INTRODUCTION OF A NEW BOGIE TECHNOLOGY FOR METRO-VEHICLES IN A NEW MARKET, CASE STUDY LONDON UNDERGROUND

Diploma Thesis

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PREFACE

This thesis has been realized under the great mentoring of Friedrich Timmer and Kurt Strommer from Siemens. I hereby express my gratitude for all the input and feedback in professional as in personal respect.

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I want to thank my roommates for their friendship and for cheering me up in hard times: Timon, Emilie, Lisa, Max and Marlies. As well as friends strengthening my back along the way: Flo, Claudia, Veronika, Mario, Karin, Patrick and Katharina. My surrogate family in London: Yasmin, Zak, Harry, Jake, Nele and Katja – thanks for everything.

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Graz, May 2011

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ZUSAMMENFASSUNG

Anfangssituation und Zweck

Die Zugindustrie ist stark umkämpft. Der Kauf von Schienenfahrzeugen ist eine langfristige Anlageinvestition. Auf Grund des langen Zeitraums bis Neuentwicklungen vollständig auf ihr Verhalten während der kompletten Laufzeit getestet sind ist es schwierig technische Innovationen zu etablieren. Das Fahrwerkskompetenzzentrum von Siemens in Graz hat ein umweltfreundliches, energieeffizientes und verwindeweiches Drehgestell entwickelt. Im Auftrag der Produktmanagementabteilung in Graz und des regionalen Verkaufs von Siemens in London werden in dieser Diplomarbeit die Möglichkeiten untersucht die Marktposition zu verbessern um das innovative Fahrwerk in London zu vertreiben.

Methodik

Diese Diplomarbeit ist geteilt in einen Theorieteil und in einen Praxis bezogenen Teil. Die theoretischen Ausführungen zum Thema Marktanalyse, Marketingstrategien und Geschäftsmodelle stellen das Fundament für die praktische Durchführung dar. Die Fallstudie basiert auf einer ausführlichen Marktanalyse. Marketingstrategien und Aktionen um die Marktposition in London zu stärken und um den Weg für eine erfolgreiche Markteinführung zu ebnen werden daraus abgeleitet. Am Schluss werden, als Basis für weitere strategische Entscheidungen, die Möglichkeiten zur Neuausrichtung des Geschäftsmodells betrachtet.

Ergebnis

Systematische Marketingaktivitäten, ausgewählt auf Grund der Ergebnisse einer umfassenden Marktuntersuchung können die Bekanntheit einer Firma und ihres Produktes auf dem Markt verbessern. Diese Marketingaktivitäten sollen des Weiteren einen intensiven Kontakt zum Kunden ermöglichen. Nur wenn bekannt ist was der Kunde wirklich braucht und möchte kann man diese Erwartungen mit einem passenden Geschäftsmodell erfüllen.

ABSTRACT

Present Situation and Purpose

The railway industry is a strongly competing industry. Rolling stock is a long-term asset and technical innovations are hard to establish due to the long time until they have fully proven their reliability. An environmental friendly, energy efficient, flexible new bogie concept has been developed at the Siemens bogie competence centre in Graz. As an appointment of the product management department of Siemens in Graz and the Sales department in London, this thesis examines the marketing possibilities for the utilization of this bogie technology in deep tube Metros for the London Underground system.

Approach

This thesis is separated in a theory part and a business case part. The theory is the fundament for the practical execution and examines three scientific areas: Market Analysis, Marketing Strategies and Business Models. The business case is based on a profound market analysis. Strategies and actions to strengthen the competitive position and to clear the way for a successful market introduction are deduced. As a basis for further strategic decisions, business models are reviewed according their applicability.

Outcome

Systematic marketing activities, which are based on a profound market analysis strengthen the awareness of a company and its product in the market and enable contacts with the customer. Finding out what the customer really wants and needs enables the vendor to meet needs and expectations with a viable business model.

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1 INTRODUCTION

The purpose of this diploma thesis is to examine the possibilities an industrial company has, to improve its competitive position with a new product development in a new market. Therefore this thesis discusses the topics: Market Analysis, Strategic Marketing and Business Models.

The applicability of the theoretical approach will be proofed on a real business case: the introduction of an innovative bogie technology in the Metro market in London. The examination of the practical adaptability is a task assignment of Siemens AG in Graz, Austria and Siemens plc. in London, United Kingdom.

In this introduction, a short outline of the initial situation is followed by an explanation of the used methodology and the goals of the thesis. This introduction closes with a theoretical description of the project phases.

1.1 INITIAL SITUATION

The investigations are made to support a specific business case: the market launch of Syntegra, a new railway bogie technology of Siemens at the London Underground System.

Syntegra is a revolutionary concept, that meets the demand of the market for sustainable and energy efficient solutions. Prototyping tests have been made, but the last step for a successful innovation has not been fulfilled yet: the market introduction followed by a financial success. What inhibits the actual sales is the fact that railway-vehicles are in continuous use for up to 40 years. Operators ask for long-term reliability guarantees, and are rarely willing to take the risk to implement something significantly new.

The deep tube rolling stock of the London Underground System is partly outdated and various lines need renewal within the next 10 years. A promising market volume is expected because of the big fleet in London and further capacity needs due to the urbanization trend. So auspicious, that not only the incumbents: Alstom Transport and Bombardier Transportation, but also other rolling stock manufacturers such as Construcciones y Auxiliar de Ferrocarriles (CAF), Kawasaki Heavy Industries and Hitachi Ltd. Transportation Systems are likely to claim their share.

Summed up, a technology-driven, environmentally-friendly, energy efficient new development and a very promising market are the boundary conditions for the research conducted within this report. Hence this thesis further analyses the constraints and discusses various actions to improve the starting position for a successful collaboration of Siemens and London Underground in the near future.

1.2 METHODOLOGY

To elaborate the tasks of this thesis, a deductive method is used. The report is divided into two main parts: a theoretical and a business case related part.

At first, scientific models which deal with the challenge of a structured market analysis are described: the PESTEL analysis, used to list the macro-environmental influencing factors, Michael Porter's five forces approach of evaluating the main interactors within an industry will be examined, followed by the generic marketing strategies and the Marketing Mix concepts. The last subchapter within the theory part lists expert opinions on different business models.

Part two, including chapter three to six, applies the theory to the praxis. To provide a basis for further investigations Syntegra, the product is described, the railway market as a whole is segmented and the market is defined in chapter three. A definition of the target market in London for underground trains is conducted. The environmental analysis deals with the greater surrounding. Further a closer look at the strategic triangle: the customer, the company and the competition, leads to an estimation of the intensity of Porter's five forces. The findings of the market properties are summed up in a SWOT analysis.

Building on that knowledge, possible marketing strategies to establish a good customer relationship are listed in chapter four. The possibilities within the areas product, place, promotion and prize are described. Various business models are examined in chapter five, such as going down stream and performance contracting. Also the possibilities for strategic alliances are discussed. The thesis finishes with a conclusion consisting of an executive summary of the results and a recommendation for the next steps.

1.3 OBJECTIVES

The major objectives of this thesis, formulated together with Siemens and the institute of Business Economics and Industrial Sociology are:

- To research the theoretical background for a **strategic analysis** to provide a basis for the modelling of tactics in special business cases
- To study the **marketing strategy and business model theory** to be able to define possible marketing activities
- To explore the metro **market in London** and its environment by getting to know the people and the situation on site
- To evaluate the possible **marketing** and **business** steps to strengthen the position of Siemens in the bidding process of London's next generation tube stock at an early stage

1.4 PROJECT PHASES

The topic of this diploma thesis is assigned to the scientific field of strategic management, an area where researchers have set up models and various methods in the last 40 years. The process of strategic management is divided into three tasks: the strategic analysis, the strategy formulation and selection and the strategy implementation.[1] Due to the limitations of time and impact of a diploma thesis the last part will not be given any further attention. To structure the process of strategic analysis HUNGENBERG further lists four different steps: preparation, information retrieval, evaluation and interpretation to fulfil in a chronological order, as depicted in the picture below.[2]

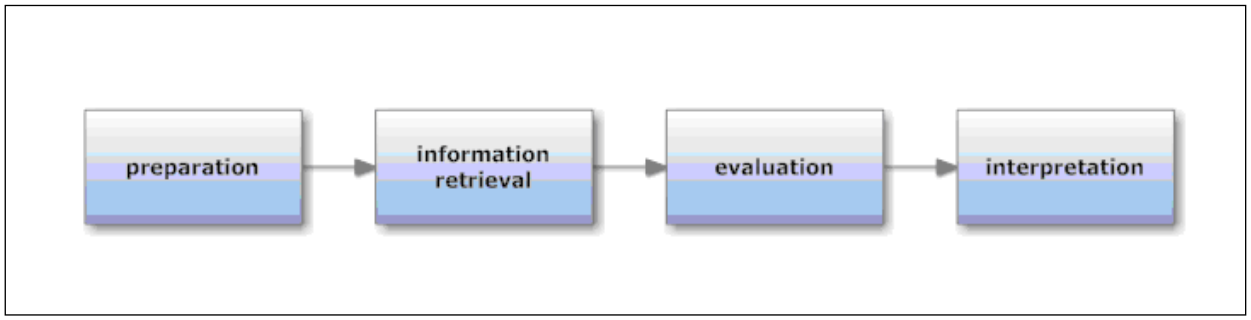

Figure 1: Analysis Steps
Source: own, based on Hungenberg (2006) p.157

The **preparation** consists of the identification and the structuring of the problem statement. A detailed formulation of the problem establishes a better understanding. This includes the problem identification and the problem structuring to better understand the symptoms and possible reasons. Based thereon a target-oriented, well-coordinated work schedule for the analysis shall be conducted.[3]

Information retrieval means to collect the required data to answer the questions defined in the preparation phase. A differentiation between primary and secondary data is made. The processing of existing data is called secondary or desk research. If the data needs concrete investigations, a primary or field research has to be conducted. In the appendix of PORTERs main work "Competitive Strategy" he lists some main routes for the data gathering phase. Useful published sources in respect of the situation in the case study are specified hereafter:[4]

- Industry Studies; Government Sources; Local Newspaper
- Trade Associations; Trade Magazines and Business Press
- Company directories and statistical data; Company documents

[1] Cf. Hungenberg (2006) p.22
[2] Cf. Ibidem p.157
[3] Cf. Ibidem p.155ff
[4] Cf. Porter (1980) p.372ff

Not explicitly listed by Porter are statistics, scientific publications, patent researches and the internet.

Field studies can be conducted as standardised or depth interviews, tests, experiments but also observation. Differing perspectives lead to varying and sometimes even contradictory statements. Therefore verifying data by cross-checking is very important. Possible discussion partners are:[5]

- Consultants; Press staff; Auditors; Standard setting organizations; Market research staff
- Engineering or sales staff of the competitor; former employees of competitors
- Industry conventions; Unions; Local organizations

To make the **evaluation** easier and to structure the information gained in market research HUNGENBERG further divides the strategic analysis in an external and an internal analysis. The external surroundings usually affect all players in the market, the so called macro-environment. The industry sector forms with its customers, competitors and the company the internal environment.[6]

The **interpretation** is a highly subjective process. Gathered information shall be reviewed and judged via the following criteria: relevance; validity; reliability; impartiality and actuality. In practice, some basic problems have been noticed at the performance of this task: [7]

- **Insecurity:** The future is often hard to predict, but only future related information can help to define a strategy.
- **Biased evaluators:** Managers perceive the company environment biased and rarely comprehensive. Facts are valued by experience made in the past and personal appreciations. Information that questions the prevailing opinion often gets ignored.
- **Complexity:** The correlation and the huge amount of facts and events easily lead to lose track of the defined goals.
- **Imperfection:** The information gathered is neither complete, nor is it possible to perfectly interpret the existing data. For example reliable and meaningful information about competitors is very hard to get. Companies are careful about what data they release to not generate economic harm.

Therefore a structured, systematic approach with a preferably heterogeneous analysis team including external consultants is important for good and impartial results.[8]

[5] Cf. Porter (1980) p.377ff
[6] Cf. Hungenberg (2006) p.158
[7] Cf. Ibidem p.155ff
[8] Cf. Ibidem p.157

1.5 REALIZATION

The accomplishment of the case study has been conducted in a chronological order of analysis steps as described in the last chapter. The four stages are detailed hereafter.

1.5.1 PREPARATION

The preparation phase starts with the problem definition. Discussing the topic together with the Project Manager in London and the Product Manager in Graz the following questions came up:

- How does the market situation in London look like?
    - The customer's company structure, his actual fleet, activities and current procurement projects
    - The competition, market share of these companies and strengths/weaknesses
    - The possible market entrants and their strengths and weaknesses
- Is Syntegra the best solution for the London Underground System?
- Which Marketing activities support Siemens/Syntegra to gain market share in London?
- Are there any special business models which should be considered?

1.5.2 INFORMATION RETRIEVAL

To get to know the specific situation in London, the information retrieval phase of the business case has been conducted on the spot. For a first introduction, information about the design study (see chapter 3.3.3) has been provided by Siemens. Additionally a first contact with the customer took place at a get together with maintenance engineers at the underground railway depot in Acton. Afterwards the following sources have been used to gain important information:

Desk Research

Whereas **company homepages** were a good way to get a basic knowledge about what a company does, where it is situated and how it follows their strategies, **annual reports** gave an insight about financial figures and strategic orientation. **Publications** provide details about special products and product platforms but one has to keep in mind that in the railway industry a customer specific design is required most of the time.

Daily **newspapers** were used to get a feeling about the sentiment of the passengers and the public and their opinion about the tube. For instance estimations about the acceptance of the newly introduced Victoria Line and problems with strikes of the tube drivers and their union have been derived from newspaper articles.

Railway specific **monthly or quarterly magazines** announce technical innovations of the competition. Research in print media archives revealed problems accompanying new designs

for London Underground which popped up in the past. For the UK relevant magazines are listed in chapter 4.3.2.

Field Research

A visit of the InnoTrans 2010, the world's biggest **railway fair**, provided a better overview of the market and its different players. It was a good opportunity to meet with different employees from Siemens in Germany as well as suppliers and competitors enabled to further discuss various topics.

Unfortunately, an **official interview** with the customer was not possible due to compliance issues and a competitor's propensity to sue. In an actual UK business case, the intensity of the customer relationship has been questioned and brought to court by the competition. Such a disruption of the further delivery process costs a lot of time and money, for the producer, but also for the buyer. With this in mind, London Underground is very cautious to treat every bidder equally and avoids **unofficial meetings** and agreements. Nevertheless there was always time to chat with people besides workshops and seminar. At least a personal impression could be retrieved.

In 2009 a **UK customer attitude survey** has been conducted by Accelerator Solutions Limited, an external market researcher for Siemens plc. The survey included 79 interviews of railway operators and representatives of the media. 90% have been performed face-to-face. The results are also integrated in the evaluation.

1.5.3 EVALUATION

Facts and Figures give an overview of the business case. Evaluating the market variables detects chances and risks and defines the focus. A description of the environment in chapter four exposes basic restrictions or no-go criteria. Siemens are evaluated to be able to define the strengths and weaknesses. Customer and competition are analysed to detect the opportunities and threats of the specific business case. The findings are weighted in the five forces and summed up in the SWOT analysis at the end of chapter four.

1.5.4 INTERPRETATION

Possible Marketing activities as described in chapter five have been derived from the competitor and customer evaluation. The focus lies in the four elements of the marketing mix: product, price, place and promotion. The business models in chapter five are trends and ideas as theoretically described in chapter 2.3 which have been considered according their applicability. Especially discussions with members of the Siemens staff, but also consultants and competitors have been used to verify the findings and to mitigate the subjectivity of the interpretation.

2 THEORY

This chapter examines the theoretical background to evaluate an industry, with the applicability to the business case kept in mind. The first subchapter takes a closer look at the procedural methods to accomplish a market analysis. The subchapter 2.2 deals with basic marketing strategies; actions and tactics to succeed in a market, finishing with the marketing mix, depicting possible areas to act. The last theory subchapter is about business models; contractual and financing approaches of big public infrastructural investments.

2.1 MARKET ANALYSIS

A strategic market analysis is the first step in the process of defining a market oriented business strategy. The main goal is to generate an information basis for decision alternatives and functional strategies to be able to react dynamically to the market with adapting tactics.[9] Merriam-Webster describes *Market Analysis* as:

> A phase of marketing research conducted to determine the characteristics and extent of a market.[10]

In the following chapter, the tools and techniques to evaluate a market, to be able to define a winning strategy on a business unit level are analysed: the macro environmental analysis and the strategic customer and competitive analysis. As a tool to further evaluate the facts, Porters five competitive forces method is described, followed by the SWOT analysis summing up the results.

2.1.1 THE MACRO-ENVIRONMENT

The macro environment of a business unit influences the company, the customer and the competition more or less equally. It can be subdivided into a political, an economical, a social, a technological, an ecological and a legal environment. The acronym PESTEL uses the initial letters of these influencing factors.[11] Economics literature also uses PEST (without environment and legal) or the extended STEEPLED (adding demographic and education).[12]

CAPON further points out that these influencing factors have three geographic dimensions: a local, a national and a global. The acronym prolongs into LoNGPESTEL.[13] Figure 2 is a graphical depiction of macro environmental factors which influence the customer, the company and the competition more or less equally.

[9] Cf. Hungenberg (2006) p.87
[10] Webster's third new international dictionary (1993)
[11] Cf. Hungenberg (2006) p.90
[12] Cf. Colemean (2009) p.62
[13] Cf. Capon (2004), p.279f

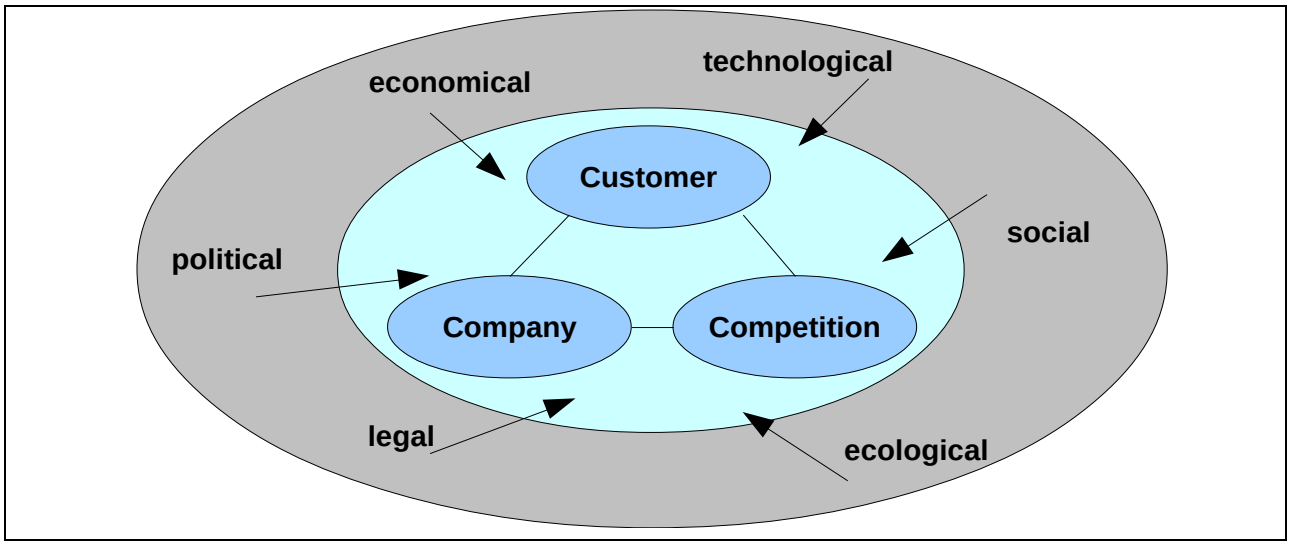

Figure 2: Macro environment of a business area
Source: own, based on Hungenberg (2006) p.90

Rarely influenceable by the company itself, this periphery can bear important odds and risks. A structured analysis of the external environment helps to anticipate threats and opportunities:[14]

P: The **political environment** refers to the stability of a country and to the business liberality of the government. Corruption and political interference in business affairs has to be considered.

E: The **economic environment** pertaining facts have to be separated according national respectively regional significance and a worldwide importance. Determining factors can be the economic growth, interest rates and price increase. The exchange rate has an influence on production costs, depending on the production site. In this context, especially those economic constraints are of interest, which go beyond the borders of the industry sector the business unit is operating in.

S: The **social environment**, people who relate to a company as customer, employee or supplier and especially those who use the product are part of the society. Society is influenced by trends such as ageing of the population and urbanization. The conglomerate of individual values and attitudes, but also religious and cultural principles defines societal requirements in products and company behaviour. In the last years, for instance an increasing importance of unrestricted mobility for the disabled and environmental protection can been noticed.

T: The **technological environment** has influenced the business world especially in the field of communication and information technology. Personal computers, the internet and e-commerce have been used as chances by the winners of this change and have stated risks for those who underestimated the influence on competitiveness. Innovations in processes and production techniques create cost advantages. Therefore it is indispensable to appreciate transformation, to be able to assess it according possible consequences to the business unit.

[14] Cf. Hungenberg (2006) p.93ff

E: The **ecological environment** determines the natural surroundings such as the geological situation of a company and the consequential access to resources which are important for the production process. But also questions about pollution and preventive environmental protection have to be posed at this point.

L: The **legal environment** restricts the room for manoeuvre in the form of standards, taxation rules and manufacturer's liability. Intensity and duration of the approval process can influence market prospects. Anti-discrimination laws, minimum wages, requested recycling rates can also affect possibilities and costs of a company. Besides the national law, supranational institutions such as the European Union increase legal complexity.

