often seen as a fourth industrial revolution and are thus especially in Germany subsumed under the expression "Industry 4.0". Specifically it is the name of a project which started in 2011 as part of the High-Tech Strategy of the German government. The aim is the computerization of the entire manufacturing industry including the interconnection of all products and services via the Internet and other networks (cf. BMBF, 2013; Sendler, 2013, p. 1; Spath et al., 2013, p. 2).

In the following, relevant new technologies will be introduced which can be potential solutions to the problems and risks described in the previous chapter. Precise suggestions of application relating to each problem will be described in chapter 5.

4.2 Driving Factors of Innovation

Innovations especially with regard to the logistics industry are driven by several societal and economic factors, which will be shortly outlined in the following.

Aging populations mainly in western economies influence the need for technology being able to support users in their daily routine. Related labor shortages in certain areas implies a growing demand for automation (cf. Richards, 2011, p. 297).

Another aspect is that modern consumers are increasingly desiring new products and services which are easily customizable and adaptable to individual lifestyles.

As natural resources are more and more depleting and environmental contamination rises global concerns, sustainability of products and technological processes plays an important role. Key aspects are reductions in waste, resource usage and CO_2 emissions as well as the searching for alternative energy supplies and transport forms (cf. ibid., p. 297 f.).

Companies are more and more encouraged to actuate collaboration among each other and share resources to increase utilization warehouses and transport modes and in this way enhance the efficiency of supply chains (cf. ibid., p. 298).

4.3 3D printing

4.3.1 Definition and Development

3D printing (3DP), which is also known as additive manufacturing (AM) or additive layer manufacturing (ALM), is the process of depositing a material hundreds or thousands successive, thin layers until a solid object comes into existence (cf. PwC and Manufacturing Institute, 2014, p. 1; The Economist, 2011). The expression "additive manufacturing" highlights the contrast to the conventional style of manufacturing with subtractive processes like cutting, drilling or basing metal (cf. The Economist, 2011). The technology is applied already since the 1980s but engineers

and designers have used it mostly for making prototypes and casting patterns quicker and cheaper than with previous methods, since the making of prototypes as one-offs with the traditional subtractive process is rather expensive (cf. PwC and Manufacturing Institute, 2014, p. 1; Reeves, 2008; The Economist, 2011). However, recent advancements in speed, capabilities and the prices of raw materials have increased the use and popularity of technology which enables the rapid manufacturing of a range of production applications in various materials such as ceramics, metals, and polymers (cf. PwC and Manufacturing Institute, 2014, p. 1; Reeves, 2008). The ability to print even production-grade plastics and metals and the development of multi-material printers regarding color, elasticity and strength are some of the main reasons why 3DP is used nowadays also for making final products (cf. Reeves, 2014; The Economist, 2011).

Many companies are currently including 3DP in some way in their manufacturing process, either for prototypes or final products. The belief exists that the technology will be used increasingly in the after-market sectors and has the potential to massively modify existing supply chains. Estimates claim that the global 3DP market will grow from $2.2 billion in 2012 to $6 billion by 2017 (cf. PwC and Manufacturing Institute, 2014, p. 1).

The popularity among the population is also growing but rather slowly. A survey in Germany regarding the interest in technological developments reveal that at least 17.4% of the people asked where interested in the possibilities of printing entire objects with a 3D printer after being presented a list of currently emerging technological opportunities which could find their way into everyday life[3] (cf. IfD Allensbach, 2014).

4.3.2   Functionality and Different Methods

A computer program can break up a model, which is drawn up either by a designer or created from a 3D scan, into a series of digital slices which are described in

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[3] The question asked had the following wording: "Here on these cards there are written down some offerings and technological developments, which are already available or will be available in the near future. Regardless whether you have the technical opportunities: Which of these are you personally interested in, which could you use yourself? " (translated from German: "Hier auf den Karten sind einige Angebote und technische Entwicklungen aufgeschrieben, die es bereits heute gibt oder in naher Zukunft geben wird. Einmal abgesehen davon, ob Sie über die technischen Möglichkeiten verfügen: Was davon interessiert Sie persönlich, was können Sie selbst gut gebrauchen?") (IfD Allensbach, 2014)

computer-aided design (CAD). The CAD files including the dimensions of each horizontal slice are interpreted by the 3D printer which constructs the respective layers from the bottom up, until the part is complete (cf. PwC and Manufacturing Institute, 2014, p. 1; Reeves, 2008; The Economist, 2011). An example of a printing process can be seen in Figure 14.
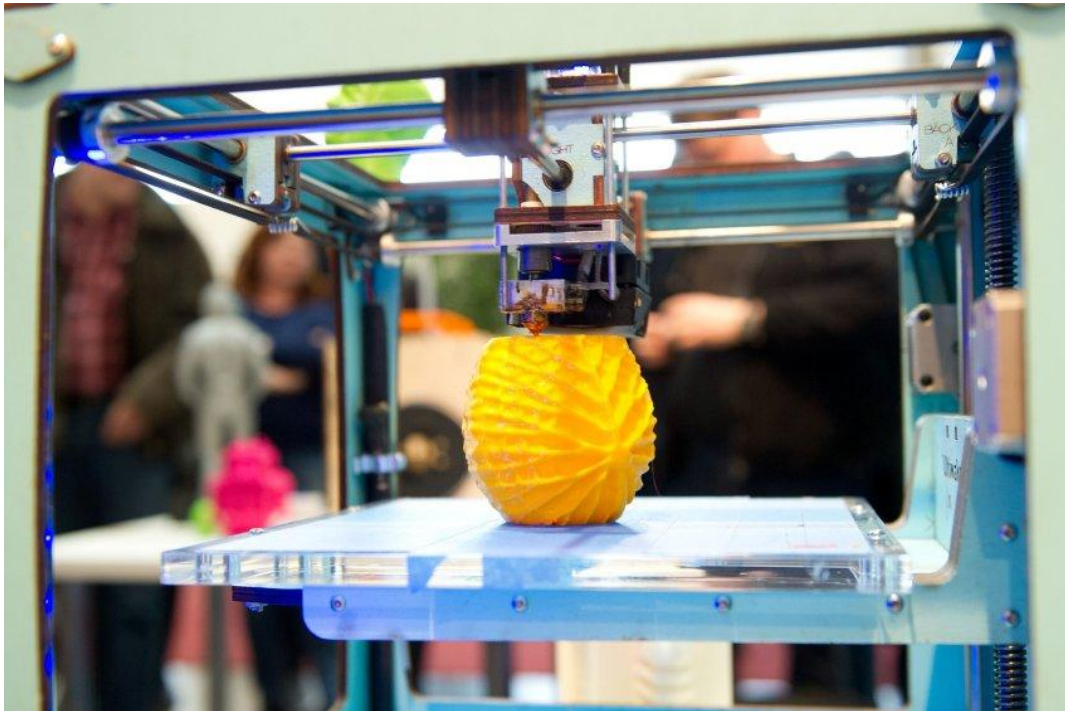
Figure 14: The inside of a 3D printer. Source: manager magazin (2013)