An analysis of the industry sector environment enables to evaluate its attractiveness, to identify influencing factors and driving forces of future developments. The formulation of a powerful strategy however needs a thorough assessment of the customer to consider special requirements and of the competitors to take their scope of action into account.[15]

The Strategic Triangle: The achievement and perpetuation of competitive advantages is one of the major nonmonetary subordinate goals a business unit has to have on its agenda. Offering a special price to performance ratio to the customer in relation to what the competition has to offer defines the competitive advantage. The strategic triangle: customer, company and competition, embeds the efforts to achieve this goal in a framework. This interrelationship is depicted in Figure 3.[16]

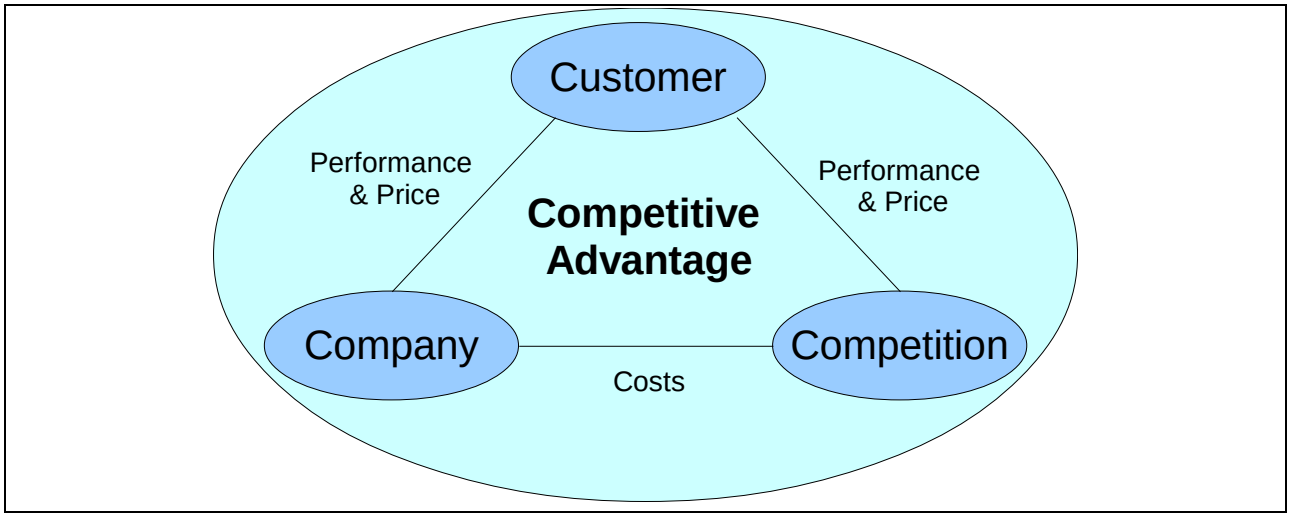

Figure 3: The Strategic Triangle
Source: own, based on Hungenberg (2006) p.185

An analysis of these main players and their relation to each other is the fundament for the strategic alignment. Therefore this task is described more in detail.

[15] Cf. Hungenberg (2006) p.98
[16] Cf. Ibidem p.185

2.1.2 THE COMPANY

The internal strengths and weaknesses have to be discussed in this analysis. The financial situation gives a quantitative picture of the competitive performance. This first indication has to be expanded by the definition of the core competences as well as resources and skills. These qualitative aspects get to the core and round up the picture of the company's situation.[17]

2.1.3 THE CUSTOMER

Precondition for a market success is the correct estimation of the customer requirements. Marketing efforts have to strongly fit to the market where the company is situated in. It is established to differ between consumers as costumers where the sub-discipline of the business to customer (B2C) marketing concentrates on and other companies as customers with the so called business to business (B2B) marketing as supporting branch. Even if the marketing activities are similar for each type, the execution and configuration of the marketing strategy differs.[18]

KOTLER and KELLER state about the business market:[19]

> The business market consists of all the organizations that acquire goods and services used in the production of other products or services that are sold, rented, or supplied to others […] Business marketers face many of the same challenges as consumer marketers. In particular, understanding their customers and what they value is paramount for both.

They highlight the following attributes for the B2B market:[20]

- **Fewer, larger buyers:** Companies in the role of the customer tend to buy bigger scales but there are a smaller number of buyers to approach
- **Close supplier-customer relationship:** Suppliers are expected to customize their offerings to individual business customer needs.
- **Professional purchasing:** Specially trained purchasing agents require special buying instruments e.g.: requests for quotations, proposals, and purchase contracts are not typical for consumer products.
- **Multiple buying influences:** More people influence a business buying decision, usually committees consisting of technical experts and even senior management
- **Multiple sales calls:** Many attempts are needed to fund a project and the sales cycle is often measured in years.

[17] Cf. Hungenberg (2006) p.134f
[18] Cf. Kotler, Keller (2009) p.221
[19] Ibidem p.222
[20] Ibidem p.222ff

- **Derived demand:** Ultimate dependency on demand for consumer goods. Therefore the business market must closely monitor the buying patterns of the ultimate consumer.

- **Inelastic demand:** The total demand is not much affected by price changes due to the inflexibility to make quick changes in the production methods and also if the business good represents a small percentage of the item's total cost.

- **Fluctuating demand:** The demand for business goods and services tends to be more volatile especially as a reaction to changes in the consumer demand which economists refer to as the *acceleration effect*.

- **Geographically concentrated buyers:** Regional areas of certain industries e.g. resource mining.

- **Direct purchasing:** Especially technically complex or expensive items are bought directly from the Manufacturer.

Within the industry sector, there are usually numerous customer groups with differing demands. To be able to address similar customers with the same marketing instrument, segmentation is adjuvant. Basis for **customer segmentation** is a list of criteria. For the buying decision important criteria shall definitely be:[21]

- Measureable: This is especially the case for from the customer observable characteristics.

- Substantial: The segment has to be large enough to pay off.

- Accessible: The segment has to be reachable; because there are restricted or closed markets.

- Differentiable: The distinction mirrors the differing reaction to well-directed marketing efforts.

- Actionable: It has to be possible to directly address marketing efforts to the specific segment.

Based on this classification, the attractiveness of the different segments can be diagnosed more easily. The specific customer group chosen, the so called target market is further described with an estimation of the market volume. The market potential is evaluated based on the market growth rate and a forecast of market trends. Important individual customers are evaluated according a possible sales volume and sales potential. The customer's strategy and strengths and weaknesses offer valuable clues about needed proposals to improve performance.[22]

[21] Cf. Kotler, Keller (2009) p.268
[22] Cf. Ibidem p.269

The Buying Centre

WEBSTER and WIND point out that if a company sells to an organization, the marketer should not only consider the members of the purchasing department but the whole *buying centre*, defined as:[23]

> All those individuals and groups who participate in the purchasing decision making process, who share some common goals and the risks arising from the decisions.

In these buying centres different people play different roles. One person can have numerous characters simultaneously. KOTLER and KELLER identified seven roles:[24]

1) **Initiators:** Users or others in the organization who request that something be purchased.

2) **Users:** Those who will use the product or service. In many cases, the users initiate the buying proposal and help define the product requirement.

3) **Influencers:** People who influence the buying decision, often by helping define specifications and providing information for evaluating alternatives. Technical personnel are particularly important influencers.

4) **Deciders:** People who decide on product requirements or on suppliers.

5) **Approvers:** People who authorize the proposed actions of deciders or buyers.

6) **Buyers:** People who have formal authority to select the supplier and arrange the purchase terms. Buyers may help shape product specifications, but they play their major role in selecting vendors and negotiating. In more complex purchases, buyers might include high-level managers

7) **Gatekeepers:** People who have the power to prevent sellers or information from reaching members of the buying centre. For example, purchasing agents, receptionists, and telephone operators may prevent salespersons from contacting users or deciders.

It has to be kept in mind, that even in a B2B market, numerous individuals with differing interests and a personal buying style not organizations make purchasing decisions.[25]

2.1.4 THE COMPETITION

At first the type and number of competitors as well as their market share has to be determined. An analysis of the competitors' style and marketing strategies as well as their products; technological features and special programs are important to evaluate the threat emanating from them. The estimation of the current situation of relevant competitors; the strategic objectives and

[23] Webster, Wind (1972) p.6
[24] Kotler, Keller (2009) p.228f
[25] Cf. Ibidem

the success of these strategies help to forecast a competitor's future focus. But also the competitor's investments and recently gained orders, his risk appetite and his innovative strength offer valuable clues to forecast his behaviour.[26]

MCLOUGHLIN and AAKER list amongst others, the following questions about the competitors:[27]

- What are their objectives and strategies?
- Their level of commitment? Their exit barriers?
- What is their cost structure?
- Do they have cost advantages or disadvantages?
- What is their image and positioning strategy?
- What are the strengths and weaknesses of each competitor?

2.1.5 Porter's Five Competitive Forces Model

Whereas an analysis of the macro environment deals with factors which influence all companies in more or less the same way, a holistic industry sector analysis assesses competitive constraints having an impact on the specific field where a business unit operates. One of the best known models for a systematic evaluation stems from Michael Porter called the concept of the "five competitive forces".[28]

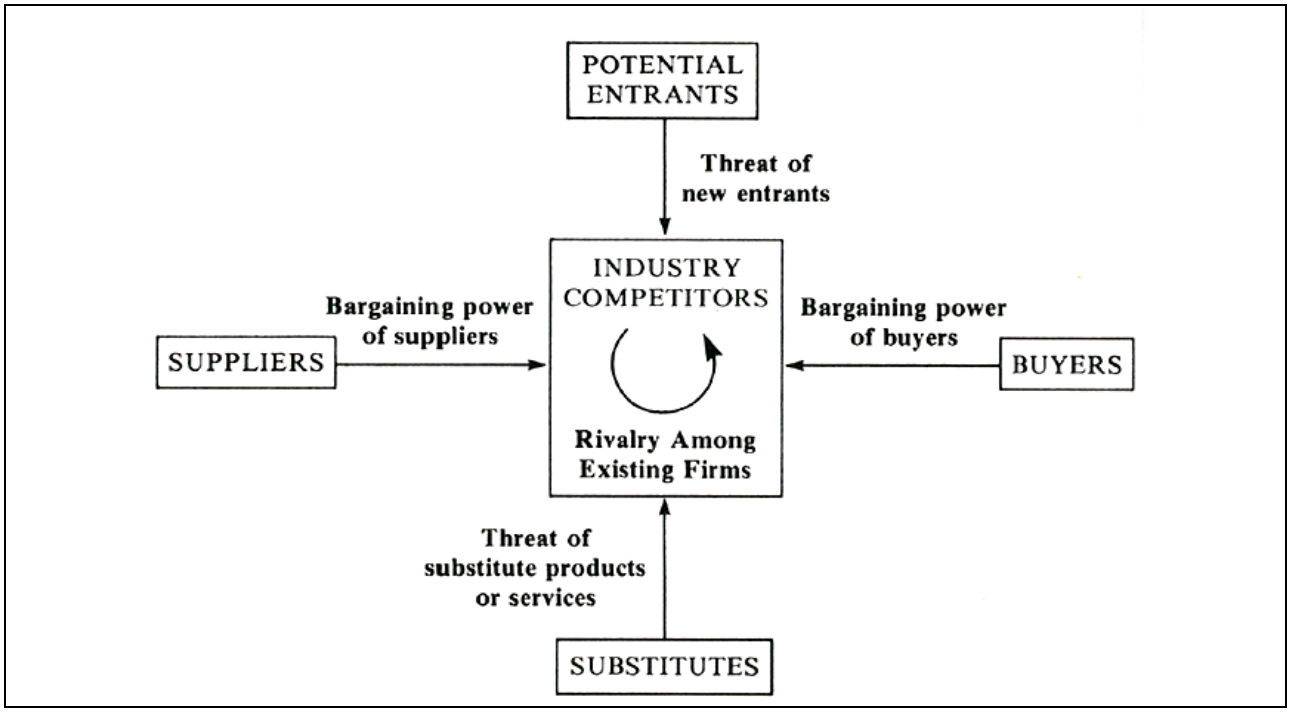

Figure 4: Forces Driving Industry Competition
Source: Porter (1980) p.4

[26] Cf. Kotler, Keller (2009) p.130ff
[27] McLoughlin, Aaker (2010) p.42
[28] Cf. Porter (1980) p.3

According to PORTER a competitive advantage can be reached by formulating a competitive strategy considering the company's relation to the other players in the industry. A structural analysis of the industry sector from an inside view enables the management to identify the potential strategies.[29]

Disregarding the outside forces which affect all industry players, Porter names five basic competitive forces as depicted in Figure 4, that together build up the market structure. A profit potential and market attractiveness can be derived from an estimation of the collective strength of these forces, which are detailed hereafter. [30]

Threat of new Entrants - Possible Market Intruders

Potential competition significantly influences the market attractiveness. There is the threat of an escalating fight for market share and a price deterioration tendency. The profitability for the previous vendors declines. The threat of new entrants is delimited by six major entry barriers:[31]

- Economies of scale refer to diminishing unit costs of a product due to a better use of resources in nearly every function of a business with bigger lots. Also pertaining to the benefit of shared operations in a multi-business firm. Applicability of one sub-product for several other end-products; additionally joint costs or intangible assets such as shared brand names and know-how can lead to cost advantage.

- Product differentiation of the incumbent can be an entry barrier for new entrants. Brand identification with the established product and customer loyalties lead to start-up losses from higher promotional costs.

- Capital Requirements. Large venture capital to invest before a purchase is generated or the need for customer credit can pose a barrier for new entrants.

- Switching costs for the buyer like employee trainings, the acquisition of new service facilities or long-run tests require a huge improvement of the substituting product to persuade a user to change the provider.

- Limited access to distribution channels, the lack of local sales facilities and references

- Cost disadvantages independent of scale

Threat of substitute Products

Substitute products have the potential to satisfy the same or similar customer needs as the products of the well-defined industry sector. Usually the product focuses on a different customer-segment or on another region. These products can become an important competitive

[29] Cf. Porter (1980) p.3ff
[30] Cf. Ibidem p.4
[31] Cf. Ibidem p.7ff

force if the cost/performance ratio convinces clients to switch to the other option, given that the conversion costs are not too high.[32]

Bargaining Power of Suppliers

High prices or minor quality can be the result of a high market power of the suppliers. This can lead to an inferior quality of the end product or unsatisfactory cost efficiency. Subcontractors are in a relatively good position if they have a unique product or created a high differentiation feature by branding. On the other hand a weak bargaining circumstance is the case, if the preliminary product can easily be produced by the buyer, who can threaten the vendor with a so called backward integration. Of course, a bigger number of providers in combination with low change costs decimate the suppliers' position. [33]

Bargaining Power of Buyers

Vice versa to the suppliers, the customers have a high potency if a concentration of providers allows them to request a high quality and better service at lower prices. In this case, the profitability is not deemed to satisfy the supplying companies any longer. Another important point is the quantity of takers and their relative force due to a capacious absorption volume. The ability for a backward integration has to be checked for the customers as well.[34]

Rivalry within the Industry

Rivalry between the companies already acting in an industry sector can be based on a price competition with alternating attempts to underprice or/and a performance competition focusing on a better product quality and auxiliary service. If the market growth is slow-going the intensity of the competition increases, on the other hand product differentiation abates the price war. Exit barriers have to be considered as well. If a company has made high investments in the sector or hopes for synergy effects, though taking losses by future profitable contracts which overcompensate these deficits.[35]

[32] Cf. Porter (1980) p.7ff
[33] Cf. Ibidem p.23f
[34] Cf. Ibidem p.24ff
[35] Cf. Ibidem p.17ff

2.1.6 SWOT ANALYSIS

The SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis can be seen as a framework for an internal and external analysis. The results of the macro environmental analysis and the industry sector analysis are clustered as external opportunities and threats. The internal analysis of the company in relation to the competitor's offer is concentrated as internal strengths and weaknesses.[36] Figure 5 depicts the information flow consolidating in the SWOT Analysis.

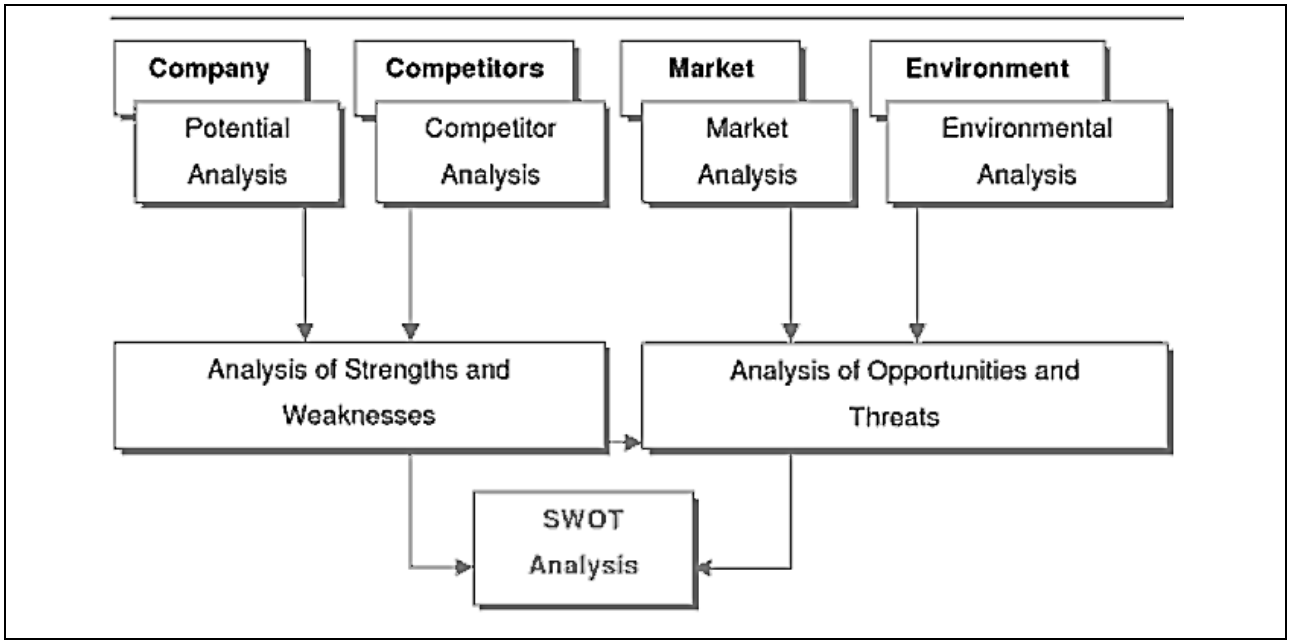

Figure 5: System of Strategic Analysis
Source: Böhm (2008) p.2

[36] Cf. Hungenberg (2006) p.88

2.2 MARKETING STRATEGIES

After a general definition of Marketing, this chapter describes the generic strategies, followed by McCarthy's Marketing mix.

2.2.1 IN GENERAL

Although the general perception of Marketing is advertisements and sales, science found a much broader understanding. There exist a lot of definitions of Marketing such as the social process approach of Philip Kotler:[37]

> Marketing is a societal process by which individuals and groups obtain what they need and want through creating, offering and freely exchanging products and services of value with others.

And a more holistic one by Peter Drucker:[38]

> Marketing is not only much broader than selling, it is not a specialized activity at all It encompasses the entire business. It is the whole business seen from the point of view of the final result, that is, from the customer's point of view. Concern and responsibility for marketing must therefore permeate all areas of the enterprise.

And later:[39]

> The aim of Marketing is to make selling superfluous […] to know and understand the customer so well that the product or service fits him and sells itself.

The Chartered Institute of Marketing (CIM) combined the various statements to the following:[40]

> Marketing is the management process that identifies, anticipates and satisfies customer requirements profitably.

Strategy stems from the Greek "strategos", in the Oxford English dictionary it is defined as:[41]

> The art of a commander-in-chief; the art of projecting and directing the larger military movements and operations of a campaign. Usually distinguished from tactics, which is the art of handling forces in a battle or in the immediate presence of the enemy.

[37] Kotler, Keller (2009) p.45
[38] Drucker (1954) p.35f
[39] Drucker (1973) p.64
[40] The Chartered Institute of Marketing Online (05.01.2011)
[41] The Oxford English Dictionary (1978)

In the game theory, strategy stands for the planning of actions in dependence of possible future activities of the other players and own alternatives. A strategy describes the way which shall lead to a special goal.[42]

According to HUNGENBERG objects of the strategic management are to give direction by defining long-term business targets such as the increase of the shareholder value, to determine the aspiration of a specific market position and to make decisions to manage structures and systems to coordinate the actions in the interest of the defined goals. Generally the goals of a business unit in a multi-business company have to be reconciled with the corporate goals. On a higher level, the interest of the management lays in the increase of the corporate value. Business units formulate a competitive strategy considering all the influence factors of the market to be able to succeed in the industrial sector they are acting in. This goal can be reached by a mix of actions conducted by the different departments. A marketing strategy is the link between the goals and the actions.[43]

2.2.2 GENERIC STRATEGIES

PORTER on the other hand, focuses on three principle orientations to generate competitive advantages. As idealized strategy types, the generic strategies merge fundamental objectives to more general alignments and ignore various single aspects:[44]

1. Focus
2. Cost/price-leadership
3. Differentiation

2.2.2.1 Focus

The focus strategy may take many forms; a company can focus on a specific customer segment or a geographic market. The narrow strategic target results in more efficiency and effectiveness. Further it enables to better meet the customer's needs or to be able to offer a better price.[45]

2.2.2.2 Cost Leadership

An overall cost/price-leadership strategy is followed by companies whose product rarely differs from the competition. The price is the predominant customer benefit. This better price can only be achieved if the company also has the cost leadership through most efficient processes. It can be achieved with a structural cost advantage or an efficient cost management. Structural cost advantages stem from the economies of scale or scope and the realization of a learning curve:[46]

[42] Cf. Dixit, Nalebuff (2010) p.22
[43] Cf. Hungenberg (2006) p.64ff
[44] Cf. Porter (1980) p.35ff
[45] Cf. Ibidem p.38f
[46] Cf. Ibidem p.99ff

- **Economies of scale** are based on the size of a company. Fixed costs decrease with the sales output. The acquisition of assets for a higher automation becomes lucrative.