There are a number of different ways how a 3D printer is constructing the successive layers to build an item. The technologies are called for example selective laser sintering (SLS), electron beam melting (EBM), stereolithography, binder jetting or fused deposition modeling (FDM) (cf. PwC and Manufacturing Institute, 2014, p. 1). To get an impression of the principle, a few of them are described in the following.

FDM uses a stream of melted thermoplastic material from an extrusion nozzle to create layers, whereby each layer is bonding to the previous layer. Different from that, SLS uses powdered materials (e.g. nylon, aluminum, titanium, glass) that are sintered or fused, layer after layer, by a laser. EBM works similar to this, but here an electron beam is the power source that binds the material (cf. ibid.). Regardless of material or power source, the method is almost always the same. One layer of building material is spread in the required pattern on a tray and after that, the tray is

lowered by no more than a millimeter and the next layer is created (cf. The Economist, 2011). The result is always a solid representation of the original CAD model, "with no mold tooling, no machining, no jigs to hold the work in place, no fixtures, and no manual intervention required." (Reeves, 2008)

4.3.3   General Areas of Application

3DP offers a number of benefits for organizations as well as private customers, relating to costs, productivity, product innovation and also environmental issues. Most of the previous usages of the technology were to be found in some industrial manufacturing sectors such as automotive, aerospace, and medical supplies (Reeves, 2008). For example in the aircraft industry, by using AM, EADS can save 90% of the raw material which would have been simply cut away in the conventional fabrication and thrown away as useless swarf. Moreover, the whole process requires less energy now and is sometimes even faster (cf. The Economist, 2011).

EOS, a German supplier of laser-sintering 3D printers, makes plastic and metal production parts for carmakers, aerospace firms, consumer-products companies, and also dentists. The claim that a single printer can create up to 450 dental crowns a day, each tailored for an individual patient, compared to craft producers who are able to produce about a dozen per day (cf. ibid.).

Due to the fact that parts can be designed and printed optimal accordingly to their function and purpose, it is for example possible to integrate porosity   in   medical implants or add "'intelligent' devices such as fiber optics, strain gauges, and shape-memory alloys between layers" (Reeves, 2008).

There are numerous opportunities for private consumers. Digital Forming is a company who offers their customers to customize various normally mass-produced products with the aid of 3D design software. It collaborates for example with mobile-phone companies so that subscribers can go online to change the different features of the case of their new phone such as the shape or the color (cf. The Economist, 2011). Shapeways is a similar company that offers personalized 3D production. More than 10,000 unique products are printed every month for customers including individuals and shopkeepers, who order jewelry, gifts and gadgets for selling them in their stores (cf. ibid.).

Local Motors, a company from Arizona, recently even managed to print the complete body of a car in a 3D printer. Because of the limited space requirements and the relatively small costs of production, the firm plans to erect plants all over the USA. The vision is to let the customers watch while their just configured cars are growing. The sale and approval for road use in the USA shall be realized yet in 2015 (cf. Bösche, 2015).

The overall advantages of additive manufacturing can be summarized as follows:

3DP requires less raw material than subtractive manufacturing and generates only little, if any, waste material. Without some manufacturing constraints e.g. surplus material for stability purposes, items can be better optimized according to their function, thus they can be designed with less weight, which reduces also the required raw material. This feature is especially beneficial for industries like aircraft manufacturing where weight reductions can save a lot of fuel consumption. Hence costs and environmental damages are reduced (cf. Reeves, 2008; The Economist, 2011).

Highly complex geometries are possible which would not be imaginable with conventional manufacturing activities. Assembly processes are reduced greatly because of the consolidation of otherwise separate parts (cf. Reeves, 2008).

Customization of products is also much more simple since the CAD files can be altered very easily without high retooling costs which may arise for traditional production processes. The technology has the potential to transform manufacturing because it lowers costs as well as risks. Economies of scale are less important, thus manufacturers don't need to produce big lot sizes to recover fixed costs, so even a lot size of one is economically reasonable (cf. The Economist, 2011).

Due to reductions in tooling requirements, raw material and work-in-progress inventory, companies can reduce their tied-up capital significantly (cf. ibid.). Transportation and logistics costs can be reduced as well since less inventory is required and the production can take place nearer to the final customer (cf. Reeves, 2008).

The complete production cycle time can be shortened substantially, resulting in a reduced time to market for new products. Moreover new innovative products can be

created very quickly without the need for fixed capital investments in tooling and machines. This is especially advantageous for entrepreneurs and small companies with less opportunities to spread risks. Basically it is not even necessary to purchase a 3D printer because of the extensive availability of service providers in this regard (cf. Reeves, 2008; The Economist, 2011).

Because of the limited financial investment required, the technology offers also in emerging markets the opportunity to leapfrog traditional centralized industrial production setups. Other aspects of emerging markets like high product-launch risks, special product design requirements, problematic investment opportunities and a widely distributed customer base advocate the potential employment of 3DP, especially in order to maintain a competitive advantage against low-cost competition (cf. Reeves, 2008).

In today's society it is undeniably important for a company to curb the effects of manufacturing and distribution on the environment. 3DP requires smaller amount of energy than in traditional manufacturing processes where many activities require pre-heating and cooling cycles which consume a lot of energy. Moreover, potentially harmful chemicals e.g. cutting fluids are no longer required. Regarding the risk of depletion for many global resources, it is advantageous that material waste and scrap are greatly reduced. As already mentioned, production processes can be relocated near to the customer, so that the need for transportation, storage, and protective packaging of finished goods is substantially reduced. This leads to an overall decreased fuel consumption and emission of greenhouse gases (cf. ibid.).

4.3.4   Negative Aspects

There are also certain critical aspects and disadvantages regarding the extensive use of 3D-printing.

An important issue is the protection of intellectual property. A secure control of data streams has to be ensured to avoid unauthorized copying of CAD files. Otherwise imitators could copy new ideas rapidly making competitive advantages diminish extremely fast (cf. Reeves, 2008; The Economist, 2011).

Despite the described energy and material savings in the manufacturing context, 3DP could also lead to a growing energy consumption in private households due to further dissemination of the purchasing of home 3D printers (cf. Reeves, 2008).

The traditional manufacturing industry and the related jobs are threatened as the need for tooling and machining suppliers may decreases (cf. ibid.). The logistics industry may has to transform their business strategies, as logistics service suppliers could be needed less for the transport of parts and products. Rather than airfreight an urgently needed spare part from abroad a company may simply print it at the location requiring the item (The Economist, 2011).

4.4 Internet of Things

4.4.1 Definition and Development

The Internet of Things (IoT) can be defined as a "network of interconnected objects that not only harvests information from the environment (sensing) and interacts with the physical world (actuation/command/control), but also uses existing Internet standards" (Gubbi et al., 2013, p. 1646). Another very comprehensive definition is given by Sundmaeker et al. (2010, p. 43):

> "Internet of Things (IoT) is an integrated part of Future Internet and could be defined as a dynamic global network infrastructure with self configuring capabilities based on standard and interoperable communication protocols where physical and virtual 'things' have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network. In the IoT, 'things' are expected to become active participants in business, information and social processes where they are enabled to interact and communicate among themselves and with the environment by exchanging data and information 'sensed' about the environment, while reacting autonomously to the 'real/physical world' events and influencing it by running processes that trigger actions and create services with or without direct human intervention."

The idea behind the Internet of Things goes back to the term "Ubiquitous computing" introduced in 1991 by Mark Weiser who imagined a world where computers are embedded in the natural human environment and somehow vanish into the background. In his article "The computer for the 21st Century" he describes his idea of how a typical room in the future should look like, with hundreds of interconnected small "tabs", paper-sized "pads" and blackboard-sized "boards" displaying all the information people may need to accomplish their everyday tasks but at the same

time being almost invisible by merging naturally with the background (cf. Weiser, 1991).

Ashton (2009) claims to be the first person to ever expressing the phrase "Internet of Things" at a presentation in 1999 concerning the implementation of RFID in the supply chain of Procter & Gamble. He argues that computers need to be empowered to acquired information without any necessary input by human beings because "the problem is, people have limited time, attention and accuracy" (ibid.).

IoT is sometimes used interchangeable with the term Cyber-physical systems (CPS), which refers more to the system of the actual physical components which use embedded technology to communicate with one another and the Internet and provide the basis for interconnected production systems, thus CPS link the physical world with virtual world to create an Internet of Things, Data and Services (cf. acatech, 2011, p. 5; Bauernhansl et al., 2014, p. 15 f.).

Virtually everything can be part of a CPS, as related software may be embedded in "devices, buildings, means of transport, transport routes, production systems, medical processes, logistic processes, coordination processes and management processes" (acatech, 2011, p. 15).

The main goal of the IoT is simply to make "a computer sense information without the aid of human intervention" (Gubbi et al., 2013, p. 1646). The information gap between the real and the virtual world shall diminish in order to employ products and machines more efficiently when being able to process information about condition, utilization, age and environmental conditions (cf. Kagermann et al., 2011).

The research institute Gartner predicts the amount of objects installed in Internet of Things applications to reach 26 billion by 2020. Furthermore, the total economic added value from IoT across all connected industries shall reach $1.9 trillion worldwide by then, with the highest profits in manufacturing, healthcare providers, insurance, and banking and securities (cf. Middleton et al., 2013).

4.4.2   Functionality and Components

Products, equipment and objects communicate and interact with the aid of embedded hard- and software. They form systems, that are able to record and process data from the physical environment via sensors. The data is accessed by network based

services which use actuators to have a direct impact on processes and objects (cf. acatech, 2011, p. 5). Beside the interaction with the physical and digital world, IoT applications are also able to evaluate and save the recorded data. They have a connection with one another as well as with global networks via digital communication facilities. Furthermore, various adaptable interfaces facilitate human-machine interaction (cf. ibid., p. 15).

According to Gubbi et al. (2013, p. 1647), there are three main kinds of components necessary to enable the total functionality IoT applications: The first is the hardware including sensors, actuators and embedded communication devices enabling wireless technologies such as Bluetooth, RFID, Wi-Fi, wireless local area network (WLAN), telephonic data services. The second is middleware which are tools allowing for on demand storage and computing for data analytics. Finally the third are presentation tools in order to visualize and interpret the data, these have to be widely accessible from different platforms.

A few prerequisites for the implementation and further development of IoT applications exist: An extensive, secure and easily accessible mobile internet infrastructure has to be available. The physical infrastructure including sensors and actuators has to be provided and shall match with international and cross-industry standards for interoperability (e.g. regarding internet protocols and addressing schemes). Adequate human-machine interaction facilities have to fulfill standards regarding usability and ergonomics. The required devices and digital services enabling the storing and processing of data have to adaptable and reasonably priced regarding activation and operation in order to ensure a widespread implementation. Challenging requirements are further high scalability, direct usability, dynamic adaption as well as software compatibility, high reliability, fault tolerance and privacy protection (cf. acatech, 2011, p. 6; Mattern and Flörkemeier, 2010, p. 7 f.).

4.4.3   General Areas of Application

Networked navigation software traces via mobile communication data the current movements of traffic participants and processes this information for improved route guidance (cf. acatech, 2011, p. 5).

The opportunity to remotely monitor autonomous production systems facilitates the increase of efficiency and flexibility within manufacturing, logistics and transportation processes (cf. ibid., p. 5 ff.).