- **Economies of scope** refer to regional or product-oriented network effects. Non-recurring costs like basic research, contract formulation, instructions, installation of a sales network and generally a better use of capacity for example of marketing efforts may further reduce costs.

- **The learning curve** describes the correlation between the production output and the costs per unit. The Boston Consulting group found out, that each doubling of the output of a standard product the unit costs drop by 20 to 30 per cent.

Objectives of **cost management** are to influence costs at an early stage of development. Potential programs are cost transparency methods like:[47]

- Cost Benchmarking
- Strategic Cost Analysis based on the Value Chain
- Total Cost of Ownership
- Lifecycle Costing
- Target Costing

Possible risks of an overall cost leadership strategy can be:[48]

- **Diseconomies of scale** often appear due to complex management structures because bigger companies ask for a higher planning and steering effort and the threat of losing overview.

- On grounds of the dynamical behaviour of the market actors, one-time reached cost advantages can quickly be alleviated by the competition through **imitation or innovation**. Therefore cost leadership has to be a continuous strategic focus.

- Even if cost drivers can be identified by an analysis and subsequently be reduced, it is absolutely necessary to consider **interdependencies** which result in overcompensating costs in other areas.

- There is also the risk of customers turning away due to negative effects of the cost savings on the quality of the product, if **minimum standards** are not fulfilled any longer.

[47] Cf. Porter (1980) p.210ff
[48] Cf. Ibidem p.45f

2.2.2.3 Differentiation

The differentiation strategy focuses on a subjectively better performance with higher customer benefit. Factors like technical properties, a good service and brand-image convince the customer to pay a higher price, the so called price bonus. These factors have to be a unique selling proposition.[49]

To enhance the value of a business unit, a company has to establish prices on the market which exceed the costs. It is not enough to perform absolutely well, a company also has to meet a customer's needs on a relatively higher level than the competitors. These product and service characteristics have to:[50]

- Be perceived by the customer as subjectively better
- Be important for the customer
- Be long-lasting – the competition is not able to close the gap without major efforts

A basic requirement is that the combination of product and performance of a company has to satisfy the customers' needs. The benefit a customer has with the offer is distinguishable into a basic and an additional value. The basic benefit fulfils elementary requirements of a product to be a suitable alternative for the purchaser. From a specific level, additional performance cannot further increase the customer satisfaction. The additional value accrues if the product or service performs extras which the customer does not take for granted. In opposition to the basic benefits, additional values can increase the overall customer satisfaction. The capability of a company to generate a competitive advantage depends on its environment, resources, skills and competences. The customers' perspective is the crucial source to find through purchase appreciated attributes.[51]

Therefore, differentiation can only be reached with reflection of the customer and the competition. There are tangible and intangible sources for variation. Tangible would be an improvement of the product properties, whereas intangible or felt amendments usually come from branding as communicated image or status. It is often much harder to imitate intangible differentiation characteristics, what makes them more promising to be sustainable. Some of the numerous distinguishing features are quality; time; brand and customer relationship and are described in detail hereafter:[52]

Higher **quality** typically increases the costs, but also the customer satisfaction and loyalty, attributes where a company can vary from the competition are:[53]

[49] Cf. Hungenberg (2006) p.185
[50] Cf. Hungenberg (2006) p.185f
[51] Cf. Ibidem p.186
[52] Cf. Ibidem p.193ff
[53] Cf. Ibidem p.194f

- Functionality: refers to the usability of a product
- Stability: the technical or economic life time of a product, but also how strong it is subject to trends or changed preferences
- Reliability: describes the probability of permanent functionality of a product without problems due to malfunction. The importance of the reliability strongly depends on the criticality of a drop out.
- Aesthetics: clearly subjective features like styling and design of the product or the packaging

These quality features can only be guaranteed with a good quality management. Quality as management principle, with methods like Total Quality Management (TQM) and Six Sigma revolutionised the standards. Nowadays it is very hard to set apart from the competition in terms of product quality.[54]

Time can be a distinguishing feature as well. The order processing time and delivery concepts like Just-in-time (JIT) have become more and more important. But also in the product development phase time is money. In fact, companies can either act as innovators, to be the first pioneers on the market, or as imitators who are early or late followers. In this context timing is sometimes more important than speed.[55]

Branding has a solely subjective value. The consumer benefits from a brand either by a reduced insecurity about the quality or by an emotional experience:[56]

- Quality trust into a brand forms by personal perception or through word of mouth recommendation of another customer. Behind this stands a specific investment of the company in the setup of the trademark.
- The emotional connection of a brand with positive values and specific attitudes is the second form of branding. The customer feels a social affiliation to a likeminded group with the purchase of a product. Some companies even created communities where users of their products can meet.

Branding is especially important for homogenous products or insufficiently informed customers. It is instrumental in emphasizing special product properties such as an environmental friendly design. A practical example for this is the way car manufacturers promote their new low carbon designs with brands like the “ecomotive” line of Seat or Hyundai “blue drive”. A consistent appearance of the name, signs and packaging, an appropriate distribution and price policy and

[54] Cf. Hungenberg (2006) p.226f
[55] Cf. Ibidem p.230
[56] Cf. Ibidem p.232f

most important the corresponding communication of the brand message in a distinctive way are indispensible.[57]

Stable and sustainable **customer relationships** are another promising approach for differentiation. Precondition is that the customer receives an increased benefit from such a special relationship. Customer advantages are lower costs for the evaluation of alternatives and the testing of the promised quality. He expects a custom-fit, individual solution which suppliers lacking experience have not the ability to deliver. Transaction costs drop due to established communication channels, known contact persons and a trusting cooperation. Extremely strong customer-supplier-relationships are characterized by uncomplicated information exchange, conjoint decisions and especially shared success. Loyal customers deliver additional value as multiplier by recommendation or if there is the chance for “cross-selling” or “up-selling”, if other goods can be offered to them. A strong individuality at the sales pitch, but also additional activities such as customer loyalty programs are crucial. Information about activities and characteristics can be administrated in special Customer Relationship Management (CRM) Systems.[58]

Possible risks of a differentiation strategy are:[59]

- **Brand damage** can significantly harm the whole company.
- Loyal customers are sometimes more **price sensitive** and it is not said, that they really recommend the product to others.

If followed consequently, the strategies promise to deliver higher revenues. For example with a bigger gross profit margin due to a leading performance, or with higher sales figures based on the price head start.[60]

PORTER recommends to clearly deciding for one of the strategies based on two assumptions: the consistency and the convexity assumption. The first one presumes that a differentiation strategy generates costs and is therefore hard to match with the cost leadership. The second one is the corollary of this discrepancy and predicts the company to be **stuck in the middle** in case of an insufficient alignment. It is called convexity assumption due to the u-shaped correlation between return on investment (ROI) and market share, as depicted in Figure 6.[61]

[57] Cf. Ibidem p.236
[58] Cf. Hungenberg (2006) p.244
[59] Cf. Porter (1980) p.46
[60] Cf. Ibidem p.41ff
[61] Cf. Ibidem p.43f

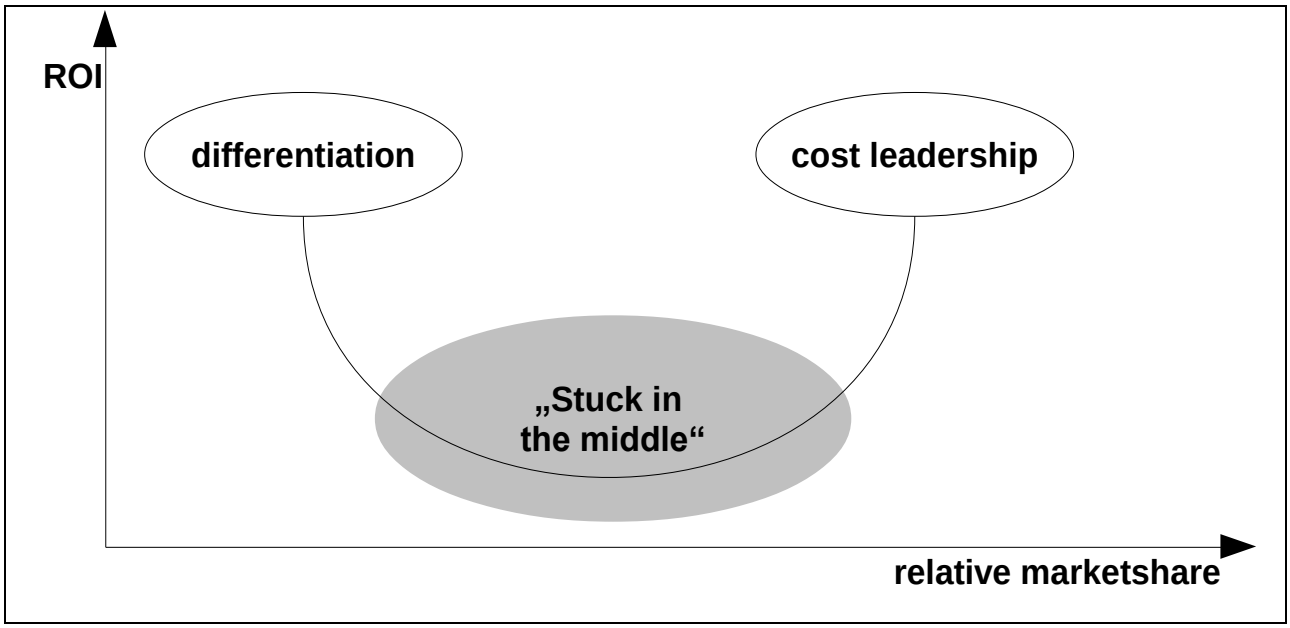

Figure 6: Correlation between return on investment and market share
Source: Porter (1980) p.43

This strict perspective is controversial and empiric strategy research led to the development of hybrid competitive strategies. The **outpacing strategy** is such a hybrid of an extraordinary performance combined with a relatively low pricing. To avoid the problems depicted by PORTER a sequential way to realize an outpacing position is important. Emanating from one of the generic strategies the other advantage is followed after a while, usually with a reinvestment of the profit already made with the previously pursued approach.[62]

One example for a natural development of a sequential outpacing strategy are innovators who are threatened by imitators. In such a case the innovator can only sustain the market position with cost reductions. A direct market entrance with an outpacing strategy is extremely difficult. The company has to compete with the particular leaders following the generic approach. A convincing innovation combined with cost-efficient production and sales methods is most auspicious. Due to the fact that both generic strategies have conflicting elements, the outpacing strategy bears a high risk.[63]

GILLIGAN and WILSON point out:[64]

> Although Porter presents competitive strategies in this way, many companies succeed not by a blind adherence to any one approach, but rather by a combination of ideas [...] the identification, development and maintenance of a long term competitive advantage, and hence a strong selling proposition, is the very heart of an effective marketing strategy.

[62] Cf. Hungenberg (2006) p.193ff
[63] Cf. Ibidem p.194f
[64] Gilligan, Wilson (2009) p.412

2.2.3 THE MARKETING MIX

A well-defined marketing strategy pursuing the corporate goals is the fundament for the on-going operational measures. McCARTHY classified 1960 **the four P's** as marketing mix activities: Product, Price, Place and Promotion.[65]

GILLIGAN and WILSON point out that the marketing mix can be seen as the tactical details of the organization's positioning strategy.[66] Hereafter the four P's are described in detail.

2.2.3.1 Product

A product is anything that is capable of satisfying customer needs.[67]

The product policy decides on the layout of the product mix. It accompanies in the narrower sense the payment in. The extended understanding of a product includes related services. Product policy includes tasks such as:[68]

- Product innovation
- Product variation and improvement
- Product differentiation
- Product elimination
- Naming and Packaging
- Product assortment

Product strategy includes the determination of quality; design; and packaging. Ansoff presents a framework for four growth strategies: market penetration, product development, market development and diversification. Market penetration can be achieved especially by branding to make existing customers more loyal and to increase the frequency or quantity of use of the product. New product development for existing markets with the objective to offer extra benefits and features to the customers is another strategy to increase sales and market share. New market segments or different countries are addressed with the market development strategy. The last and for sure riskiest option is the diversification, commercializing new products on new markets. [69] Figure 7 shows these four strategies embedded in Ansoff's framework.

[65] Cf. Kotler, Keller (2009) p.62f
[66] Cf. Gilligan, Wilson (2009) p.373f
[67] Jobber (1998) p.32
[68] Cf. Bruhn (2007) p.28f
[69] Cf. Jobber (1998) p.32f

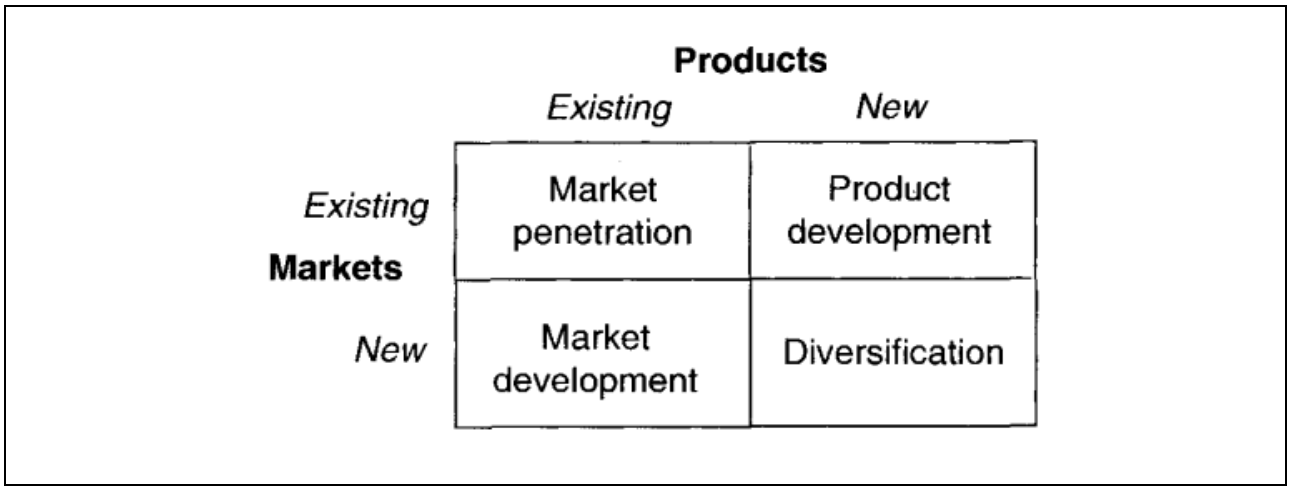

Figure 7: Product growth strategies: the Ansoff matrix
Source: Jobber (1998) p.33

In the context of the business case especially the case of a new product development is of interest. WILSON and GILLIGAN discuss the importance for organizations following a proactive new product strategy, to meet the following criteria:[70]

- A fundamental and sustained commitment to new product development, and willingness to accept the associated costs and risks
- An ability to protect the new product
- An a ability to target high-volume or high-margin markets
- The availability of the financial, staff and time resources needed, as well a s a willingness to commit them
- A degree of flexibility so that the strategy can be modified to reflect changing environmental conditions
- Top management commitment

2.2.3.2 Price

The price policy defines conditions of purchase offers to the customers including the price, incentives, discounts, bonuses, cash discounts and delivery and payment agreements.[71]

2.2.3.3 Place

The place defines the distribution policy and furthermore the availability of the product for the customer in terms of time and area. The sales representatives and the retailers usually

[70] Wilson, Gilligan (2005) p.514
[71] Cf. Bruhn (2007) p.29

represent the distribution policy in personal. Decisions have to be made on: distribution channels, locations, inventory, delivery, transport and logistics.[72]

2.2.3.4 Promotion

A better word for the last P is communication policy, including measures for the communication between a company and its actual and potential customers, employees and stakeholders. Established means are:[73]

- Advertising (paid for) e.g.: commercials on radio, internet, in print media, product placement, etc.
- Sales Promotion, Merchandising, Direct Marketing
- Public Relations
- Personal Communication e.g.: fairs, exhibitions,
- Internal Communications; Multimedia Communication
- Sponsoring

The use of social media to support a company's interests is examined because of the current boom of this possibility.

Networking

Networking is a strategic and systematic approach to socialize with friends, acquaintances, business partners and patrons.[74]

Kane et al. state that with the actual trend of social media, global networking wins a new dimension. On the one side, the internetworking pushes the propagation of opinions and shortens the reaction time for activities conducted by pressure groups. Mobile applications keep interested users posted about new developments and activities within seconds. On the other side, web 2.0 increases the possibilities for so called community outreach and the chance for positive and cooperative public relationships. With this comes a big demand on new skills, adaptive tactics and strategies to cope with the challenges this medium bears. Weblogs, Wikis, online petitions, RSS feeds, social networks and similar offers are the virtual place for communication and knowledge exchange. The various online-groups differ in their behaviour, the full range from friendly and cooperative to aggressive and hostile demands cultural empathy to find the correct approach. People trust in the information provided by the internet. The web 2.0 especially enables good relationships; fast organisation; the origination and connection of

[72] Cf. Ibidem
[73] Cf. Ibidem
[74] Cf. Scheler (2000) p.18

knowledge; and the access to information. Especially if purchasing new products, buyers more and more seek information on the internet.[75]

The essential task is to combine the possible marketing activities to achieve a specific positioning in the market. The marketing mix lists the variables which can be actively influenced to be successful with a product.[76].

2.2.4 ATTACKING THE LEADER

The situation in the case study invites to profoundly contemplate about the situation of challenging the market leader from the intruders' perspective. To come to the point, attacking an industry leader, who is established in the market is quite risky. PORTER names reputation, economies of scale, cumulative learning and a preferred access to suppliers or channels as some of the many advantages an incumbent has. One has to nullify the leader's competitive advantages. Therefore a thorough knowledge of the market structures and environmental conditions is essential to identify signals for vulnerability.[77]

An imitation of the leader is not recommended because of his longer staying power. PORTER identified three basic conditions for a successful attack:[78]

- A sustainable competitive advantage
- Proximity in other activities
- Some impediment to leader retaliation

Ways to attack a leader can be found along the value chain by:[79]

- Reconfiguration and innovation in the way things are done
- Redefinition of the competitive scope such as focus, narrowing or widening the range performed by one company
- Pure Spending
- Strategic Alliances

[75] Cf. Harvard Business Manager, (3/2010) p.96ff
[76] Cf. Matys (2005) p.181f
[77] Cf. Porter (2004) p.513ff
[78] Cf. Ibidem p.515
[79] Cf. Porter (2004) p.517ff

2.3 BUSINESS MODELS

Another approach to succeed in a market is not only to set up marketing strategies, but to change the whole business model. The questions what a business model is and which possibilities exist are content of this chapter. In alignment with the business case three specific business models are described hereafter: Downstream Business, Performance Contracting and Alliances.

2.3.1 BUSINESS MODELS IN GENERAL

The term business model is hardly used homogenously. Recently it was especially associated with e-commerce models. TIMMERS defines business models as:[80]

> An architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various business actors; and a description of the sources of revenues.

Backhaus et al. see three dimensions of business models with the value proposition for the customer and partners as a core issue contributing to the competitive advantage. As a second dimension the model of generating revenue describes the different ways to gain profit e.g. with provisions or revenues from advertisements. The architecture as the third dimension mainly focuses on the design of the value chain and defines with the variables of the product, performance and information how to achieve the proposed values. [81]

However one has to point out that a business model is not a strategy. It is only the description of what a business offers and how it generates these values with partners, suppliers and customers. The strategy on the other hand describes how to be able to compete with this business model.[82]

Business model innovation describes the complete redesign or introduction of a new business model to distinguish from the competition. Examples for a successful business model innovation are: Apple's combined market launch of the profitable iPod with the low profit margin iTunes to create a new overall benefit for the customers, the track record of no-frills airlines in the US and Europe, and discounters like Wal-Mart.[83]

2.3.2 DOWNSTREAM BUSINESS

The industrial goods manufacturing companies are currently expanding their offering to provide additional services. The combination of stagnant product demand and an increasing complexity

[80] Timmers (1999) p.32
[81] Cf. Kleikamp (2002) p.14f
[82] Cf. Davenport et al. (2006) p.182
[83] Cf. Clayton et al. (03/2009)

of the products combined with a lack of know-how on the customer side have pushed the manufacturers' economic value downstream.[84]

WISE and BAUMGARTNER state that the traditional value-chain role of manufacturers – producing and selling - becomes less and less attractive and goes toward providing services required to operate and maintain products. This also reflects in the changing gross domestic product, where in the last decades, the percentage of services has risen compared to a diminishing manufacturing share. To realize this concept, they list four basis downstream business models:[85]

1. **Embedded services:** Sophisticated customer orientation with smart products. This can be realized by saving labour costs on the customer's side by offering motivated and better qualified personnel or by creating software links the product in an efficient way to the rest of the customer's organization.