IoT makes it possible to count and keep track of everything, and therefore know well ahead when things need to be replaced or repaired. Moreover, machines and facilities will autonomously organize their maintenance and repair strategy in accordance with the current degree of utilization, while making sure that enough backup capacities are available to maintain production in the case of maintenance-related disturbances. In this way, waste, loss and costs can be considerably reduced (cf. acatech, 2011, p. 5; Ashton, 2009).

An application possibility in the automobile industry is found for example in the area of electromobility, where efficient route management is facilitated through CPS (cf. acatech, 2011, p. 15). In the medical industry, IoT systems can be used monitor patient treatments or optimize emergency deployments in hospitals. Due to demographic change, Ambient Assisted Living (AAL) solutions will be increasingly installed for the daily support of people in need of care (cf. ibid., p. 16).

With regard to the increasing depletion of fossil energy resources, intelligent power networks (smart grids) are employed for private as well as organizational energy consumers to optimize energy consumption and support production planning (cf. ibid.).

In the area of logistics, the internal and external transport of goods can be supported through integrated position tracking and status enquiries in real time. This facilitates precise planning and monitoring of deliveries (cf. ibid., p. 16 f.)

IoT devices can be implemented in various ways into home appliances. To name just a few examples, a "smart home" can include alarm clocks which adjust the wake-up time due to traffic conditions, weather sensors applied to clothing that alert the wearer in case of high pollen count of bad air quality, screens on the refrigerator door suggesting meals while considering the diet recommendations send by the doctor and updating the online grocery order accordingly, media devices automatically adapting to the user preferences and security systems protecting the home while the resident is guided to work in his own car via the best route available (cf. Oracle, 2014, p. 1).

IoT applications can also be combined with 3DP both in private consumer surroundings as well as in the industrial manufacturing context. The 3D printer simply becomes an IoT device and thus is interconnecting with other devices. In this way, the build status and performance can be monitored and controlled with online tools for example via a smart phone. Additive manufacturing can also be used to embed RFID tags into products which is of high value for the logistics industry. Moreover, with the usage of different materials it may be even possible to print electronics and optics within products to create intelligent devices from scratch (cf. Reeves, 2014).

4.4.4   Negative Aspects

Environmental impacts of IoT appliances have to be regarded as well. Especially the high energy consumption raises concern. Due to the permanent internet connection possible savings from intelligent energy management are reversed by the smart applications themselves. According to a study of the International Energy Agency (IEA), almost two thirds of the 616 terawatt hours (TWh) consumed by IoT devices in 2013 were wasted (cf. Förster, 2014).

IoT applications involve the flow of massive data streams carrying highly important information, which require high levels of informational security, also regarding the management and storage of the captured information. The requirements of privacy and information security will be raised to a new level. The acceptance of the general public and confidence in this new technology will also be dependent on the levels of security and the transparency of such flows of data (cf. acatech, 2011, p. 29).

4.5 Future Impact of Innovations

The Gartner 2012 Hype Cycle of emerging technologies (see Figure 15) measures the expectations towards new technologies over time and thus represents their emergence, adoption and maturity stages. According to this forecast, IoT is in a phase of growth and will still need about 10 years until full market adoption and 3D Printing has disseminated widely and might already be common in 5 years.
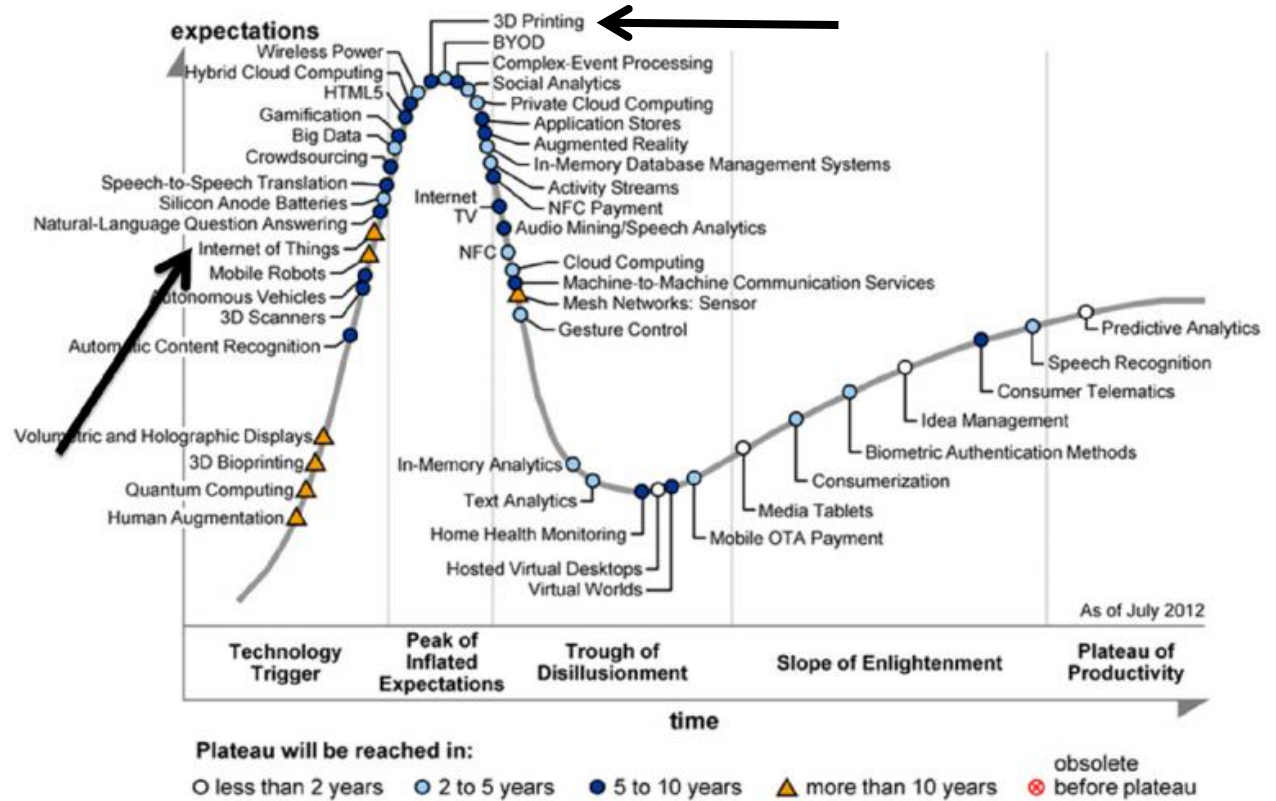
Figure 15: Gartner 2012 Hype Cycle of emerging technologies. Source: Gartner Inc., 2012, qtd. in: Gubbi et al., 2013, p. 1648.