2. **Comprehensive services:** Enlarging the offer through the corporate strength of a company by adding financial services or additional auxiliaries needed. General Electrics offered financing for the acquisition of their locomotives besides financing additional assets needed for the operation of their product such as freight wagons or maintenance vehicles.

3. **Integrated solutions:** Meeting the customer's needs with a support function, like Nokia offering to help smaller phone companies to develop their networks and provided know how for the provision of products and services to the end customers.

4. **Distribution control:** This model does not offer new services for the customer, but enters the customer's business, creating an own distribution channel, like Dell did with the internet shop.

To analyse the attractiveness for this business models a company should look at the customer's usage costs over the product life cycle, relative to the product's price. Another indicator for a high down streaming potential gives the installed-base-to-new-unit ratio. It compares the recent sales with the units in service. As an example the automobile industry has a ratio of 13 to 1, locomotives 22 to 1 and aircrafts 150 to 1.[86]

Advantages of going downstream are: [87]

- It is a focus on identifying and exploiting new channels

- A big benefit of this trend is a higher margin in continuous revenues combined with fewer assets needed.

[84] Cf. Kleikamp (2002) p.1ff
[85] Wise, Baumgartner in Harvard Business Review (9-10/1999) p.134
[86] Ibidem p.135ff
[87] Ibidem p.139

- It gives insight into the customer's needs, which enables to further refine products and services.

- It is a chance for the establishment of customer allegiance with strong bonds. The technical differences between the offers of major manufacturers are often small and easily bridged. To go down stream means a possibility to gain strong relationships with fewer, but profitable and loyal customers.

This development not only enables a diversification[88] of offers, but also delivers possibilities to achieve a competitive advantage through differentiation independent from the product itself. With smart services a company also has the possibility to set new standards in the industry. New skills and people are needed to realize the shift in strategic alignment. After the implementation, it is important to find new ways to measure a company's performance. Absolute sales figures such as market share are not so significant any more.[89]

2.3.3 PERFORMANCE CONTRACTING

The business model "performance contracting" offers the customer not only products and services but entire turnkey solutions. Performance contracting is a combination of a contract and a financing model. Whereas the normal approach would be to supply the good and receive the payment upon acceptance, performance contracting changes this standard. The characteristics of performance contracting imply, that winning the contract not only triggers a transaction, but also the start for a long term business relationship.[90]

The manufacturer sells not the product itself, but the performance of the product as a benefit. The producers offer is usually enhanced by the maintenance and service of the assets. The revenues are continuous usage fees. Over the years, various versions of this model have evolved e.g.:[91]

- Provision of the asset in a leasing style and guaranteeing the availability of the performance: the producer has the risk of unpredictable costs and the residual value risks
- Provision and operation of the assets. The customer buys the performance outcomes. This includes further risks for the manufacturer.

In principle, performance contracting is especially applicable for products with a derivate benefit and a small life cycle cost proportion of the acquisition costs. This means relatively low CAPEX compared to the OPEX.[92]

CAPEX is the abbreviation for Capital Expenditure, meaning long-term investments for industrial goods, e.g.: machines, buildings, initial equipment, spare parts, IT etc. It is a key figure in the

[88] As described in chapter 2.2.3.1
[89] Cf. Wise, Baumgartner in Harvard Business Review (9-10/1999) p.141
[90] Cf. Kleikamp(2002) p.8
[91] Cf. Ibidem p.22ff
[92] Cf. Ibidem

balance sheet. Higher CAPEX costs increase the number of assets and therefore trigger depreciations.[93]

OPEX are operational expenditures, and stands for the business expenses for on-going investments to run the operative business in an efficient way. The OPEX are summed up by costs for working materials, utilities, personnel, leasing, energy etc. They are fully entered in the balance sheet.[94]

Advantages of Performance Contracting are:[95]

- Exploitation of additional value-creation potential
- Stabilization of the sales volume through periodical revenues and therefore independence from seasonal ups and downs or economic changes
- The concept has the potential to enable the acceptance of product innovations
- With the customer tie comes customer loyalty and a long lasting relationship as a basis for further business

Threats of Performance Contracting are:[96]

- Dependence from the customer to get the investment amortized, especially if the product is very specific and a rededication is not or hardly possible
- Specific investments in human resources with a low degree of mobility
- The outsourcing of responsibilities comes with a know-how loss of the consumer who then gets into a dependency situation himself due to successive dequalification
- A main barrier for performance contracting is that companies tend to be very restrictive with allowing external people to access their premises or have insight to the controlling figures. Therefore it is important to build up a partnership with the customer based on solid trust.

2.3.4 FORMING ALLIANCES

Partners might complement an offer. Some companies count their capability of forming strong partnerships to their core competence. Well managed alliances offset weaknesses and increase chances. In any case, considering alliances and applying creative thinking of how these

[93] Cf. Gabler Wirtschaftslexikon (15.02.2011a)
[94] Cf. Gabler Wirtschaftslexikon (15.02.2011b)
[95] Cf. Kleikamp(2002) p.22ff
[96] Cf. Ibidem

partnerships can look like is worth the effort. PORTER distinguishes alliances formed by acquisition or coalition such as licensing, joint ventures or supply agreements.[97]

By giving licenses to another company, a product can be introduced in a new market with less setup cost. The brand strength or access to sales channels of the other company can be used. KOTLER further differentiates four different types of strategic alliances:[98]

1. Product or service alliances
2. Promotional alliances
3. Logistics alliances
4. Pricing collaborations

Although in the European Union “domestic content” will not be a requirement in a public invitation to tender, strategic alliances can help to strengthen the position as an international bidder to win the competition for a regional public investment.

2.4 CONCLUSION

The specific business case situation with only one customer who is a public institution made it difficult to find applicable theoretical approaches. It seems that there are more standards for the marketing of consumer products than for the very diverse business to business area. What unites the two Marketing directions as a current trend is the customer orientation in the design of products. The better the appreciation of the customer the more successful a company can be. This comprehension of the customer also has to be the basis for the design of a specific business model. The described models can only be a fundament for a new overall package.

The following chapters (three to five) are solely business case related and apply the presented theories to the specific situation: the market introduction of Syntegra in London.

[97] Porter (2004) p.529f
[98] Kotler, Keller (2009) p.94f

3 MARKET ANALYSIS

The first business case related chapter starts with the market analysis. It provides a definition of the market. The strategic triangle: company, customer and competition is analysed according their financial figures, their strategic orientation, their innovative strength and their marketing mix. Further the industry environment is described in the macro-environment subchapter. The evaluation of the retrieved information is conducted as the weighing of the five competitive forces after PORTER, as described theoretically in chapter 2.1.5. This chapter finishes with a summary of the findings in the SWOT analysis.

3.1 MARKET DEFINITION

The market segmentation helps to understand the industry where the business unit is operating in, the target market further specifies the customer(s) which shall be addressed and the attached market size. A determination of the incumbents accompanies the breakdown of the actual market share. The potential of the market is analysed by the observation of trends concluding in the early and late replacement purchases which are likely to be taken by London Underground.

3.1.1 THE MARKET SEGMENTATION

A train is a connected series of vehicles also called cars for rail transport that move along a track, to transport freight or passengers from one place to another. Trains operate from a very low speed like the cog railway, which sometimes goes as slow as below 10 km/h to very fast as high speed vehicles up to 400 km/h and more. A proper segmentation is not very easy because various notations are used in different manners and contexts.[99] The most common notations are segmented in Table 1.

Railway Market Segmentation					
Load	**Usage**	**Power Source**	**Transmission of Force**	**Axle Load**	**Max. Speed**
Freight	Urban	electric: third rail	Concrete to rubber wheel	light capacity < 10 tons	80 km/h
People	Commuter	electric: overhead wire	Steel rail to steel wheel	mid capacity 10 to 16 tons	120 km/h
	Inter-City	Diesel	Magnetic without contact	high capacity > 16 tons	200 km/h
	Airport	Steam			> 250 km/h

Table 1: Market Segmentation for Rail Cars
Source: Own

[99] Cf. Baur (2006) p.11

Syntegra the product used in the case study can be classified as highlighted in green in the table above. The various notations are described hereafter:[100]

- At the early 19th century **Locomotives** were driven by steam. Nowadays diesel and electric traction are the most common types. Siemens just introduced their new locomotive design called Vectron at the InnoTrans 2010. Locomotives are used as traction engine for **Freight Trains** and **Passenger Trains.**

- **Motor train sets** can be differed between **Electric Multiple Units (EMU)** with electrification received through overhead lines or third rail; **Diesel Multiple Units (DMU)** and diesel electric multiple units (DEMU). Trains can also be segmented according their axle load into light, medium and high capacity trains.

- **Light Rail Vehicles (LRV)** usually carry less than 10 tons and are sometimes also referred to as **Tram, Trolley** or **Streetcar**. Special layouts of LRV's are the low floor tram with a floor height of 350 to 400 mm and the ultra-low floor tram starting from 200 mm floor height.

- The **Heavy Rail Vehicles (HRV)** segment includes Heavy Metros and Mid-Sized Metros depending on the axle load and the vehicle width.

- There are also special kinds of trains running on corresponding special tracks such as Maglev, VAL and cog railways: **Magnetic levitation (Maglev)** is a technology used for the drive on monorails, avoiding friction caused by the functional grip between rail and wheel. Siemens was involved in the development and marketing of the German Maglev called Transrapid. **Cog railways** on the lower speed end transmit forces by form closure. Other special solutions are **High Speed Vehicles,** which are accelerating up to more than 400 km/h and **Tilting Trains**, a special technology increasing the comfort in curves by reducing lateral acceleration.

The market can also be segmented geographically into sales regions. In the railway business this usually happens in conjunction with the track gauge and other differing technological constraints e.g. of various voltages or envelopes. Customers can further be differed according their affinity to new technologies or a very risk avoiding approach.[101]

Siemens segments the market according the technological requirements. Top and high end customers are very specialized with only a few manufacturers being able to offer. Mid and low end markets usually require local content with less sophisticated components. The market segment which Syntegra is adopted for in the first run is heavy rail with a mid-capacity Metro. In the market case only one customer who is operating in one specific geographical region will be addressed.[102]

[100] Cf. Janicki (2008) p.20ff
[101] Cf. Siemens internal information
[102] Cf. Ibidem

3.1.2 THE TARGET MARKET

Siemens is currently positioned as 8th biggest Metro-supplier in the world. Headquarter for Metros at Siemens in Vienna has identified a 2.6 % growth p.a. in the Metro market.[103]

With the development of a new medium capacity sized Metro platform solution called Inspiro Siemens is eager to strongly increase the market share within the next decade. For a fast rise in market share the biggest Metro operators have to be addressed. New York City's (NYC) metropolitan transit authority (MTA) has the biggest stock of more than 7,000 cars. Unfortunately NYC recently assigned a new big contract to Alstom and Kawasaki Heavy Industries and no further orders are planned in the near future. MTA has also strong entry barriers, such as a long term homologation process for new suppliers including the provision of free prototypes hence Inspiro cannot be offered there.[104]

Moscow, as the second biggest Metro, allows only Russian suppliers.[105] London as the third biggest operator has no real market restrictions.

The ranking of the operators according their fleet sizes is recorded in Table 2.

Ten biggest Metro Operators worldwide			
Rank	**City**	**Country**	**No. of vehicles**
1	New York City	USA	7000
2	Moscow	Russia	4312
3	London	UK	4023
4	Tokyo	Japan	3750
5	Paris	France	3557
6	Seoul	South Korea	3500
7	Mexico City	Mexico	2637
8	Madrid	Spain	1618
9	St. Petersburg	Russia	1445
10	Berlin	Germany	1274

Table 2: The biggest Metro Operators and their Fleet Volume status 2009
Source: own, based on the Railway Directory (2009)

Japan has strong local manufacturers, among others Kawasaki Heavy Industries and Hitachi Ltd. Corporation. Paris is traditionally also supplied by French manufacturers, mainly by Alstom. Therefore the best chance to win a big market share at one of the biggest Metro operators is with London.

[103] Cf. Siemens internal presentation (2008)
[104] Cf. Alstom Online (20.11.2010)
[105] Cf. Siemens internal information

3.1.3 THE MARKET SIZE

The trains running at in the London Underground system can be divided into two different sizes, due to the differences in the construction methods of civil engineering works. The reasons for this differentiation are historical, dating back to the beginnings when the first tunnels were built with the cut and cover method. This technique generated a relatively big space for the tunnels, but caused acute surface disruption. The later deep-level bore method led to tunnels with a smaller diameter.[106]

The picture below (Figure 8) shows the two different sizes of rolling stock operating in the London underground system

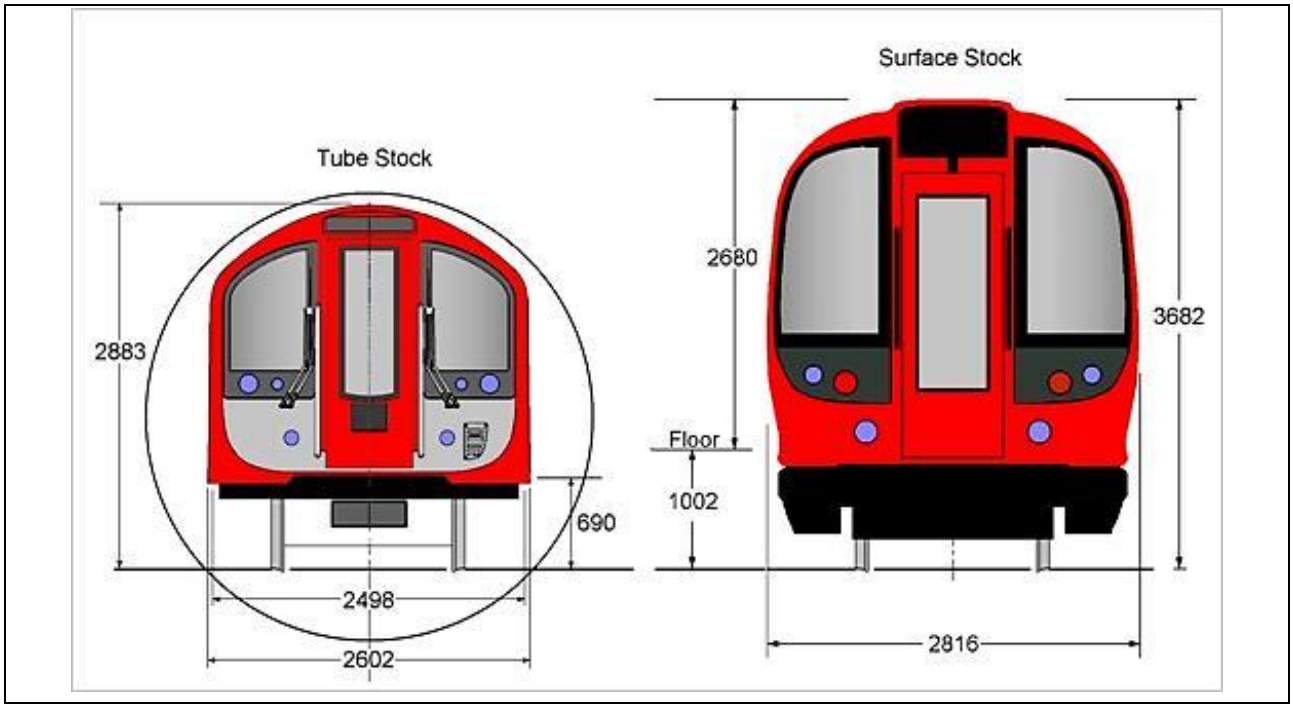

Figure 8: London Underground Railway Tunnel Sizes with measures in mm
Source: Tubeprune (11.10.2010)

Besides diameter, other physical features such as curvature; platform length; and in recent times the signalling system make each line unique. This means that rolling stock is often only useable on one specific line. Overall, London Underground Limited has currently 4078 cars operating on 11 lines.[107]

To give a better orientation, appendix A shows a map of the London Underground System with the various lines and their routes.

[106] Cf. Tubeprune (11.10.2010)
[107] Transport for London Online (28.07.2010)

The old Sub-Surface Rolling Stock

Four lines are operating in the shallower sub surface tunnels: the Metropolitan, the Hammersmith & City, the Circle and the District Line.

The current stock is listed in Table 3.

Sub-Surface Stock				
Line	**Current Stock**	**Trains**	**Introduced/ Refurbished**	**Supplier/ Refurbishment**
Metropolitan	A Stock (A60 & A62)	453	1961-1963/ 1994-1997	Cravens/ Adtranz
Hammersmith & City	C Stock (C69 & C77)	276	1970-1979/ 1991 -1994	Metro-Cammell/ RFS Industries
Circle line				
District (Edgware Road – Wimbledon)				
District	D Stock (D78)	450	1979-1983/ 2004-2008	Metro-Cammell/ Bombardier

Table 3: Current Sub-Surface Rolling Stock in London
Source: own, based on Rolling Stock data sheet 2nd edition 03/2007

New Sub-Surface Rolling Stock

The major part of a £3.4bn contract awarded to Bombardier in April 2003 covers the supply of 1,362 cars for the sub-surface lines between 2008 and 2015, all to be built at Derby, UK. For the larger loading gauge Sub-Surface Lines, 190 MOVIA 237 trains will replace older stock on the Metropolitan, District, Circle and Hammersmith & City lines. Two prototypes ran 40,000km to ensure they are fit for purpose. Additionally 75 six-car District Line trains, the last of existing stock to be replaced, are being refurbished to work until the early part of the next decade.[108]

The old Deep Tube Rolling Stock

There are seven different deep tube lines; all of them have different properties and therefore also slightly different designs. So far no interoperability has been realized.

Table 4 lists the rolling stock, currently operating in deep tube tunnels including facts like the number of cars, the year of manufacture and the original supplier.

[108] Railway Technology Online (22.11.2010)

Deep Tube Stock						
Line	**Current Stock**	**Trains x cars**	**cars**	**weight**	**capacity**	**Supplier**
Victoria	1967	43x8	344	202.8 t	926	Metro Cammell
Bakerloo	1972	36x7	252	167.2 t	816	Metro-Cammell
Piccadilly	1973	86.5x6	519	157-160 t	798	Metro-Cammell
Central	1992	85x8	680	170 t	1085	ABB, Bogies by Kawasaki
Waterloo & City	1992	5x4	20	86 t	518	ABB, Bogies by Kawasaki
Northern	1996	106x6	636	157.6 t	773	Alstom, Bogies by Adtranz
Jubilee	1996	63x7	441	176 t	1021.4	Alstom

Table 4: Current deep tube Rolling Stock in London
Source: own, based on Rolling Stock data sheet 2nd edition 03/2007

The new deep tube rolling stock

Bombardier is currently introducing the new **Victoria Line** Rolling Stock. In total, 47 eight-car Movia 248 trains will be built for this occasion. The first pre-production prototype cars began testing in Derby before test operation on the route in 2007. The Northumberland Park depot is being modernized to handle the new '2009 Stock' of which, once accepted one train will leave the assembly line every 15 days until August 2012. Improved acceleration and braking will shorten journey times and allow a planned increase in frequency on the Victoria Line from 28 trains per hour to 33. The **Jubilee Line** has benefited from additional carriages in January 2006, increasing train lengths from six to seven cars. [109]

Renewal for the other lines is discussed in the chapter about the market potential.

3.1.4 The Market Share

To identify the key players, the London Underground Rolling Stock market is split up into the manufacturers' share of units, currently in service. Consolidated from the tables above, the fleet comes from the rolling stock producers: Cravens Railway Carriage and Wagon Company Limited (Cravens), Alstom, British Rail Engineering Ltd. (BREL), Metro Cammell and additionally two consortia of ABB Transportation & Kawasaki Heavy Industries sub-supplying only bogies and one of Alstom and ADtranz.

[109] Railway Technology Online (22.11.2010)

The original suppliers have merged into two major companies: Bombardier and Alstom. 1966 Cravens has been absorbed by Metro Cammell, which itself has been sold 1989 to Alstom. BREL, ABB Transportation and ADtranz consolidated with Bombardier. At present only Alstom, Bombardier and Kawasaki Heavy Industries stay the course.

From the 4,078 cars operating on the London Underground System in 2008, Alstom including Metro Cammell and Cravens have built the main share of 3,371 cars. Bombardier and by them acquired companies provided 700 cars. The market shares are partitioned as shown in Table 5

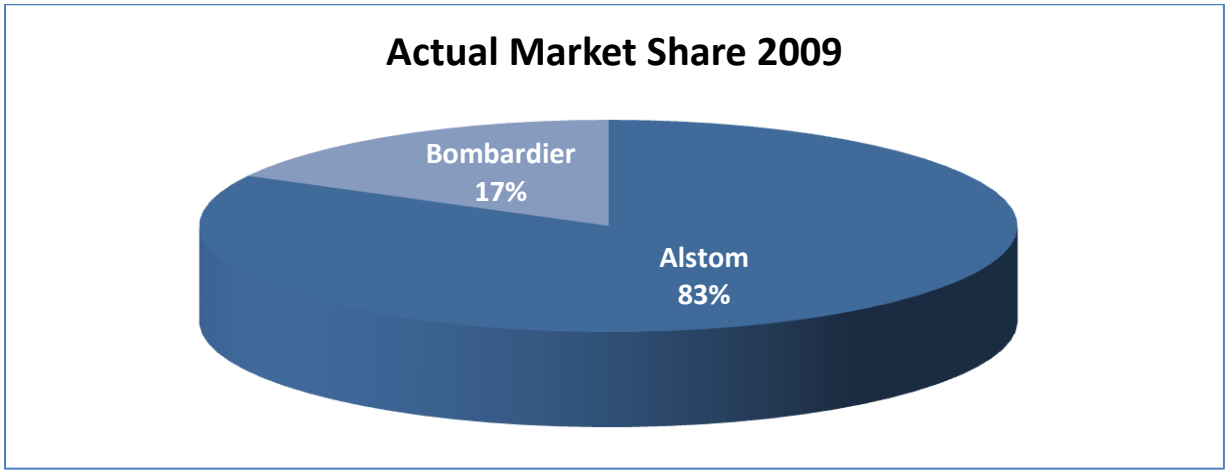

Table 5: Market Share of Railway Cars operating in the London Underground 2009
Source: own, based on Rolling Stock data sheet 2nd edition 03/2007

With contracts for the supply of 1,362 new S Stock cars and 47 new Victoria line cars assigned to Bombardier in 2003, the breakdown of market share will clearly change. The expected market shares in 2018, when the already awarded contracts have been delivered, are supposed to look as depicted in Figure 9.

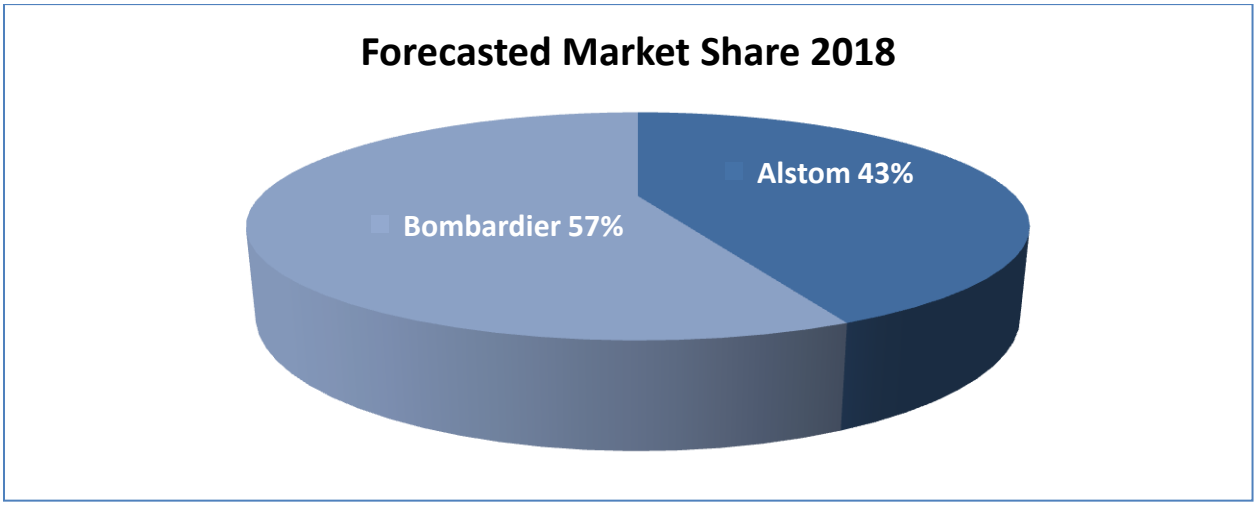

Figure 9: Forecast of the Market Share 2018
Source: own, based on Rolling Stock data sheet 2nd edition 03/2007 and Railway Technology (22.11.2010)

Bombardier will then have supplied 1,738 new trains operating together with 700 old trains on the Central and Waterloo & City Line. Alstom will still be the supplier of the 1,848 old Bakerloo, Piccadilly, Northern and Jubilee Line cars.

3.1.5 THE MARKET TRENDS

Railway operators have the goal to ensure passenger mobility with reliable and cost efficient trains. After 30 to 40 years the maintenance costs of a train become inefficient which usually triggers a replacement purchase. New trains are also needed to meet a higher market demand for public transport due to population growth. Apart from the urgently needed replacement of old and maintenance intensive stock, London also has to cope with an out-dated signalling and platform infrastructure. The passenger demand has increased annually by 2.4 % in average in the last ten years.[110]

Therefore the Underground System is upgraded in a several years continuing project called "Transforming the tube". The biggest challenge improving the system is to amend its appearance and performance, while keeping the service running. Extra stimulus and resources resulted from London being awarded the 2012 Olympics. By 2020 the current programme is supposed to bring 30% more capacity with new trains, track and signalling. For example the introduction of moving block signalling is promising greater line capacity, this feature alone is making it possible to increase passenger numbers by 20%.[111]

The illustration below, Figure 10 shows the planned percentage of capacity increase on the different lines emerging from this project.

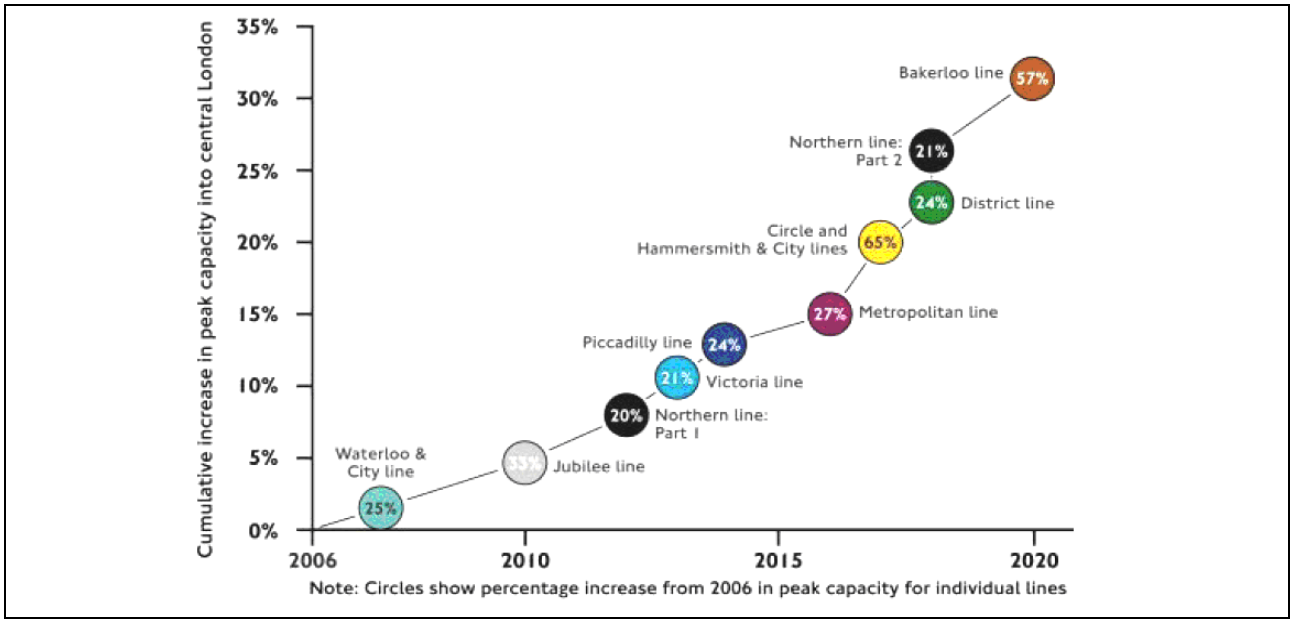

Figure 10: Percentage of Capacity increase by 2020
Source: Transforming the tube brochure p. 5

[110] See Appendix A passenger growth
[111] Transforming the tube brochure (2010)

In former times railway operators were highly involved in the design and construction of their fleets. Nowadays big affiliated manufacturers assume not only the design, production and assembly of new trains, but also compete to obtain service contracts from the operators. A train is either built by a consortium of manufacturers or from one single full-range supplier like Siemens.

Market environmental trends are listed in chapter 4.1.

3.1.6 THE MARKET POTENTIAL

Due to the SSL contracts recently awarded to Bombardier Transportation, the bigger SSL rolling stock does not bear an interesting potential. The rolling stock operating on deep tube lines is partly outdated and only the Victoria line trains have been renewed in the last ten years. By 2020, Transport for London (TfL), the operator, expects annual Metro journeys to increase from the current approximate 1 billion to 1.5 billion. TfL yearly revises and publishes their investment programs. 2010 it stated concerning the update of the deep tube rolling stock that in the year 2016 the prototype for the new Bakerloo line train shall go into service, followed by the delivery of the new trains starting 2018 with the last train supposed to be on track 2020.[112]

Cancellation of the Piccadilly line tender due to the downfall of the Tubeline PPP[113] left it insecure which line will be put out to tender first. The Central line fleet has significant quality problems and has to be replaced before reaching the full lifetime.[114]

An approximate timeframe of the replacements from 2020 to 2033 are listed in Table 6.

Early replacements					
Line	**Stock**	**Age 2011**	**Delivery date**	**Trains x cars**	**Sum**
Bakerloo	1972	39 years	~2018	9x45	405 cars
Piccadilly	1973	38 years	~2020	9x93	837 cars
Waterloo & City	1992	19 years	~2022	5x6	30 cars
Central	1992	19 years	~2023	11x85	935 cars
Total					2207 cars
Nr. of bogies if semi-articulated					2430 bogies

Table 6: Fix early deep tube fleet replacements,
Source: own, based on LUL presentation

The later replacements are estimated as listed in Table 7.

[112] TfL Business Plan 2010
[113] more details, see chapter 3.3.1
[114] TfL Business Plan 2011/2012-2014/2015

Insecure later replacements					
Line	**Stock**	**Age 2011**	**Delivery date**	**Trains x cars**	**Sum**
Northern Expansion			~2028	9x131	1179 cars
Northern	1996	15 years	After 2030	6x106	636 cars
Jubilee	1996	15 years	After 2030	7x63	441 cars
Total					2256 cars
Nr. of bogies if semi-articulated about					2662 bogies

Table 7: Insecure later deep tube fleet replacements
Source: own, based on LUL presentation

This totals a market potential of 5092 bogies over the next 25 years.

3.2 THE COMPANY - SIEMENS

In this chapter Siemens, the vendor of the case study is characterized. First a rough overview of the whole enterprise will be given, going into detail describing the marketing mix.

Siemens is an integrated technology company with a focus on the three sectors industry, energy and healthcare which are sub-divided into 15 divisions and furthermore are broken down into business units. Cross-Sector Services support the core business. Regional organizations in 190 countries at 1,640 locations represent the company worldwide.[115]

This diploma thesis has been generated in cooperation with Siemens plc., London, United Kingdom and Siemens AG Graz, Austria, both operating in the Industry sector (I) in the division Mobility (MO), highlighted in red in Figure 11 which depicts the company segmentation.

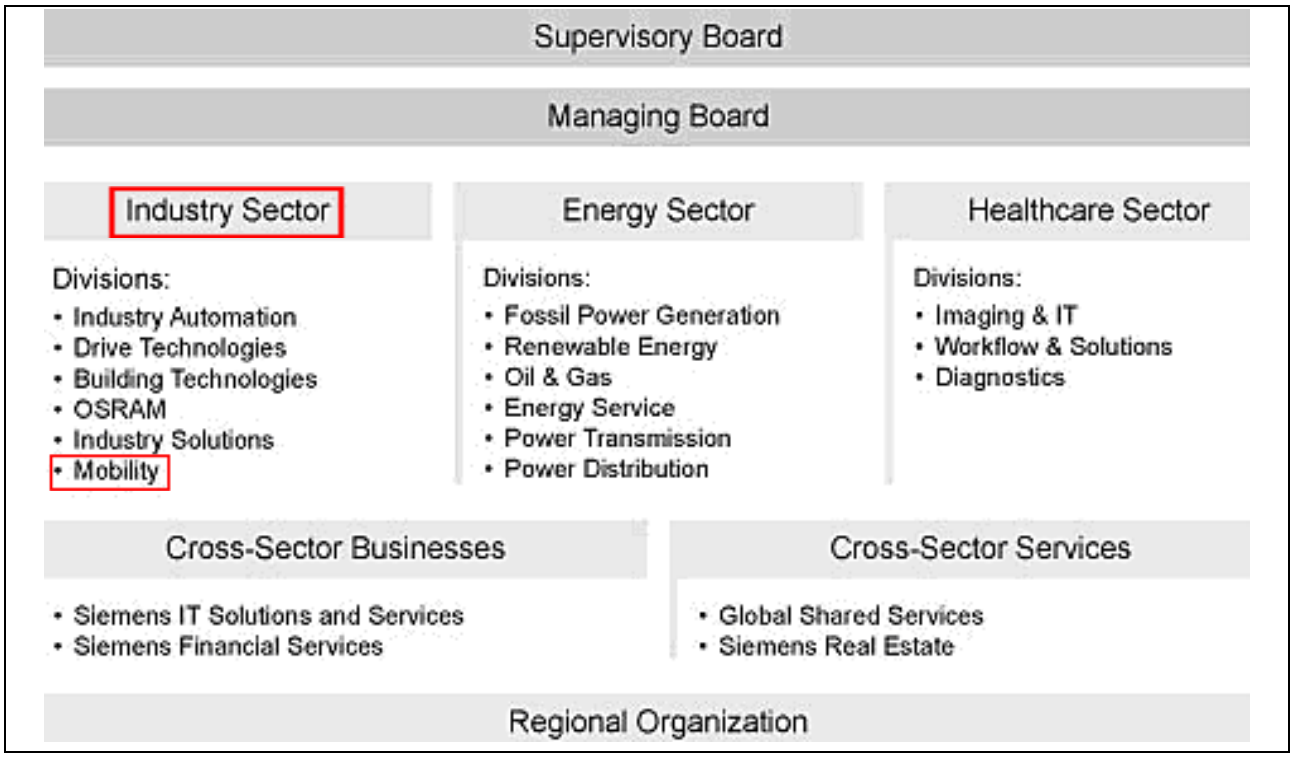

Figure 11: Siemens business areas
Source: Siemens Online (03.10.2010)

The Management

Dr. Gerhard Cromme chairs the Supervisory Board of Siemens AG, which has 20 members. President and Chief Executive Officer of Siemens AG is Peter Loescher, leading the company with support of seven other members of the managing board, supervising a worldwide workforce

[115] Cf. Siemens Online (03.10.2010)

of 405,000 employees. Thereof 30,100 people are working in research and development (R&D), where the percentage of total revenue invested is 5.1%.[116]

Key figures in fiscal 2010 Siemens Corporation[117]

Employees 405,000

New orders worth EUR 81,163 million

Revenues of EUR 75,978 million

Profit margin 10.7%

Siemens Sector Industry (I): The industry sector seeks to improve customers operating productivity, energy efficiency and flexibility within six divisions: Industry Automation, Drive Technology, Building Technologies, OSRAM, Industry Solutions and Mobility.

Siemens Division Mobility (I MO): Siemens Mobility provides transportation and logistics solutions. The products offered range from airport logistics and postal automation to rail and road solutions. As full range supplier the division positions itself with a "complete mobility" approach, combining various modes of transportation and support services to offer turnkey concepts.[118] The business units operating in the mobility area are: Rolling Stock, Rail Automation, Major Projects and Electrification, Infrastructure Logistics and Traffic Solutions.

The cooperation partners of this report from Siemens in Graz and in London are in the business unit Rolling Stock (RS) internally referred to as Siemens I MO RS.

Siemens Business Unit Rolling Stock (I MO RS): The business unit Rolling Stock develops produces and markets rolling stock for traction railway vehicles operating in the passenger transport area. The product portfolio includes:

- Light Rail, with the worldwide operating Combino and the new low floor tram Avenio
- Heavy Rail with the 2010 presented Inspiro platform. A contract has already been awarded to deliver Inspiro to Metro warszawskie (Warsaw) in a consortium with Newag.
- Diesel and Electric Multiple Units such as the Desiro and the new Desiro City which is e.g.: especially successful in the UK market with the Desiro UK
- Passenger trains like the Viaggio with the Viaggio Comfort model in service e.g.: as the Austrian Federal Railway (ÖBB) Railjet with a speed up to 230 km/h
- High speed vehicles such as the Velaro used as the ICE 3 at Deutsche Bahn (DB)
- Locomotives like the also 2010 presented Vectron

[116] Cf. Siemens annual report FY 2010, at Siemens the fiscal year always ends September 30
[117] Cf. Ibidem
[118] Cf. Siemens mobility Online (03.10.2010)

I MO RS also supports the customer at the maintenance of his fleets and delivers components.

Siemens Bogie Competence Centre (I MO RS BG): Siemens AG in Graz is part of the Industry sector; division mobility; designing and producing bogies for passenger rolling stock. With a railway production history dating back to 1854, the former company Simmering Graz Pauker (SGP) was fully acquired by Siemens AG in 2001. With its most advanced production line, as for instance high-performance robot welding, the site in Graz has a capacity for approximately 3500 bogies each year.[119]

The picture below shows the engineering office as well as the production plant in Graz Eggenberg.

Figure 12: Siemens Plant in Graz, Eggenberg
Source: Siemens internal presentation (2010)

Key figures in financial year 2009 of Siemens I MO RS BG in Graz:[120]

Employees	1200 worldwide and about 900 in Graz among 150 highly trained engineers
New orders:	EUR 414 million
Sales:	EUR 233 million > 75 % direct export share
Production:	3,321 Bogies (2010)
Locations:	Graz (A), Sacramento (USA), Aurangabad (India)

Siemens AG in Graz is the world's biggest research and development and production facility for bogies in the passenger transport such as Metros; Tramcars; Multiple units; High speed trains and Locomotives.

[119] Cf. Siemens internal presentation (2006)
[120] Cf. Siemens internal presentation (2010)

3.2.1 PLACE - LONDON

Siemens' activities in the United Kingdom date back 167 years, when William Siemens set foot in England in 1843. William Siemens subsequently took out a sting of patents, some developed in co-operation with his elder brother Werner. Several of these related to telegraph equipment, which provided the basis for his company's growth.

Werner Siemens founded a company in Berlin in 1847, to take advantage of the latest developments in communications technology, and quickly established a reputation as one of the leading innovators in the field. The company's London office opened in 1850 and formally became Siemens Halske & Co in 1858; William and Werner Siemens' partner Halske, a young German mechanic, was bought out of the company in the mid-1860s. The company's discovery of the electro-dynamic principle in 1886 was the starting point for electrical power engineering, providing power generation and electric motors. In 1879 Siemens built the world's first electric train for Bush Mills, Northern Ireland, and in 1883, the first public railway designed by Siemens was opened on Brighton seafront and still runs today. A principle pioneer of the UK's electricity industry, Siemens installed the world's first commercial power station, and also its first electric street lighting, in Godalming, Surrey in 1881.[121]

Nowadays Siemens employs 16,915 people in the UK, including about 6,000 in the manufacturing sector. Last year's revenues were GBP 4.2 billion, including exports of over GBP 1 billion, and over GBP 60 million were spent on research and development. Siemens has offices and factories throughout the UK, with its headquarters in Frimley, Surrey.

Siemens plc. I MO RS conducts a sales department in London, Westminster, which maintains good contacts with London Underground Ltd.

3.2.2 PRODUCT - SYNTEGRA

Traditionally railway vehicles consisted of the running gear, the vehicle underframe and the vehicle superstructure was mounted on the underframe. Modern developments have seen the vehicle underframe and superstructure elements being combined in the creation of the modern monocoque bodyshell. Bogies now support the vehicle carbody and they essentially consist of the bogie frame, the wheel sets and necessary suspension systems.[122]

Although the railway operator will buy a complete train, bogies play a decisive role in the buying process.

To provide a better understanding of the product dealt with in the case study, hereafter the basic technology and Syntegra, the special bogie solution Siemens in Graz considers to offer in London are depicted.

[121] Cf. Siemens UK online (28.07.2010)
[122] Baur (2006) p.11

Bogies

Bogies enable the car body to turn on top of the underframe as the German word “Drehgestell” already implies. Not all bogies transmit traction forces, only motor bogies have powered wheel sets. Trailer bogies are unpowered, but are usually fitted with a braking system due to safety reasons.[123]

The basic functionalities fulfilled by bogies are: [124]

- to carry vertical forces, such as freight wagons or passenger coaches
- to lead the vehicle along the track
- to transmit forces, especially brake forces and if it is a motor bogie also drive forces

Figure 13 shows an example for a bogie.