The Internet of Things and 3D printing are most presumably going to change market structures heavily. There will be a great demand for suppliers of services regarding cyber-physical systems or raw material for usage in 3D printers (cf. acatech, 2011, p. 5). But on the other side, conventional manufacturing is going to struggle for its significance if someday everyone can print e.g. their own toothbrush whenever required.

5   Concrete Solutions

In the following sections, the presented technologies will be used to propose solutions for the potential problems described in chapter 3.2. Additional organizational optimization opportunities will be suggested which may not necessarily be regarded innovations, but can further help in the context of improving business processes in emerging market supply chains.

5.1 Solutions for Demand Related Problems

As already said, volatile demand patterns impede accurate forecasting. In order to solve this problem, either the methods to determine demand have to be improved or there has to be found a way to react as fast as possible to sudden demand boosts. While the enlargement of safety stock would increase the inventory costs, it is certainly a preferable solution to reduce the lead times in order to eliminate delivery problems in case of forecasting errors or other unpredictable events. The shorter the lead time, the less inventory is required (cf. Christopher, 2011, p. 124 f.). This possibility will be further examined in section 5.3 where optimization opportunities for production processes are proposed.

In the following, firstly a way to improve forecasting methods is presented, followed by two options to change respectively adjust to the conditions responsible for the prevalent volatile demand.

5.1.1 Improve Forecasting by Automation of Supply Chain Communication

Improved forecasting reduces insecurities regarding demand trends, therefore the amount of safety stock required to meet targeted customer service levels can be lowered. Communication of current demand levels and future indications between customer and supplier is crucial in order to avoid for example the bullwhip effect (see also section 3.2.2). The application of IoT networks can enhance the knowledge about the demand in certain supply chain structures. Products that are interconnected with the supplying base, can sense and communicate their deterioration or obsolescence based on specific inquiries about the condition of themselves and their environment. The forwarded information can be processes

quickly with the result that required replenishment amounts are delivered well ahead of time.

5.1.2 Impede Plagiarism via Tracking Applications

Common plagiarism due to weakly enforced intellectual property regulations threatens the selling objectives of original brands. CPS can be used to inhibit the introduction of counterfeit products into the logistics process through global tracking and tracing activities (cf. acatech, 2011, p. 17). This can avoid the dissemination of plagiarized products that may steal customers thus reduce sales. The possibility of precise product identification can be realized through the application of RFID tags within the product itself or on packaging material or pallets used for transportation. RFID operates with a small transmitter to send radio frequencies from pallets and cases that allow those items to be instantaneously located by the customer or the carrier in an instant (cf. Gourdin, 2006, p. 14). At relevant tracking locations, the products can be scanned to confirm the authenticity of the articles.

5.1.3 Adapt Product Design to Varying Market Requirements

The development of low-cost products which are also resistant to competitive environments is called frugal engineering (cf. Fontanella-Khan, 2011). As customer needs can vary substantially in emerging markets compared to developed ones, this could be an opportunity to successfully attract customers.

5.2 Solutions for External Supply Related Problems

To ensure punctual and high-quality availability of required raw material, it is one the one hand necessary to improve the order processes and on the other side find ways to accelerate and optimize inbound transportation. Another possibility is the complete avoidance of external suppliers to decrease dependency on their reliability.

5.2.1 Automate Ordering Processes

For improvement and acceleration of order processes, the implementation of electronic procurement systems (EPS) is advisable. EPS reduce the fixed ordering cost, which allows for more frequent orders. Generally, it helps to lower the overall inventory costs. Other benefits of EPS include the possibility to faster react to changes, the consolidation of purchasing activities across multiple departments, the elimination of unnecessary manual activities and an improved collaborative relationship with suppliers (cf. Sunderraj and Kumari, 2013, p. 33). Such partnerships with domestic suppliers are also helpful for leveraging their local knowledge regarding the challenging economic conditions in emerging markets.

The current available computer technology makes it even possible to fully automate the whole logistics systems related to inventory management and purchasing activities. The event of inventory declining to a certain level can automatically generate an order which will be transmitted via (EDI) to the supplier. The automated system of the supplier arranges that the needed amount is pulled automatically from storage and initiates shipping to the customer. In the course of this mechanism, the levels of inventory are updated on both sides, the billing is triggered and all the necessary documents are generated automatically, so that the whole process can take place without any humans needed directly (cf. Gourdin, 2006, p. 14).

5.2.2 Optimize Transports through Continuous Tracking of Shipments

The transport of goods in emerging markets is exposed to certain risks such as the possibility of theft or insufficient road networks which make it hard to rapidly carry goods. IoT applications enable the continuous tracking of shipments so that the system can always monitor the current location of the vehicles and the carried shipments and therefore react quickly in case of abnormal interruption for example by alerting the supervisor. The tracking can be realized by global positioning systems (GPS) that work with the help of satellites (cf. Gourdin, 2006, p. 14).

RFID represents another possibility to track goods throughout the whole transportation process and also during their movements into and inside the warehouse. Consistent and standardized infrastructure and tagging devices have to be implemented within the facilities of the manufacturer as well as the suppliers (cf. ibid., p. 195).

Even more important is in this context the optimization of the transports of perishable goods. In this case, cold chain preserved throughout the whole life cycle of the product. Therefore a continuous monitoring is necessary in order to ensure high quality. A very important factor in cold supply chains is the visibility and control of the temperature at each step of the chain. In this way only, it is possible to guarantee impeccable quality to the customer. The presented technological developments in the areas of monitoring, efficient transportation and communication information technologies have made the trading of food and other perishable goods (like flowers or medicines) easier. Furthermore, all activities which concern processing and transportation as well as warehousing should be transacted fast to ensure the durability of the products (cf. Zavanella and Zanoni, 2009, p. 87).