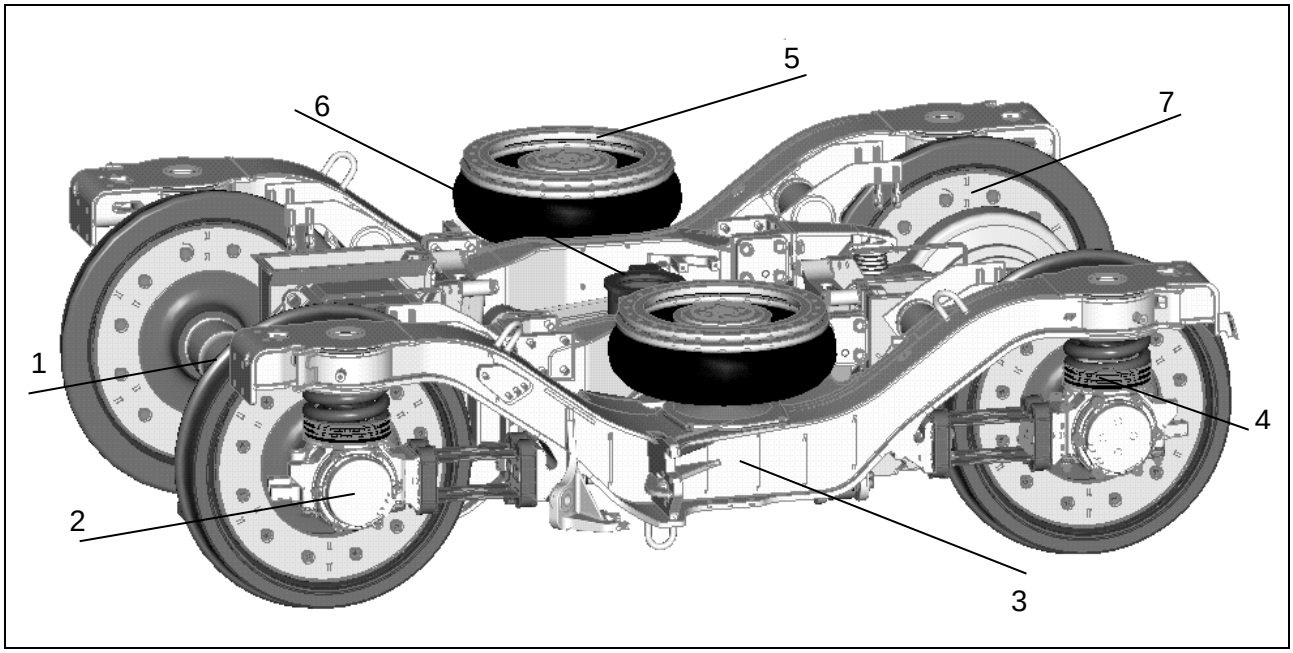

Figure 13: Example for a bogie
Source: Haigermoser (2002) p.183

Basic components of a bogie as identified by numbers in the example in Figure 13 are listed in Table 8.

Conventional design solutions for the performance of the various tasks in the 2nd column are supplemented by the chosen approach for Syntegra in the very left column.

[123] Cf. Baur (2006) p.13ff
[124] Cf. Haigermoser (2002) p.13

Bogie Components				
No.	**Component**	**Task**	**Principle**	**Syntegra**
1	Wheel / Wheel set (steel)	Transmission of loads and of driving and braking forces to tracks	• tired wheel • full wheel • resilient wheel	Full wheel Ø 690 mm (new)
2	Bearing	Changeover between static and rotating component	• journal • rolling contact	Combined motor / wheel set rolling contact bearing
3	Bogie Frame	Absorption of suspension and wheel guidance forces	• rigid • flexible	Flexible connection between lateral and longitudinal beam
4	Primary Suspension	Safety against derailment, motion and vibration damping	• mechanical spring (rubber, coil spring) • hydraulic or frictional damping	Elastomeric primary springs or coil springs
5	Secondary Suspension	Mitigation of impact in vertical and horizontal direction	• mechanically (coil spring) • hydraulically • pneumatically	Pneumatic springs
6	Vehicle Interface	Carbody support, trans-mission pull/push forces	• centre pivot • bogie bolster • traction rod	Traction rod with rubber elements
7	Braking Device	provision of required braking characteristic	• mechanically: disc, shoe, tread • electro-dynamic • magnetically	Fail safe electric brake: ED plus IED Mechanical brake: 4 tread brakes
8*	Propulsion System	transmission of electric force into drive force: DC: 3000/1500/750 Volt AC: 15 kV 16⅔ Hz 25 kV 50 Hz	• Synchronous: Indirect / direct drive • asynchronous	Synchronous permanent magnetic AC direct drive
9*	Gearbox	Final drive ratio Fully, partly or not at all suspended	• Hollow shaft • Axle mounted • Nose suspended (cannon box)	No gearbox

Table 8: Bogie Components
Source: own, based on Baur (2006) p.53ff and Siemens internal information

* Only in motor bogies, not depicted in Figure 13

Syntegra

Syntegra is a revolutionary motor bogie solution. With a highly integrative approach, it challenges existing standards. Drive, chassis and braking technology are combined to an efficient mechatronic System. The direct drive, light weight concept promises less energy consumption and lower life cycle costs due to the lower complexity.[125] The new development was a cooperative design. The flexible and therefore torsion sensible frame has been developed at the bogie competence centre of Siemens in Graz. The gearless direct drive, based on a permanent magnetic fully encapsulated synchronous machine has been invented at Siemens Drive Technologies in Nuremberg.

For a first market launch Syntegra has been optimized for the metropolitan transit. The InnoTrans in Berlin is the biggest railway fair in the world, taking place biennial. At the InnoTrans 2006, Syntegra was first presented to the public[126] as shown in Figure 14. Four years later, at the InnoTrans 2010 Siemens introduced a new Metro train platform named Inspiro offering Syntegra as a bogie purchase option.

Figure 14: First Syntegra design approach presented at the InnoTrans 2006
Source: Siemens internal presentation

Special Characteristics of the Syntegra solution:[127]

Wheel/Wheel set: Syntegra is realized with a very short wheelbase (1600 mm). The lack of a gear transmission ratio requires small wheels with a diameter of about 660 mm. The first design has a standard gauge of 1435 mm

[125] Siemens Syntegra Image Folder (2009)
[126] Cf. Railway Gazette, article from 01.11.2006
[127] Cf. Siemens Syntegra image folder

Wheel set Bearing: The motor mounted around the axle and the inside bearing of the wheels enables a special combined bearing for the motor and the wheel set.

Bogie Frame: Syntegra is a lightweight design with a total weight of 4800 kg. Due to the inside bearing and the short axle distance it needs less installations space. Hence the payload can be increased. Longitudinal and cross beam are connected with flexible rubber joints.

Primary and Secondary Suspension: The primary suspension consists of elastomeric chevron springs (rubber coated springs). The secondary step has two air spring bellows mounted outside the longitudinal beams including a lift lock.

Propulsion system: The propulsion unit consists of two gearless single axle direct drives based on a permanently energized, fully encapsulated synchronous motor (PSM) delivering 150kW each. It can be realized either air-cooled or with liquid cooling. Figure 15 shows the assembly of the drive technology around the axle, which is also the rotor in this case.

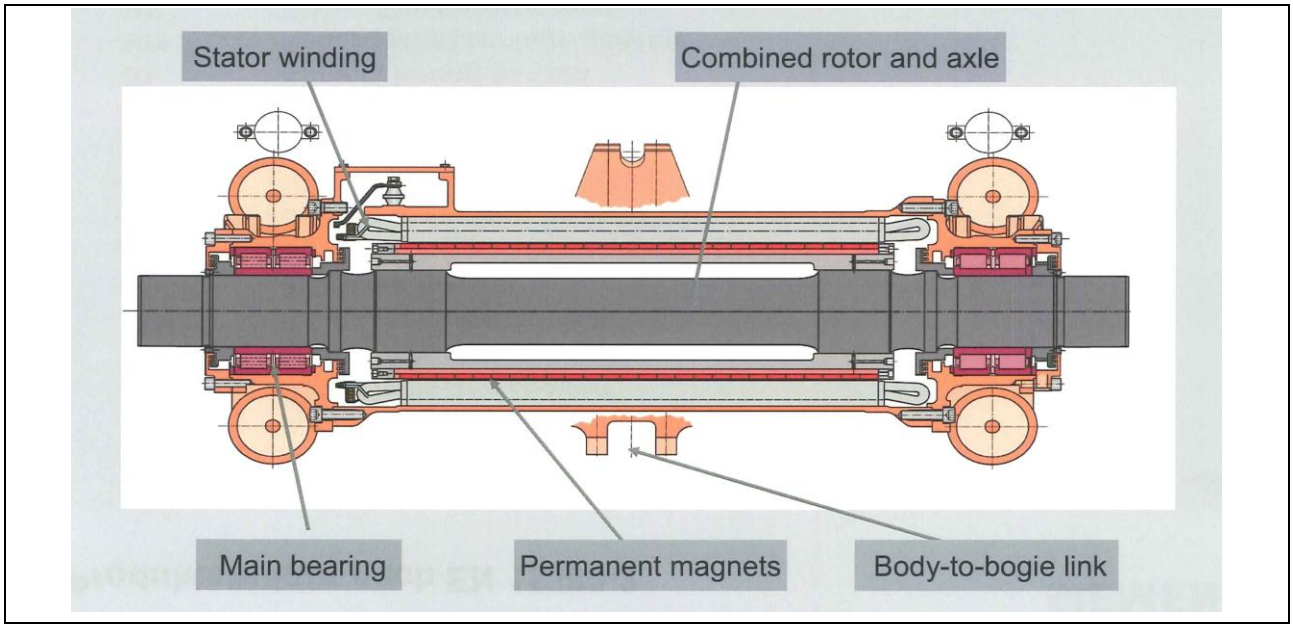

Figure 15: Syntegra drive Permanent Magnetic Motor
Source: Siemens Syntegra Image Folder

Braking device: Syntegra offers no full mechanical break. Instead the braking technology is integrated in one complete mechatronic system. Permanent energized synchronous machines allow a generator-based braking. An inherent electrodynamics brake (IED) supplements the system consisting of a braking contactor. At the moment, an additional shoe brake fulfils an emergency and parking brake function.

Vehicle Interface: The body-to-bogie link is solved in a different way for Syntegra London. A big clamp improves the load transmission from the wheel set directly to the car body. Traction forces do not distort the bogie frame and improve the fatigue behaviour.

To test the new development in an authentic surrounding, Syntegra is currently operating under an actual car body of the Metro in Munich. The **Stadtwerke Munich (SWM**) was also considered as the first operator to acquire the new technology. However SWM decided against a purchase of Syntegra for their new fleet. SWM pointed out, that they were very interested in energy saving, but also want a proven design. Therefore SWM relies on existing, mature and proven bogie concepts to diminish risks and require more operational experience before ordering a high number of vehicles. A technical reason for SWM not to be too enthusiastic about Syntegra might also be the sufficient space in tunnels in Munich, hence no urgent need for a space saving bogie solution.[128]

Table 9 shows the prototyping history and therefore the effective service experience of the Syntegra bogie at SWM.

Chronicle of the Syntegra Prototype in Munich	
Modification and implementation of Syntegra in a SWM car	**June – December 2005**
Validation process in Wegberg-Wildenrath: Tests, accreditation process, brake certificate and finally transfer back to Munich	**January 2006 – June 2007**
Acceptance and approval for test runs including dynamic behaviour, operational measurements and brake behaviour	**October 2007**
Accreditation	**June 2008**
Passenger Service	**August 2008**
Further development and additional trial of an alternative, air cooled instead of water cooled, Motor concept and thermal test runs proofing the new solution	**February 2009**
Reaccreditation and passenger service	**October 2009**

Table 9: Chronicle of the Syntegra Prototype in Munich
Source: own, based on Siemens internal presentation

The next step is either a full prototype train, or a direct product introduction to prove the promised saving potentials and the reliability of Syntegra.

The market introduction for Syntegra has been further considered for different customers in the last few years. A barrier for Syntegra to be offered to some operators has been disqualification criteria in the technical specifications. For example, if the customer requests a fully sprung motor this would exclude Syntegra as an option.[129]

[128] Information gained in discussions with a Technical Project Engineer of Siemens who was in charge of the Syntegra Prototype in Munich
[129] Siemens internal information

To learn from the past this chapter also takes a closer look to the reasons why the attempts were more or less successful. Eventually it also describes why Syntegra is considered for Metros in the London Underground System.

Syntegra as Single Component: The sale of Syntegra as subcomponent with Siemens as a sub-supplier for an external carbody builder could not be realized in the past due to the high innovative character. On the one hand Siemens fears the loss of know how. On the other hand, these companies are usually smaller, hence rarely willing to take the relatively high financial risk of implementing a concept with operational experience of just some 100,000 km

Syntegra for Desiro UK: In the beginning of the development phase for the regional service EMU/DMU train Desiro UK, Syntegra was envisaged for the bogie solution. This has been dropped at an early stage because at this stadium of the development, the target costs had not been reached. Compared to a conventional design the costs were too high. From a technical point, the overall size of a direct drive permanent magnet motor which could go up to 160 km/h is too big and the thermal condition hard to control.[130]

Syntegra for London Underground: The technical requirements at London Underground are very special. Since London has the oldest Underground System in the world, the infrastructure is also partly outdated and the prevailing conditions of the track repeatedly caused fatigue cracks in the rigid bogie frames.[131]

The picture below shows a rendering of the first for London Underground adapted design with air-cooled space-optimised motors.

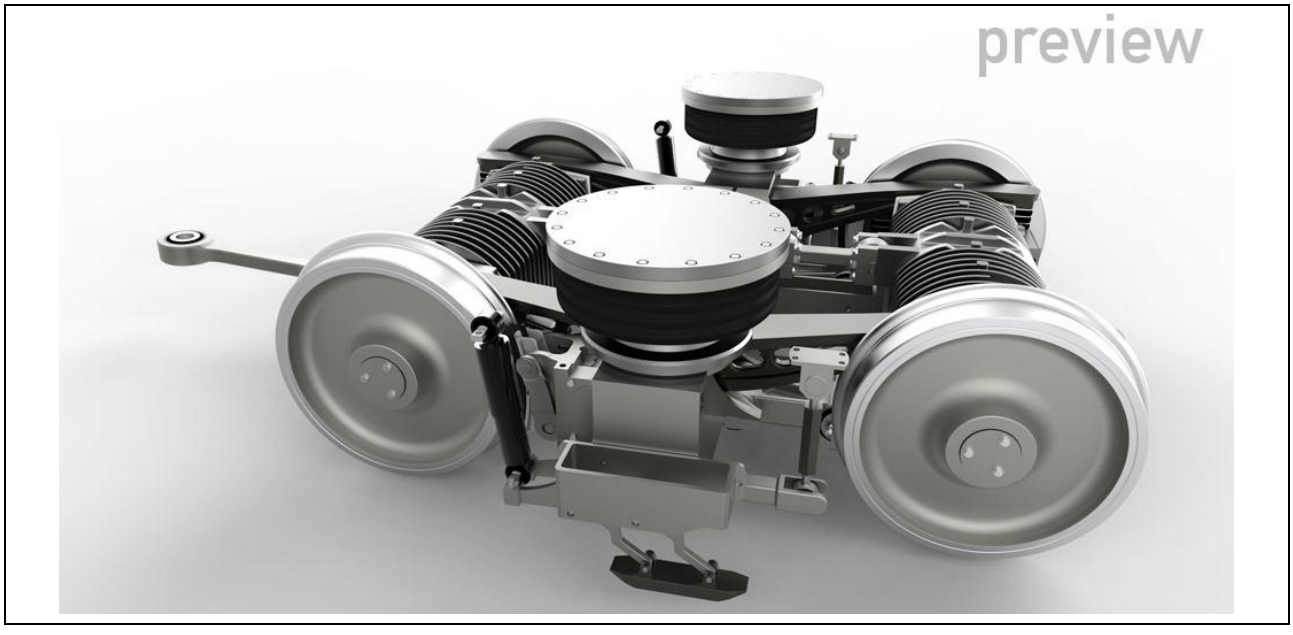

Figure 16: Computerised image of a Syntegra 2010 bogie with air cooled traction motors
Source: Railvolution (4/2010) p.59

[130] Siemens, Interview with a Desiro UK Project Manager and the Bid Manager (13.09.2010)
[131] Baur (2006) p.230f

The current political discussion about cutting CO2 emissions shows the increasing importance of environmentally friendly solutions. London also has a problem with the increasing heat in tunnels, therefore energy efficiency is important. The new trains are also supposed to be articulated with fewer bogies and therefore a higher axle load per bogie.[132]

The properties of Syntegra partly meet the special requirements of being flexible, small, light and energy efficient. Nonetheless a comprehensive adapter construction is inevitable. For example the body-to-bogie link is solved in a different way for Syntegra London. A big clamp improves the load transmission from the wheel set directly to the car body. Traction forces do not distort the bogie frame and improve the fatigue behaviour.

3.2.3 PROMOTION

Customer relationship in the sector of industrial goods is mostly based on previous well conducted projects. Therefore this chapter takes a closer look at the business activities Siemens had within London Underground so far.

Bogie Refurbishment Project: In 2007 Siemens AG in Graz, Austria won a bogie modification Project for the Central and the Waterloo & City line. The scope was to deliver 1420 new bogie frames including the motor mounting as well as the modification of 2950 gearboxes and delivering new couplings. This refurbishment project enabled Siemens to start a positive customer relationship. All contractual milestones and customer approvals were achieved within time and so far Siemens is ahead of the delivery schedule. The collaboration is to be claimed as a reference project within LUL.

So far Siemens made a good impression concerning delivery reliability and LUL is satisfied with the quality of the delivered work. The Brand perception according the most occurring free comments of participants of the customer survey is:[133]

- high quality of products,
- engineering excellence and efficiency
- dependable, reliable and durable
- German, Teutonic

Piccadilly Line Tender: Siemens AG in Graz had the intention to bid for the new Piccadilly line rolling stock upgrade which was out to tender in 2007, the customer was Tubelines. At first Siemens decided to offer the Syntegra solution but later withdrew from the bid hence the venture was too high. However Tubelines cancelled the invitation to tender. So far no contract has been assigned for new Piccadilly line trains.

Design Study: LUL repeatedly noted that Siemens has met their expectations with their contribution in the Design study. Based on the results, they are very interested to further collaborate and perceive Siemens as a considerable alternative to the top dogs in the market.

[132] The Rail Engineer (02/2011) p.40ff
[133] Cf. Siemens UK customer attitude survey managed by Accelerator Solutions Limited (2009)

On fairs and conferences Siemens presents new developments such as Syntegra in 2006. Siemens regularly publishes adverts and articles in magazines. But there is room for improvement. The customer survey also questioned five representatives from the railway media. Their perception includes the following statements[134]:

- *Bombardier seen as having developed stronger, longer-term relationships with the media*
- *Would like more 1-1 briefings, more technical background from outside the press office*
- *Need more technical contacts to get detailed information, more depot/production facility visits*

3.2.4 PRICE

A UK railway consultant stated about the chances of Siemens to succeed: “Customer thinks of Siemens: it is expensive but reliable”. Also the customer survey reflects this impression. Siemens is better than Alstom and Bombardier in most of the “soft facts” such as track record, on time delivery and honesty. Concerning the price Siemens polled badly and seems to have a high potential concerning cost efficiency.[135]

Syntegra faces the common problem of innovations of the hardly predictable amortization of the development costs. Risk contingencies diminish the cost advantages through light weight design and saving of the gear box.

Strengths:

- Won customer interest with Syntegra
- No history of bad reputation, delivery delays, neglected promises in London – track record
- High degree of innovativeness challenges existing standards
- Better and more intense Customer Relationship than other incumbents

Weaknesses:

- High degree of innovativeness triggers insecurities at the customer side
- Hardly predictable influence on track wear and rolling contact fatigue of the axle mounted motors

[134] Cf. Siemens UK customer attitude survey managed by Accelerator Solutions Limited (2009)
[135] Cf. Ibidem

3.3 THE CUSTOMER - LONDON

The customer for such big investments is usually not a single company, but a consortium, consisting of political institutions, financers and the operator(s). The operator defines the functional requirements and the technical restraints for the manufacturers to develop an adapted product. The usual approach is that the suppliers receive an invitation to tender from the operator with a technical specification describing how the future train should look like. The suppliers then have a few months time to prequalify to tender and to submit an offer. The proposed solution has to be compliant with the specification; otherwise the offer might be rejected. The following chapter lists the important information about the involved parties and decision makers of the customer.

In London the operator is London Underground Limited (LUL), which is a subsidiary of Transport Trading Limited (TTL) this in turn being the trading body of Transport for London (TfL). TfL is a statutory body to implement the Mayor's transport strategies also including for example bus, bicycle, taxi, light rail and river boat services.[136] Figure 17 shows the structure where LUL is embedded in, restricted to the parties which are involved in the purchase decision making process. The LUL Nominees and Tubelines are the Public Private Partnership successors.

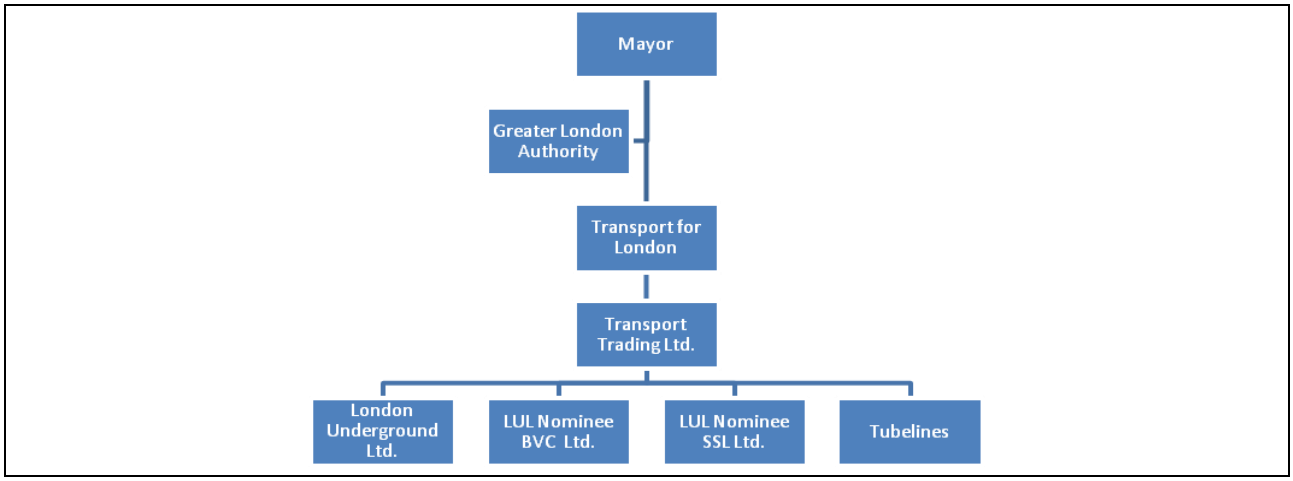

Figure 17: Organizational chart of the in the decision process involved companies of the customer
Source: own, based on Transport for London Online (12.09.2010)

With the intention to transfer financial risk from the public to private companies, the government agreed on a Public Private Partnership (PPP) structure in the year 2000. The three different so-called infrastructure companies (infracos) were given 30-year-contracts with frequent rates in return of taking the responsibility to upgrade the tube network. This included signalling, tunnels, tracks, stations and rolling stock as well as to ensure operation. The PPPs failed to fulfil the promise of cost effective maintenance and upgrade and were recently reintegrated into TfL as LUL Nominees.

[136] Cf. Transport for London Online (12.09.2010)

3.3.1 INSTITUTIONS

Political Institutions authorize the operating company, support as financer and act as representatives of the public. To give a better insight, the influencing facilities are outlined below. Policy makers and political institutions are subject to constant change. The organizational chart above is a snapshot of the current structure and has to be updated in case of alteration.

Department for Transport (DfT): In February 2008 a total funding for TfL of GBP 39 billion until 2017/18 was confirmed by the Department for Transport. Currently, TfL receives GBP 3.2 billion per year in funding from the DfT.[137] 20 October 2010 the treasurer decided not to cut funding for new metro rolling stock.

Greater London Authority (GLA): The Greater London Authority supports the work of the Mayor of London, helping his office to develop and deliver strategies for London. GLA also supports the London Assembly in their role of scrutinizing the work of the Mayor and representing the interests of Londoners. While the Mayor and the London Assembly are elected by Londoners, the staff of the GLA is a permanent body that provides continuity in the on-going development and delivery of strategies for London. The GLA is currently led by Chief Executive Leo Boland.[138] The GLA supports TfL with about GBP 2,804 million per year. [139]

The Mayor of London: Boris Johnson was born 1964 in New York and was elected Mayor of London on 6th May 2008 following his predecessor Ken Livingston. Before he became Mayor of London he was working as a journalist, has published several books and regularly appeared on TV. He is a member of the conservative party. Appointed to the chair of Transport for London by the Greater London Authority, the Mayor approves proposals for new or significant initiatives and those where expenditure is over GBP 50,000.[140] The latest big transport project supported by the mayor was a cycle hire scheme introduced in central London in the summer 2010. As environmental friendly alternative for Londoners to commute, but also for tourists, the system sponsored by Barclay with 6,000 cycles available across the city is perceived as a success in the public. Due to the intense engagement of the Mayor, the scheme is also called Boris bikes.[141] The Mayor additionally assigned an **"Independent Investment Programme Advisory Group"** to advise Transport for London on the investments for the improvement of the public transport, consisting of six experts from private companies.[142]

The Mayor's transport advisor: Kulveer Ranger is Mayor Johnson's advisor for transport. In this position his duty is to provide policy advice and direction, set priorities and take decisions relating to transport issues on behalf of the Mayor.[143]

[137] Cf. The Chartered institute of Logistics and Transport UK Online News article as per 21. July 2010
[138] Cf. The Government of London Online (25.02.2011a)
[139] Cf. TfL Business Plan 2011/2012-2014/2015
[140] Cf. The Government of London Online (25.02.2011b)
[141] Cf. The Guardian Online (26.02.2011)
[142] Cf. Transport for London Online (12.01.2010)
[143] The Government of London Online (25.02.2011c)

The London Assembly: The Assembly directly questions the Mayor's activities, strategies and decisions. It also publishes the findings and recommendations from its investigations and makes proposals to the Mayor.[144] Through the course of each year, the Mayor attends ten meetings of the London Assembly, referred to as Mayor's question time, at which he and members of the administration can be questioned about their actions by the Assembly. In addition to responding to oral and written questions from Assembly Members, the Mayor submits a report on his activities.[145]

Transport for London (TfL): As a statutory body created by the Greater London Authority Act 1999 TfL's role is to implement the Mayor's Transport Strategy and manage transport service across the capital. The strategy prepares for the capital's predicted growth of 1.25 million more people and 750,000 more jobs by 2031.[146] The GLA sets down TfL's powers and duties. TfL's organization of 31,000 employees is directed by a Board which has been appointed by the Mayor of London, who chairs it and has the ultimate responsibility. The appendix of this report contains a detailed organizational chart of TfL to enable a better understanding of the company's structure.[147] TfL has a Standard and Poor's credit rating of AA+ as per December 2010.[148]

Public Private Partnership (PPP): When the Labour Party seized power in 1997, it chose a Public Private Partnership to finance public transport investments. Private companies financed the regeneration of the investment backlog in return for lengthy maintenance and management contracts and guaranteed returns. Under the PPP contracts, three new infrastructure companies (infracos) were formed: Metronet Rail BCV, Metronet Rail SSL and Tubelines.

PPP Metronet Rail BCV	
Line responsibility	Bakerloo, Central, Victoria and Waterloo & City Lines
Shareholders **from February 2000**	**Bombardier 20%,** Seeboard plc. 20%, Balfour Beatty 20% Thames Water 20%, Atkins Metro Ltd 20%
Private Sector Contractors:	Design & Build: Trans4m; Bombardier; Rollingstock; Westinghouse; Balfour Beatty
Principal Banks/ **Bond Arrangers**	Abbey National Treasury Services PLC, Deutsche Bank Royal Bank of Scotland, CIBC World Markets Ltd
TfL admission since	July 2007

Table 10: PPP Metronet Rail BCV
Source: Own, based on Partnerships UK Online (12.12.2010)

[144] Cf. The Government of London Online (25.02.2011d)
[145] Cf. Ibidem (25.02.2011e)
[146] Transport for London Online (12.09.2010)
[147] See Appendix C
[148] Cf. Transport for London (20.02.2011)

London Underground Limited was further on responsible to operate the trains including safety and signalling. As depicted in Table 10: PPP Metronet Rail BCVTable 10 and Table 11 Bombardier Transportation is a 20 % Shareholder of the Metronet PPPs. The update of the rolling stock was part of the framework contracts. Concerning rolling stock update within the Metronet BCV contract, only the introduction of new Victoria Line trains has started delivery so far.

PPP Metronet Rail SSL (Sub-surface lines)	
Line responsibility	Circle, District, Metropolitan, Hammersmith & City and East London Lines
Shareholders from February 2000	**Bombardier 20%,** Seeboard plc. 20%, Balfour Beatty 20% Thames Water 20%, Atkins Metro Ltd 20%
Principal Banks/ Bond Arrangers	Abbey National Treasury Services PLC, Deutsche Bank Royal Bank of Scotland, CIBC World Markets Ltd
TfL admission since	July 2007

Table 11: PPP Metronet Rail SSL
Source: Own, based on Partnerships UK Online (12.12.2010)

For the sub-surface lines, Bombardier will supply a single fleet of increased size to replace the trains of different types which run on the Metropolitan, District, Circle and Hammersmith & City lines. The first train arrived on the Metropolitan line 2010. Once the renewal work is complete, the capacity of the four lines is expected to increase by over 40 per cent overall through the faster and larger train fleet, a new signalling and service control system and upgraded infrastructure. All new trains for the Sub-surface lines' upgrade will be of the same walk-through design with air-conditioning and only the train length changing between the various lines.[149] However, the decision to contract out underground improvements has not proven to be wholly successful. Both Metronet companies entered administration in July 2007 due to outstanding debts.[150]

As a third infraco Tube Lines (JNP), detailed in Table 12, jointly owned by Bechtel and Amey (Ferrovial) won a 30-year contract for infrastructure maintenance and upgrade of the Jubilee, Northern and Piccadilly lines starting on the 31 December 2002. The train manufacturer Alstom Transport is a private sector contractor of this PPP and hence won rolling stock updates on the Jubilee Line and maintenance work for the Northern Line. Although Tube Lines has been able to uphold the contract longer than the Metronet companies, in May 2010 it was acquired by TfL. The shareholders of the PPP contractor have agreed to sell their equity in the company to TfL

[149] Cf. Bombardier Transportation Online (12.12.2010)
[150] Cf. National Audit Office Online (26.02.2011)

for GBP 310 million. Tube Lines is now a wholly owned subsidiary of TfL. The arrangement, set out by the Mayor and TfL, will enable LUL to work with the private sector on the upgrades.[151]

PPP Tube Lines (JNP)	Tube Lines
Line responsibility	Jubilee, Northern, Piccadilly
Shareholders **From January 2005**	Amey 66.7% Bechtel 33.3%
Private Sector Contractors:	Bechtel - Design & Build, Amey, **ALSTOM,** Grantrail & Trackwork, Alcatel
Principal Banks/ **Bond Arrangers**	Societe Generale, Bank of Scotland, Mizuho Bank, WestLB AG
TfL admission since	May 2010

Table 12: PPP Tube Lines JNP
Source: Own, based on Partnerships UK Online (12.12.2010)

Although the PPPs no longer exist, they influence the business case. Due to the fact that the people who were working for the PPPs, partially former Alstom or Bombardier employees were reintegrated and are now working for London Underground Ltd.

3.3.2 LONDON UNDERGROUND LIMITED (LUL)

The London Underground System has been initiated and mostly built by private enterprises. Though for much of its history it has been in public ownership. London Underground Limited (LUL) was formed in 1985, but its history dates back to 1863 when the world's first underground railway opened with a six kilometre subterranean railway section. 1890 started the first electrified intrinsic metro. The system runs 54% on the surface, the remainder being a combination of sub-surface and later deep-level tube lines. [152]

LUL carries more than one billion passengers a year, as many as the entire national rail network in the United Kingdom. With around three and a half million journeys made each day, on 11 lines serving 270 stations and over 408 km of railway, LUL are now running more services than ever before on the 140-year-old network. The Mayor's Transport Strategy sets out the approach for achieving the Mayor's transport vision: that London's transport system should excel among those of global cities, providing access to opportunities for all its people and enterprises, achieving the highest environmental standards and leading the world in its approach to tackling

[151] Cf. Transport for London Online (07.01.2010)
[152] Cf. London Transport Museum

urban transport challenges of the 21st century. The strategy is to combine a reliable train service with the highest standards of customer care. Unfortunately the historical under-investment in the Underground has left it with unreliable and out-dated infrastructure. To overcome the legacy of this LUL has embarked on a massive investment program to deliver the extra capacity needed to keep pace with rising demand. The level of renewal and refurbishment work is on a scale unseen for more than 60 years.[153]

3.3.3 DESIGN STUDY

The acquisition of new trains was regulated in the PPP contracts. The long contract period did not bring risky but promising technological developments forward. With the downfall of the PPPs, responsibilities for maintenance and purchase of assets were transferred back to LUL. Technological and economic circumstances have changed. Future oriented managers at LUL consider modern alternatives to the existing conservative rolling stock technologies. The main drivers for change are according to LUL[154]:

- Demand growth
- Environmental targets
- Financial constraints
- Passenger expectations

Hence, a modern train concept should meet the following requirements:

- Optimized for capacity:
  In 2008 LUL experienced a passenger increase of 7%[155]
- Low energy consumption and high energy efficiency:
  In fact, LUL is the largest consumer of electricity in London and traction energy accounts for 85% of LUL's CO2 Emissions[156]
- Affordability: The downfall of the PPPs was very cost intensive and left debts
- Comfort and reliability: passenger satisfaction is very important in London

LUL commissioned a consulting company which developed in cooperation with universities an idealized train concept and invited the leading train manufacturers to take part in a design study. Goal of this study was to examine the applicability of new technologies for the deep tube bored Bakerloo and Central line and the feasibility to achieve potential benefits and quantitative targets. The non-binding character of the design study enables to overcome the risk-barriers for innovations experienced in the normal tendering procedure and delivery contracts.

Contracts to Alstom, Siemens and Bombardier: The invitation to tender for taking part in the design study started in May 2009 and in July the contracts were awarded to three different companies in different depths. Alstom and Siemens developed the entire scope whereas

[153] Transport for London Online (28.07.2010)
[154] London Underground Ltd. presentation
[155] Ibidem
[156] Ibidem

Bombardier concentrated on the bogie concept. This conforms to the declaration of a LUL Manager that the emphasis, also for awarding a new contract, lays in the bogie design.

Five Milestones: The Design Study was divided into five milestones with presentations from the suppliers and a feedback from LUL. The final milestone was due on the 29. March 2010. The last evaluation took Parson, the consulting company, and LUL longer than expected and was subdivided into a bogie concerned and later a car design focused feedback presentation which took place on 29th October 2010.

Results: The evaluation of the suppliers' proposals showed that most of the expectations according energy efficiency, lower bogie life cycle costs and modern car body design can be fulfilled by the manufacturers. LUL committed that they will definitely not go for a conventional train design in the future but instead for a modern concept. According the Siemens bogie design the external project manager of the design study project stated that he has a feeling that Syntegra is not the first choice. Siemens is best in most of the other points like car body and articulating concept. In Siemens shoes he would develop Syntegra further to be able to offer a 2nd generation Syntegra alongside the "conservative" Syntegra solution which consists only of proven design. In demand is especially a steering concept. He acknowledged, that with Syntegra, Siemens offered not just a draft, but a relatively proven design, whereas the competition showed so far never realized or tested drawings, maybe promising more than they will be able to keep.

Next Steps: The insecure financial situation and new elections which led to a governmental change in May 2010 led to a deceleration of the intended next steps: the start of a tendering process for a prototype and further on new trains. In the final feedback of the design study LUL declared the intention to keep the collaboration with the suppliers on-going and to introduce new trains either on the Bakerloo or the Piccadilly line in 2018.

3.3.4 THE BUYING CENTRE

An analysis of the Buying Centre according the roles defined in chapter 2.1.2 is made hereafter, answering the question: Who holds which role?

Initiators: The crucial points of the initiative for a buying process are on the one hand the dying assets who need to be replaced due to their age and therefore an inefficient demand in maintenance efforts. On the other hand urbanization, tourism and congestion of the streets trigger a capacity increase whereon the Mayor has to react to. In London the Mayor's transport strategy paper initiates major investments.

Users: The users of the product are the passengers. The public opinion influences attributes of the trains depending on the bogie design as well. Directly, like requirements in riding comfort and acoustics, but also indirectly if an air condition or a higher amount of seats increases the axle load. This has an influence on the decision of LUL for or against Siemens as the supplier.

Influencers: Malcolm Dobell, Head of Train Systems at Transport for London visited Graz and was very impressed by the Syntegra solution. He initiated the design study to find out how modern technology can be used to design a more efficient train. He personally supports attempts to use Siemens as a future supplier. His early retirement might weaken the relationship between Siemens and LUL.

Parsons Group International Limited consulted LUL on train system optimisation. It is most likely that they influence the technical specification with their know-how and opinion. In discussions the project manager of Parsons seemed to be convinced of the passive steering concept to mitigate wheel/rail wear in an extend that justifies the extra effort.

At LUL reintegrated PPP employees which have formerly worked for the competition might influence the invitation to tender in their favour.

Deciders: The assessment of the technical and commercial offer is conducted by various teams which are only responsible for a special area and are not allowed to have prior consultations or arrangements. The results are reconciled at a single blow to ensure an independent and fair evaluation process. The weighing of commercial factors like price and life cycle costs but also of technical factors like track wear, efficiency of the HVAC system, capacity and design can only be estimated from personal discussions with the customer so far.

Iain Flynn, Lead Sponsor of Train Systems & Upgrades at London Underground a former manager at Metronet and consultant of Alstom[157] decides on the funding of the bid procedure and prototypes. The financing of the next invitations to tender is also attributed to him.

Approvers: The mayor has the responsibility for the city transport and signs contracts worth over GBP 50.000. The London Assembly has to approve the mayor's and TfL's decision.

Buyers: London Underground defines the specification, decides about prototyping, sets the timeframe, leads through the bid procedure and prepares the decision.

Gatekeepers: Single employees of London Underground could act as gatekeeper if they have a preference for one of the competitors or personal prejudices against the performance and the appearance of Siemens. Attention also has to be put on the knowledge and competences of the regional sales personnel.

3.3.5 NETWORKING ACTIVITIES OF THE CUSTOMER

Employees of Transport for London and London Underground are active in various associations. They appear as speakers at seminars or as participants on various events. This can be seen as a great opportunity to get in touch with the customer. Examples of the activities are listed below:

[157] Cf. Linkedin Online (28.03.2011)

- The Chartered Institute of Logistics and Transport (CILT) - Mike W. T. Brown, Managing Director of London Underground speaks about the topic “Upgrading the tube whilst keeping London moving” in March 2011.[158]

- The Institution of Railway Signal Engineers (IRSE) – At a young member Seminar in 2010 two speakers were from LUL speaking about the Victoria line upgrade and the introduction of the S-Stock trains. [159]

- The Institute of Engineering and Technology (IET) – Ian Fisher, Senior Project Engineer from LUL spoke about London Underground’s new trains in December 2010.[160]

3.3.6 FINANCING MODELS FOR PUBLIC TRANSPORT

Public transport has various sources of financing. Before special business offers can be offered, this chapter shall shed light on the options a government has to finance their services. Hans RAT, UITP Secretary General lists the following eight possibilities in a paper about financing public transport:[161]

1) Fare Collection

Due to the pricing policies of public authorities creating prices, not in relation to the performance supplied supporting, fares usually do not cover the expenses. Special groups such as students, children, elderly people and disabled get special tariffs and people travelling longer distances are not charged in relation to the used infrastructure.

2) Charging third parties

To use infrastructure and rolling stock external users can be charged. This includes property rentals of shops in and around public transport stations.

3) Public Funding

Since the first two methods often do not enable the full recovery of the costs public funding has to compensate the rest. Public budgets are usually very restricted which led to the introduction of new innovative sources of financing, such as:

4) Collecting money from public transport beneficiaries:

Employers benefit from a bigger pool of employees, retailers have bigger markets, land promoters and real estate owners win from increase land and housing prices. The so called land value capture levy names the increase of property prices if made accessible resulted from investments and new development of transport connections.

[158] Cf. The Chartered Institute of Logistics and Transport UK Online (11.11.2010)
[159] Cf. The Institution of Railway Signal Engineers Online (10.09.2010)
[160] Cf. The Institution of Engineering and Technology Online (20.09.2010)
[161] Cf. Rat (2008) p.55ff

5) External cost principle

Public transport competes with road users for public investments. The ineffective, polluting and congesting private transit gets charged for road use and parking to discourage the use of cars. These tolls help to finance infrastructure updates. A special form for urban areas is the congestion charge as realized in London, Stockholm and Singapore. Acceptance of these charges varies. On the one hand, some people are claiming the restriction of their personal freedom, but on the other hand a partly relief of air pollution and jammed roads convinces moaners.

6) Public Private Partnership (PPP)

These long term deals between private sector consortia and the government to design, build and maintain public transport infrastructure have been realized in many countries with more or less success. The consortia consisting of building and maintenance contractors, banks and operators usually found special companies. It is a way of sharing commercial risks and to raise capital for investments. Chapter 6.3.1 depicts the way it has been conducted in London.

7) Private Finance Initiative (PFI)

Based on the privatisation of public assets the PFIs guarantee service via a contract.

8) Carbon Trading

The Kyoto Protocol enabled three versions of carbon trading deals. Two of them could be used to finance public transportation. The *Clean Development Mechanism* (CDM) supports emission-reduction projects in third world countries financed by industrialized countries with the benefit of certified emission reduction credits. The *Joint Implementation* (JI) is a scheme that allows one country to count results on emission reduction investments in another country for its own good, earning emission reduction units. These certificates help countries which signed the Kyoto protocol to achieve their commitments. Although the Kyoto protocol framework only runs until the end of 2012, the JI and the CDM programs are long-term and continue to exist.[162]

[162] Cf. United Nations Framework Convention on Climate Change Online (29.01.2011)

3.4 THE COMPETITION

The companies which have already supplied rolling stock and currently hold maintenance contracts with LUL are Alstom and Bombardier. The most likely intruders are, apart from Siemens, the Spanish Construcciones y Auxiliar de Ferrocarriles (CAF) and the two Japanese manufacturers Hitachi Ltd. Transportation Systems and Kawasaki Heavy Industries Rolling Stock. This estimation is based on the fact that these companies have been invited to the design study and their ability to produce and supply Metros in such a high density as needed in London. Bombardier and Alstom are the largest competitors as long-term incumbents; therefore the two companies are described in detail. A short analysis of the possible market entrants follows. The access to information about the possible technological solution for the Londoner Metro-market of the competitors is very limited and is partly based on news articles and the companies' web appearances.