After the arrival of the transported goods at the warehouse, possible damages during transport have to be detected within the receiving process. As manual controls may miss quality issues, it is better to have automatic systems that can exactly recognize e.g. wrong measurements. Automation can also help facilitate the storing activities. Hereby it is possible for IoT networks to identify the optimal storage area and shortest routes within the warehouse.

5.2.3 Accelerate Customs Clearing Processes by means of IoT

If IoT systems would be implemented not only for data processing within and between companies but also by governments and international organizations, it would be possible to accelerate previously bureaucratic and tedious processes such as customs clearing. Shipments could notify cross-border control stations early in advance via communication networks. By this way, paperwork could be reduced drastically.

5.2.4 Bypass Ordering through 3D Printing

With the usage of 3D printing, it is possible to avoid ordering parts from suppliers which may are far away when needing a specialized part or when rapid design changes are needed. This makes the whole order processing quicker and cheaper. (cf. The Economist, 2011). Uncertainties regarding the punctual and reliable supply

of needed parts disappear, so that the company may cope better with demand fluctuations. Costs for ordering and transporting parts from suppliers will be reduced to a great extent, since the only requirements are the raw material for the 3D printer and the CAD file to create the final product.

5.3 Solutions for Internal Production Problems

In case of the incapability to forecast exact customer demand, a company must try to reduce the response time after an incoming as much as possible.

5.3.1 Reduce Lead Times in General

The order lead time or order cycle time is the time passed between order placement and delivery of the product (cf. Gourdin, 2006, p. 55). The order cycle was already depicted in chapter 3.2.1. Shorter lead times would require less inventory to be held in advance. A systematic approach would be to analyze each and every stage in that time frame in order to identify potentials for optimization. The different steps are order placement, order entry, order processing, order assembly and transport. While the order assembly and transport while be analyzed in section 5.5, the following concerns the receipt and processing of customers orders.

The first step is the order placing by the customer. This can certainly be accelerated by Internet of Things appliances which even the situation where the customer himself doesn't need to do anything at all. The product will notice itself when it has to be repaired or replaced and will place an order via the Internet prior to that moment.

The time to process the entry of an order and to trigger the corresponding order picking or production can be reduced as well by automatic processes which take also into consideration current utilization levels and vacant work stations. Thereby traditional production processes can be optimized with the help of IoT devices. With an incoming order, the interconnected system may checks the availability of required machines, raw material, auxiliary production tools, and labor force. Moreover, production lines can be coordinated and monitored to enable an immediate detection of disruptions. The products themselves can control their production progress via the embedded sensor systems and can communicate irregularities directly or even trigger counter-measures. This reduces failures and accelerates processing times

thus reducing the lead time. Furthermore, the utilization of resources can be optimized continuously (cf. Kagermann et al., 2011).

3D printing enables the processing or orders without needing any final product inventory at hand. However, the company is still able to produce the product quickly and cost-efficiently. Especially when set up costs are high (setting up a manufacturing order or ordering a purchased item), a relatively large lot size would normally be required to balance the setup costs against the cost of inventory investment (cf. Toomey, 2000, p. 3). But 3D printing virtually eliminates the process of setting up machines.

5.3.2   Avoid Production Stoppages

In the production process, disruptions can occur due to sudden failures of machines and facilities or absent special parts. Ordering missing parts from external suppliers would consume valuable time, especially if special parts are sourced from outside of the country. The 3D printing technology can optimize these occurrences since the relevant part for the continuation of the production process or for repairing the machine can be simply printed out within a short period of time.

5.4   Solutions for Stock-keeping Problems

5.4.1   Monitoring of Stock Levels through IoT

The implementation of RFID tags on every loading unit or even on every product enables the continuous tracking of inventory levels and product locations within the warehouse. This can impede for instance stealing. Moreover it is possible to monitor possible deterioration of goods. With embedded sensors, they are able to sense their own condition.

5.4.2   Automated Handling Systems

For movements within warehouses due to transshipment activities or production requirements, the usage of automated handling systems can improve efficiency and reduce costs substantially. These interconnected decentralized systems may be equipped with sensors to process information about their positions and surroundings.

Through network connection, they can access information about all product locations and the locations of other handling devices. Thus collisions and damages can be avoided and highly optimized handling routes are achieved.

5.5 Solutions for Distribution Related Problems

5.5.1 Order Picking and Assembly

For realization of picking and commissioning activities, similar automated systems as described above (see 5.4.2) can be implemented. Thereby it is possible for these systems to compute optimized picking routes to minimize the overall steps.

5.5.2 Product Packaging

The packaging of products and loading units is especially important in emerging market environments as special requirements exist. On the one side, adaptation to challenging transport and warehousing conditions is necessary and on the other side, different demand needs based on income and distribution outlet have to be considered, at best already early in the product design phase (cf. Blanco, 2009, p. 4).

5.5.3 Optimize Shipping to Customer

The transport may often be delayed due to lot size restrictions. Either the customer has to wait or the containers are filled uneconomically. Therefore there should be cooperation networks. Researchers in logistics propose a more efficient way of organizing transport. An "Open System Software" should be established, and every participant of the global transport network should be able access it via the Internet. Means of transport should be shared and used jointly and smaller transport units should be even more standardized in order to ensure a undisturbed well-functioning supply chain, regardless of which transport mode is used. In this way, maximum capacities are efficiently utilized, which leads to less cost and shorter delivery times. Furthermore, there is less traffic and hence environmental are reduced. But the author points also out that there remain unsolved issues like the accounting and fair payments of the performed transport services (cf. Vahldiek, 2014).

5.5.4 Locate Production Closer to the Consumer

With the help of 3D printing, it is possible to realize the manufacturing of products concurrently at multiple locations close to the final consumers. This strategy enables a "truly distributed supply chain" (Reeves, 2008) with less different stages, accelerating lead times and reducing transaction and logistics costs. Moreover, single-source supply chain risk can be avoided (cf. ibid.).

6   Conclusion and Critical Review

The main purpose of this thesis was to discover critical aspects of business activities in emerging markets and how they influence proper inventory management. Suitable optimization opportunities were supposed to be identified through the application of currently promoted technological and organizational innovations.

First of all, the notation emerging markets has no consistently employed definition. Thus it is not undoubtedly determinable which countries belong to this group of economies and which can on the other side be allocated to e.g. developed countries or least-developed countries. For the purpose of being able to address specific economies, a group of 17 core emerging markets was formed on the basis of comparing relevant definition and classification attempts by scientific researchers and economic institutions. An analysis with regard to political/legal, economical, socio-cultural and technological factors resulted in multiple emerging-market-specific risks which were outlined in the context of inventory management activities. Eventually innovative technologies for example within the scope of the German project research project "Industry 4.0" were explored to develop appropriate optimization opportunities.

One of the main problems in emerging markets is the necessity to hold relatively high amounts of inventory since the economic situation regarding demand and supply is very vague and erratic compared to developed marketplaces. As high inventory levels usually directly increase inventory costs, it is necessary to either combat against the sources of uncertainty or find alternative solutions. In this regard, especially the additive manufacturing technology proves to serve as an effective option to reduce inventories drastically. To some extent, it enables the direct printing of final products immediately after the demand emerges. Consequently the dependence on suppliers and steady demand levels diminishes. Another useful innovation are Internet of Things-networks which contribute greatly to the automation of manufacturing and logistics processes.

Due to the fact that these technologies are presently rather expensive, the question arises if their introduction in emerging markets which are characterized by rather low capital endowments is reasonable. However, as these technologies are still in the research phase even in developed countries, there is a vast potential for optimizing

related cost and performance. Depending on the degree of this future development, the implementation into emerging market supply chains becomes more feasible.

Hence for concrete use cases, applicability and usability of the suggested technological solutions have to be thoroughly analyzed. Implementation costs are especially for comprehensive cyber-physical systems and large high-tech 3D printers significant. This has to be balanced against potential savings in the supply chain. Furthermore, the existence of specific prerequisites has to be guaranteed such as extensive internet access for IoT applications.

Moreover, it has to be remarked that the challenging country conditions illustrated in this thesis don't necessarily have to pertain to every emerging market. Besides factors such as infrastructure and resource availability can be greatly diverging even within one country. A more thorough analysis of specific markets and locations can give more profound information about the indicators and conditions which are most important for the respective company's needs. Generally it is important not to blindly impose global standards on emerging markets, but to consider the developing and dynamic nature of these locations.

Appendix

A   Country groups according to different classifications

A.1   Classification of economies by income

Source: The World Bank, 2014

34 Low-income economies:

Afghanistan, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Dem. Rep. Congo, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bisau, Haiti, Kenya, Dem. Rep. Korea, Liberia, Madagascar, Malawi, Mali, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sierra Leone, Somalia, Tajikistan, Tanzania, Togo, Uganda, Zimbabwe

50 Lower-middle-income economies:

Armenia, Bhutan, Bolivia, Cameroon, Cabo Verde, Rep. Congo, Côte d'Ivoire, Djibouti, Egypt, El Salvador, Georgia, Ghana, Guatemala, Guyana, Honduras, Indonesia, India, Kiribati, Kosovo, Kyrgyz Republic, Lao PDR, Lesotho, Mauritania, Micronesia, Moldova, Mongolia, Morocco, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Samoa, São Tomé and Principe, Senegal, Solomon Islands, South Sudan, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Timor-Leste, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Yemen, Zambia

55 upper-middle-income economies:

Angola, Albania, Algeria, American Samoa, Argentina, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, China, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, Fiji, Gabon, Grenada, Hungary, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Lebanon, Libya, Macedonia, Malaysia, Maldives, Marshall Islands, Mauritius, Mexico, Montenegro, Namibia, Palau, Panama, Peru, Romania, Serbia, Seychelles, South Africa, St. Lucia, St. Vincent and the Grenadines, Suriname, Thailand, Tonga, Tunisia, Turkey, Turkmenistan, Tuvalu, Venezuela

75 high-income economies:

Andorra, Antigua and Barbuda, Aruba, Australia, Austria, The Bahamas, Bahrain, Barbados, Belgium, Bermuda, Brunei Darussalam, Canada, Cayman Islands, Channel Islands, Chile, Croatia, Curaçao, Cyprus, Czech Republic, Denmark, Estonia, Equatorial Guinea, Faeroe Islands, Finland, France, French Polynesia, Germany, Greece, Greenland, Guam, Hong Kong SAR, Iceland, Ireland, Isle of Man,

Israel, Italy, Japan, Rep. Korea, Kuwait, Latvia, Liechtenstein, Lithuania, Luxembourg, Macao SAR, Malta, Monaco, Netherlands, New Caledonia, New Zealand, Northern Mariana Islands, Norway, Oman, Poland, Portugal, Puerto Rico, Qatar, Russian Federation, San Marino, Saudi Arabia, Singapore, Sint Maarten, Slovak Republic, Slovenia, Spain, St. Kitts and Nevis, St. Martin, Sweden, Switzerland, Trinidad and Tobago, Turks and Caicos Islands, United Arab Emirates, United Kingdom, United States, Uruguay, Virgin Islands

A.2 Classification according to the CIA World Factbook

Source: Central Intelligence Agency, 2013

34 Developed countries:

Andorra, Australia, Austria, Belgium, Bermuda, Canada, Denmark, Faroe Islands, Finland, France, Germany, Greece, Holy See, Iceland, Ireland, Israel, Italy, Japan, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, NZ, Norway, Portugal, San Marino, South Africa, Spain, Sweden, Switzerland, Turkey, UK, US

27 former USSR/Eastern Europe countries:

Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, Yugoslavia

172 less developed countries:

Afghanistan, Algeria, American Samoa, Angola, Anguilla, Antigua and Barbuda, Argentina, Aruba, The Bahamas, Bahrain, Bangladesh, Barbados, Belize, Benin, Bhutan, Bolivia, Botswana, Brazil, British Virgin Islands, Brunei, Burkina Faso, Burma, Burundi, Cabo Verde, Cambodia, Cameroon, Cayman Islands, Central African Republic, Chad, Chile, China, Christmas Island, Cocos Islands, Colombia, Comoros, Democratic Republic of the Congo, Republic of the Congo, Cook Islands, Costa Rica, Cote d'Ivoire, Cuba, Cyprus, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Falkland Islands, Fiji, French Guiana, French Polynesia, Gabon, The Gambia, Gaza Strip, Ghana, Gibraltar, Greenland, Grenada, Guadeloupe, Guam, Guatemala, Guernsey, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, India, Indonesia, Iran, Iraq, Isle of Man, Jamaica, Jersey, Jordan, Kenya, Kiribati, North Korea, South Korea, Kuwait, Laos, Lebanon, Lesotho, Liberia, Libya, Macau, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Martinique, Mauritania, Mauritius, Mayotte, Federated States of Micronesia, Mongolia, Montserrat, Morocco,

Mozambique, Namibia, Nauru, Nepal, Netherlands Antilles, Ne Caledonia, Nicaragua, Niger, Nigeria, Niue, Norfolk Island, Northern Mariana Islands, Oman, Palau, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Pitcairn Islands, Puerto Rico, Qatar, Reunion, Rwanda, Saint Helena, Ascension, and Tristan da Cunha, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Solomon Islands, Somalia, Sri Lanka, Sudan, Suriname, Swaziland, Syria, Taiwan, Tanzania, Thailand, Togo, Tokelau, Tonga, Trinidad and Tobago, Tunisia, Turks and Caicos Islands, Tuvalu, UAE, Uganda, Uruguay, Vanuatu, Venezuela, Vietnam, Virgin Islands, Wallis and Futuna, West Bank, Western Sahara, Yemen, Zambia, Zimbabwe

44 least developed countries as a subgroup of the less developed countries:

Afghanistan, Bangladesh, Benin, Bhutan, Burkina Faso, Burma, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Cote d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, The Gambia, Ghana, Guinea, Guinea-Bissau, Haiti, Kenya, Lesotho, Liberia, Malawi, Mali, Moldova, Mozambique, Nepal, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, Sudan, Tajikistan, Tanzania, Togo, Tokelau, Tuvalu, Uganda, Zambia

A.3 Classification according to the IMF

Source: Central Intelligence Agency, 2013

36 advanced economies:

Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, South Korea, Latvia, Luxembourg, Malta, Netherlands, NZ, Norway, Portugal, San Marino, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan, UK, US

27 countries in transition:

Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Lithuania, Macedonia, Moldova, Mongolia, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan

130 developing countries:

Afghanistan, Algeria, Angola, Antigua and Barbuda, Argentina, The Bahamas, Bahrain, Bangladesh, Barbados, Belize, Benin, Bhutan, Bolivia, Botswana, Brazil,

Brunei Darussalam, Burkina Faso, Burundi, Cambodia, Cabo Verde, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Comoros, Democratic Republic of the Congo, Republic of the Congo, Costa Rica, Cote d'Ivoire, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gabon, The Gambia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kenya, Kiribati, Kosovo, Kuwait, Laos, Lebanon, Lesotho, Liberia, Libya, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Mauritania, Mauritius, Mexico, Federated States of Micronesia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Qatar, Rwanda, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Syria, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Tuvalu, Uganda, United Arab Emirates, Uruguay, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe

A.4 MSCI Market Classification

Source: MSCI, 2014

23 Developed Markets:

Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, NZ, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, UK, USA

23 Emerging Markets:

Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Qatar, Russia, South Africa, Taiwan, Thailand, Turkey, United Arab Emirates

32 Frontier Markets:

Argentina, Bahrain, Bangladesh, Bosnia Herzegovina, Botswana, Bulgaria, Croatia, Estonia, Ghana, Jamaica, Jordan, Kazakhstan, Kenya, Kuwait, Lebanon, Lithuania, Mauritius, Morocco, Nigeria, Oman, Pakistan, Palestine, Romania, Saudi Arabia, Serbia, Slovenia, Sri Lanka, Trinidad & Tobago, Tunisia, Ukraine, Vietnam, Zimbabwe

A.5 FTSE Market Classification

Source: FTSE International Limited, 2014

25 Developed Markets:

Australia, Austria, Belgium/Luxembourg, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, South Korea, Spain, Sweden, Switzerland, UK, USA

10 Advanced Emerging Markets: Brazil, Czech Republic, Hungary, Malaysia, Mexico, Poland, South Africa, Taiwan, Thailand, Turkey

12 Secondary Emerging Markets: Chile, China, Colombia, Egypt, India, Indonesia, Morocco, Pakistan, Peru, Philippines, Russia, UAE

26 Frontier Markets:

Argentina, Bahrain, Bangladesh, Botswana, Bulgaria, Côte d'Ivoire, Croatia, Cyprus, Estonia, Ghana, Jordan, Kenya, Lithuania, Macedonia, Malta, Mauritius, Nigeria, Oman, Qatar, Romania, Serbia, SlovakOman, Pakistan, Palestine, Romania, Saudi Arabia, Serbia, Slovenia, Sri Lanka, Trinidad & Tobago, Tunisia, Ukraine, Vietnam, Zimbabwe

A.6 Dow Jones Index Country Classification

Source: Dow Jones Indexes, 2011

26 Developed Markets:

Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, USA

21 Emerging Markets:

Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, South Korea, Taiwan, Thailand, Turkey

30 Frontier Markets:

Argentina, Bahrain, Bangladesh, Bulgaria, Croatia, Cyprus, Estonia, Jordan, Kazakhstan, Kenya, Kuwait, Latvia, Lebanon, Lithuania, Macedonia, Malta, Mauritius, Nigeria, Oman, Pakistan, Qatar, Romania, Serbia, Slovakia, Slovenia, Sri Lanka, Tunisia, Ukraine, UAE, Vietnam

A.7 Emerging Markets classified by Kvint

Source: Kvint, 2009, p. 105 f.

83 emerging-market countries:

Albania, Algeria, Argentina, Armenia, Azerbaijan, Bahrain, Barbados, Belize, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Cyprus, Ecuador, Egypt, El Salvador, Estonia, Gabon, Georgia, Ghana, Greece, Guatemala, Guyana, Hong Kong, Hungary, India, Indonesia, Iraq, Ireland, Israel, Jamaica, Jordan, Kazakhstan, Latvia, Lithuania, Macedonia, Madagascar, Malaysia, Malta, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Saint Kitts and Nevis, Saint Lucia, Saudi Arabia, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Taiwan, Thailand, The Bahamas, Trinidad, Tunisia, Turkey, Turkmenistan, Ukraine, United Arab Emirates, Uruguay, Vietnam

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