3.4.1 BOMBARDIER

Bombardier is operating in two main sectors: Aerospace and Rail Transportation. With their excessive acquisition politics – in the last decades they bought more than 20 different companies designing and manufacturing railroads such as MAN, Wegmann, Henschel, SLM, BREL and Waggon Union - they are now the world leading supplier of rolling stock. [163]

Facts and Figures[164]

Sectors:	Aerospace, Rail Transportation
Headquarter:	Montréal/Canada
Founded:	1942
Sales	USD 19.4 bn
Orders	USD 43.8 bn
Employees group worldwide/ Rail Transportation:	62,900/33,800

Place

Bombardiers headquarter is in Montréal, Canada and they have several sites in the UK. In Derby there are three factories including a bogie production centre. The new Victoria Line for London Underground is built in Derby.[165]

Bombardier runs maintenance depots in the whole UK and in London: Ealing Common Depot, Euston House; Hornsey Train Service Centre; Northumberland Park Depot (for the new Victoria Line) and the Selhurst Depot.[166]

[163] Bombardier Bogie Forum Online (18.02.2010)
[164] Cf. Auszug aus dem Geschäftsbericht Bombardier per 31.01.2010
[165] Cf. Rail professional Online (10.11. 2010)
[166] Cf. Bombardier Online (10.11.2010)

Bombardier has three main bogie production sites in Siegen in Germany, Crespin in France and Savli in India. Bogie frames for Siegen and Crespin are produced in a specialized facility in Hungary. In total Bombardier Bogies has an annual production capacity of about 5,000 bogies.[167] Derby, the business area bogies is represented with an engineering centre and conducts several projects especially for London Underground and the Asian market.[168] In October 2010 Kulveer Ranger, the transport advisor for the Mayor of London and therefore Boris Johnson's director of transport policy, visited the production site in Derby.[169]

Contracts in the UK: Bombardier supplied several intercity trains including ELECTROSTAR EMUs, TURBOSTAR DMUs and Voyagers DEMUs to English rail operators. The light rail vehicle CITYFLO 150 has been supplied to the City of Manchester and a 100% low floor vehicle for Nottingham. Not least due to the fact that Bombardier remains as the only train manufacturer in the UK they are highly established in the market.

Contracts in London: In London Bombardier sold 1758 cars (see chapter 3.1.3 about the market size) which are currently being introduced. In the year 2000 24 FLEXITY SWIFT light rail vehicles have been supplied within a PFI Contract to Tramlink London Croyden. For Gatwick Airport, Bombardier replaced the interterminal transit system with their INNOVIA automated people mover concept.

Metro Orders: Apart from the London contract Bombardier recently received orders for 1000 cars in China and another 340 cars for Delhi Metro in India. In Montréal Bombardier managed to convince local politics to award the contract for new metro cars for the Metro to them as local suppliers, without inviting others to tender. Alstom sued against this procedure and won. The whole contract, published 22 October 2010, for the delivery of 52 trains consisting of 9 cars was about 869m Euro (1.19 bn Canadian Dollar). Bombardier’s share is 525m Euro. Construction, production and assembly will be conducted at the sites in La Pocatière and Saint-Bruno in the Canadian province of Québec.[170]

Design Study: Based on the evaluation criteria of the consultant company Bombardier made a good performance with the bogie solution handed in. One reason for the good rating was the mitigated track wear this bogie is supposed to cause.

Product

The metro platform of Bombardier is called MOVIA. FLEXXBogies is the overhead brand portfolio for Bombardier railway bogies. FLEXXMetro bogies are the special urban solution. According their website, 20,000 FLEXXMetro bogies are currently in service. There are three different design approaches:

- FLEXXMetro 1000: light weight metro (9 to 12t axle load) which is used e.g.: in London

[167] Bombardier Bogie Forum Online (18.02.2010)
[168] Cf. Baur (2006) p.253
[169] Cf. This is Derbyshire Online (22.02.2011)
[170] Cf. Finanzen.net Online (20.01.2011)

- FLEXXMetro 2000 medium weight metro (12 to 16t axle load)
- FLEXXMetro 3000 heavy weight metro (16 to 19t axle load)

All these designs have outside mounted bearings, articulated 'H' frames and are designed for standard gauge.

The latest development of Bombardier in the bogie sector is the FLEXXTronic platform. This mechatronic approach includes an active radial steering concept and tilting technology, actually being tested within the "Green Train" project in Sweden. This concept especially supports high speed vehicles. Adjuvant technologies are FLEXXTrack, a track condition monitoring system, the FLEXXGuide, which is a bogie condition monitoring system and FLEXXTronic WAKO, a roll movement compensation application. According a company brochure, these four innovations can be applied in all FLEXXBogies. Figure 18 shows the FLEXXTronic bogie solution from Bombardier.

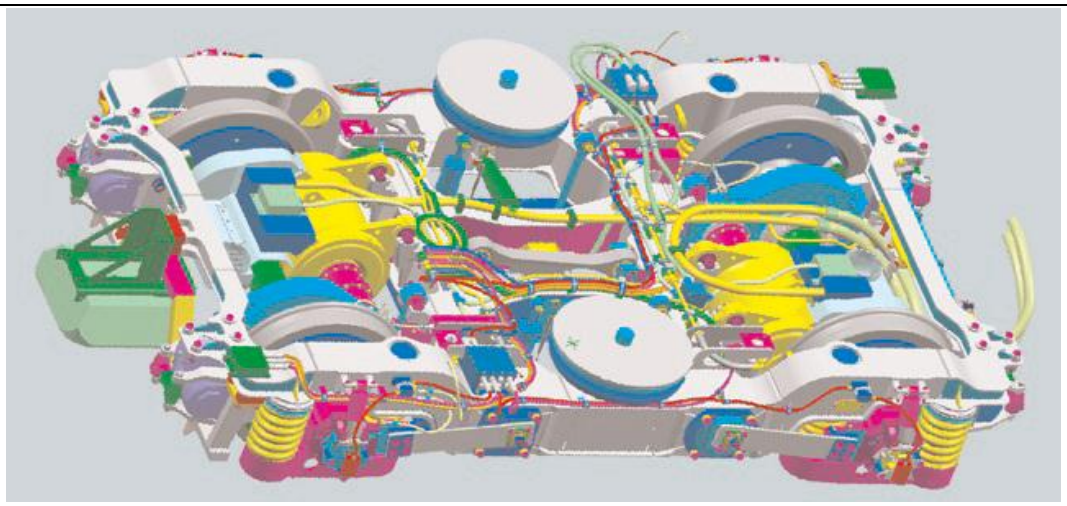

Figure 18: Bogie Solution FLEXXTronic from Bombardier
Source: Bombardier Transportation Online (25.11.2010)

Promotion

Bogie Operator Forum: Bombardier bogies is represented in the Internet with an operator Forum. Members can log in and get special information

Networking in Associations: The Institution of Mechanical Engineers (IMechE) organized an autumn technical visit going to Zurich, Switzerland where the participants visited the Bombardier Transportation AG in central Zurich.[171] The next summer technical visit 2011 of the IMechE Railway Division goes to Sweden and Denmark where not only the Stockholm Metro but again also the Bombardier Manufacturing are going to be inspected.[172] IMechE has a "Railway Division Young Members" group where among others two academics from the customer LUL are active alongside two young engineers from Bombardier Transportation in the UK.

[171] Cf. Institution of Mechanical Engineers Online (20.01.2011)
[172] Cf. Ibidem

Social media: As an example for the use of the internet to support community interests Figure 19 shows the screenshot of a Facebook group with the title “metro de montreal a Bombardier et Alstom”. As per 16th November 2010 1,088 members stated via affiliation to this group their interest in the contract award to the consortium of Bombardier and Alstom.

Figure 19: Screen print of a Bombardier and Alstom supporting Facebook group
Source: Facebook Online

They also used this way of propaganda in the UK to promote the new intercity train contract, arguing with the loss of jobs. Additionally Bombardier launched an official online petition, where even her majesty’s government answered. Evidence can be seen in Appendix D.

Price

In the UK customer attitude survey Bombardier was rated 4.3, outplaying Siemens and Alstom by far.[173]

Strengths:

- Purchase price
- Experience in the market with the Victoria line and the S-Stock contracts
- Production plants in the UK and willing to apply political pressure, because the project saves UK jobs
- Established customer relationship, established network in the UK rail industry

Weaknesses:

- Technical problems and delivery delays on the new Victoria line
- The new Victoria line is perceived as a quite heavy and old fashioned design
- Slightly arrogant market leader behaviour
- Delivery delays on the recent projects and neglected promises

[173] Cf. Siemens UK customer attitude survey managed by Accelerator Solutions Limited, 2009

3.4.2 ALSTOM

Alstom is active in three industry sectors: Power, Transport and the new sector Grid founded in June 2010. The transport division competes with rolling stock, signalling, infrastructure, offering turnkey solutions as well. Alstom is Number 1 in the high speed trains market.

Facts and Figures[174]

Sectors:	Power, Transport, Grid
Headquarter:	Levallois-Perret Cedex, France
Founded:	1928
Sales /Sales in Transport	19.65 bn EUR/5.75 bn EUR
Orders/Order in Transport	14.92 bn EUR/5.48 bn EUR
Employees group worldwide/Transport/ Transport UK:	81,500/27,000/2,000

Place

Alstom Transport is present in over 60 countries and employs some 27,000 people. They recently invested in a 25 % stake in Transmashholding to strengthen their position in Russia.

In the UK, Alstom runs service plants to maintain the tilting Pendolino trains. In Chester Arriva trains for Wales are serviced and Preston has a logistics centre for spare parts. The UK head office is in Rugby. In London, depots in Morden and Golders Green provide maintenance for the Northern Line fleet and on the Stratford Market site for the Jubilee Line rolling stock.

The former Metro-Cammell plant in Washwood Heath (UK) was led by Alstom Transport from 1998. The Pendolino high speed train for UK private train operator Virgin was built there. However the new trains for the Jubilee Line were produced in Spain. Washwood Heath was closed in December 2005 due to a restructuring process of Alstom after making heavy losses with project cost overruns. This led to major job cuts and Bombardier Transportation remaining the only train producer in the UK.[175]

London: In 1994 Alstom was awarded the supply of 106 trains for operation on the Northern Line under a public finance initiative (PFI) the forerunner model of the public private partnership. The contract included a fairly paying compensation for the new trains, but interesting revenues for the 20 years of maintenance following.

The public private partnership Tubelines JNP (see chapter 3.3.1 for details) awarded the contract for the new Jubilee Line to Alstom and they also installed new signalling for the Jubilee Line trains to increase the frequency. Alstom further conducts the maintenance of the 63 trains of the Jubilee Line.

[174] Alstom annual results, as per March 2010
[175] Cf. BBC Online (23.11.2010)

Product

Alstom's Metro solution is called METROPOLIS. On the company homepage Alstom states about their metro business: "*Alstom supplies metros to some 45 cities, with one metro system out of every four worldwide rolling off Alstom's production lines. Today, over 3,000 Alstom metro cars have been sold - carrying more than 1 billion passengers every year.*"[176] The metro is modularly designed offering medium-gauge or large-gauge cars in aluminium or stainless steel. Train sets can incorporate between 3 and 10 cars, each 16 to 25 meters long and 2.6 to 3.2 meters wide.[177]

The Ixege bogie was launched 2009 as a new tram and light low-floor metro bogie at the 58th UITP World Congress and Mobility & City Transport Exhibition in Vienna, Austria. The bogie is designed to improve the ride quality on poor-quality track and is claimed to be the first bogie to combine the ability to rotate with a low floor. A permanent magnet is installed outside the bogie. The first application of Ixege will be on 36 trams being built for Istanbul and 31 Citadis Dualis tram-trains for SNCF.[178]

Alstom promotes sustainability traction with permanent magnet motors (PMM) and IGBT inverters with a power/weight ratio of more than 1 kW/kg and an efficiency ratio of 98%. The PMM Stator has an increased number of poles; the PMM Rotor has a low resistivity of magnets. The concept is air self-ventilated and totally enclosed [179] The PMM have been tested as prototypes in 2004 but have also already managed the market introduction in the AGV. The Italian private rail operator Nuovo Trasporto Viaggiatori (NTV) purchased 25 AGV trains and the PMM motor will also be installed in the 22 Coradia Polyvalent regional trains which will be supplied to Auvergne and Poitou-Charentes in France.[180]

Metro Orders: In the last ten years, METROPOLIS Metros have been supplied amongst others to Barcelona Line 2 (Spain), Shanghai and Nanjing (China), Singapore, Santiago (Chile), Paris (France) and Budapest (Hungary). In 2002 Alstom, in partnership with Kawasaki Heavy Industries, has entered the underground market in the City of New York (US), with a contract containing the delivery of 400 R160 subway cars. New York City Transit (NYCT) has also made demands on further options increasing the share of Alstom to a delivery of 1,002 metro cars. The design is for heavy capacity and contains an alternating current propulsion system and a stainless steel body structure.[181]

Alstom's share of the EUR 869 m contract for the Metro Montréal is EUR 344 m with contribution of the sites in Sorel-Tracy und Montréal. This was only possible after suing to be let into the agreement, whereupon Bombardier and Alstom built a commercial consortium.[182]

[176] Cf. Alstom Online (12.12.2010)
[177] Cf. Alstom Metropolis Image Folder (2008) p.5
[178] Cf. Railway Technology Online, (18.11.2010)
[179] Cf. Alstom Online (12.12.2010)
[180] Cf. Finanzen.net Online (20.01.2011)
[181] Cf. Alstom Online (20.11.2010)
[182] Cf. Montreal Gazette Online (20.11.2010)

Promotion

Forum: To push their new tram platform Citadis-Dualis, Alstom organized a tram-train forum including a trip on their test track in Valencienne, a visit of the production and assembly workshops.[183]

Networking in associations: Organized by the Institute of Engineering and Technology[184] Simon Groom an employee at Alstom Transport speaks about the Alstom AGV High Speed Train at a meeting next March 2011. This shows that Alstom is also actively networking in the UK.

Web 2.0: Alstom's fans, customers and employees can follow new developments like contract conclusions, financial figures and publications on twitter and Facebook. On Facebook Alstom has a group with 3,960 members (as per January 2011). Videos are spread via their own YouTube Channel, which exists since 2006,[185] the French Video platform "Dailymotion"[186]. There also exists the beta version of an Alstom WebTV.[187]

Corporate Social Responsibility: 2007 Alstom established a foundation which supports communities worldwide, but especially in developing countries, in projects which improve and preserve the environment. Whereas 2008 the projects where published with videos and 2009 new projects were announced on the homepage, there are no further projects listed for 2010 and 2011.[188]

Price

In the UK Alstom is perceived as average pricy, positioned between Siemens and Bombardier. In the customer survey they had a price rating of 3.7 (1 is extremely poor and 6 is extremely good).[189]

Strengths:

- Experience in the market with the Northern line and the Jubilee line contracts
- Aggressive defense of the market share
- Established Customer Relationship, good network

Weaknesses:

- Very average performance on the design study

[183] Cf. Alstom Online (12.01.2011)
[184] Cf. The IET Online (20.11.2010)
[185] Cf. Alstom Online on Youtube (21.11.2010)
[186] Cf. Alstom Online on Daily Motion (20.11.2010)
[187] Cf. Alstom webtv Online (20.11.2010)
[188] Cf. Alstom Foundation Online (20.11.2010)
[189] Cf. Siemens UK customer attitude survey managed by Accelerator Solutions Limited (2009)

3.4.3 HITACHI LTD

Hitachi Limited is a Japanese multi-business company operating in the following sectors:

- Social Infrastructure & Industrial Systems
- Information & Telecommunication Systems
- Power Systems
- Electronic Systems & Equipment, Construction Machinery
- High Functional Materials & Components
- Automotive Systems, Components & Devices
- Digital Media & Consumer Products
- Financial Services

The subsidiary Hitachi Transportation is in the railroad business. Hitachi was invited to take part in the design study but refused.

Facts and Figures

Sectors:	see above
Headquarter:	Tokyo, Japan
Founded:	1910
Net Sales	1,938.8 billion YEN[190]
Revenues / in Transport	8,969 bn YEN/ 1,250 billion YEN[191]
Employees group worldwide	359,746

The rail group headquarter for Europe is in London.

UK Orders: On the 12th Feb 2009 Agility Trains a consortium between the shareholders Hitachi and John Laing, an infrastructure company was selected as the preferred bidder for the Intercity Express Programme. Hitachi has entered the UK market by delivering high speed trains to HSBC Rail Ltd. and London & South Eastern Railway Limited. [192]

Following the contract of CTRL-DS Project (Channel Tunnel Rail Link for Domestic Service), Hitachi established Hitachi Rail Maintenance (UK) Ltd in Ashford, starting its maintenance operation from October 2007. [193]

The Product range of the Transportation sector includes:

- Rail Vehicles
- Signalling

[190] Cf. Hitachi Online (31.01.2011) fiscal year 2010
[191] Cf. Ibidem
[192] Cf. Hitachi Rail Online (30.09.2010
[193] Cf. Ibidem

- Monorail System
- Rolling Stock Components
- Power Supply.

According the company homepage Hitachi developed a linear motor system with a non-adhesive drive for metros, which they delivered to several Japanese operating companies. This technology enables a smaller clearance diagram which would fit to the deep tube lines having to cope with limited space. However, the introduction of this product requires major amendments in the infrastructure, due to the reaction plate which has to be installed between the tracks. Apart from that, Hitachi's core competences are located in the field of advanced commuter and express trains, tilting technologies and high speed trains.

Metro Orders: Metros have been delivered especially on the Japanese market, but also to Porto Alegre Brazil, Atlanta (USA).[194] In a consortium with Yongji Xinshisu Electric Equipment Co., Ltd and CNR Changchun Railway Vehicles Co., Ltd a contract was awarded 2008 for the supply of 168 EMU's to be used in the Shanghai Metro network.

Customer Perception: According the Siemens UK customer survey Hitachi had the best average rating, especially leading with a very good rating in the categories price; on time delivery; and lifecycle value for money. Hitachi was perceived as best in class of understanding the customer, quality of product and flexibility as well.[195]

Networking in associations: Paul Cooper, the Commercial Manager of Hitachi Rail Europe, is part of the committee of the Young Railway Professionals as the Institution of Mechanical Engineers representative alongside three members from LUL and one from TfL. His role includes working on new opportunities for rolling stock and railway system products in the UK and Europe, as well as commercial management for bids and existing engineering contracts.[196]

Hitachi had the best **price** performance in the customer survey with an average rating of 5, meaning very good.

Strengths:

- Price
- On time delivery
- Lifecycle value for money and quality of the product

Weaknesses:

- According the survey the customers perceive Hitachi as not so easily accessible
- Lacking track record

[194] Cf. Hitachi Rail Online (20.01.2011)
[195] Cf. Siemens UK customer attitude survey managed by Accelerator Solutions Limited, 2009
[196] Cf. Young Rail Professionals Online (20.01.2011)

3.4.4 CONSTRUCCIONES Y AUXILIAR DE FERROCARRILES, S. A.

Construcciones y Auxiliar de Ferrocarriles (CAF) only manufactures railway rolling stock and focuses on this core competence.

Facts and Figures[197]

Sectors:	only Railway Systems
Headquarter:	Beasain, Spain
Founded:	1917 dating back to 1860
Sales:	1,258 m EUR
Orders:	4,335 m EUR
Employees:	~2,000

CAF's headquarter is in Madrid and also most of the other plants are situated in Spain. In the UK they have a Depot in Belfast but no settlement in London or England.

The product range includes rolling stock such as:

- High Speed Trains; Locomotives
- Regional trains, Commuter trains, Electric Motorcars
- Metro Units, Streetcars and light rail trains
- Turnkey solutions
- Custom-made parts and components
- Maintenance and service offer

Recent developments are:[198]

- The ACR System, an ultra-capacitor based on-board energy storage system offering up to 1200 metres catenary-free operation even for existing systems.
- The BRAVA truck design allows adaption of the bogie to different track gauges.
- ATMS is a bogie monitoring system to improve safety and allow proactive maintenance.
- In the Ecotrans Research Project CAF collaborates with public and private companies to develop urban transit systems for the future in Spain.

UK Orders: In England CAF has delivered trains for the Heathrow Express. CAF tendered for the Piccadilly line and got shortlisted. However the tender got cancelled when the Tubeline PPP got reintegrated at LUL. This means they already showed great interest in the market.

[197] Cf. CAF Online (20.11.2010 a)
[198] Cf. CAF Online (20.11.2010 b)

Metro Orders: In Montréal CAF considered to sue the deal of Société de transport de Montréal (STM) with Bombardier/Alstom in court. But according news reports they are not further challenging the award due to the changes of national law in Quebec.[199]

CAF had further recent deliveries of Metro cars to Rome, Brussels, Madrid and Barcelona.

Strengths:

- Innovative
- Very flexible due to relatively small company structure
- Lower cost of overhead

Weaknesses:

- Lower financial background, than the multi-business competition
- No networking activities in associations or elsewhere in London have been detected.

[199] Cf. Montreal Gazette Online (20.11.2010)

3.4.5 KAWASAKI RAIL CAR

Kawasaki Rail Car is part of Kawasaki Heavy Industries, Ltd. (KHI) headquartered in Kobe. KHI operates in the sectors Shipbuilding, Rolling Stock, Aerospace, Gas Turbines & Machinery, Plant & Infrastructure Engineering, Consumer Products & Machinery and Hydraulic Machinery.

Facts and Figures:

Sectors	see above
Headquarter	Tokyo, Kobe, Japan
Founded	1878
Sales/Sales Rolling Stock	USD 12.6 bn/USD 1.8 bn[200]
Orders/Orders Rolling Stock	USD 10.8 bn/USD 829.4 m
Employees	32,300[201]

KHI has a subsidiary in London in St. Helens Place. Kawasaki Rail Car has no a special site in the UK. A statement about price formation cannot be given due to lack of information. The rolling stock fleet includes:[202]

- subway cars, light and heavy rail cars; commuter bi-level and single level cars
- Shinkansen alias Bullet train, a high speed train operating in Japan
- Maglev trains, mass transit vehicles based on a propulsion system which uses magnetic levitation to lift and drive vehicles

Kawasaki is experimenting on hybrid propulsion systems using storage-battery technology.

Metro Orders: Kawasaki supplied bogies for the 1992 Tube-Stock for the Central and Waterloo & City Lines. Therefore they already have some experience with special conditions in the London Underground System. However these bogies cause a lot of problems and even caused a derailment. The independent report for LU said inspections after the previous incident failed to identify the gearbox failure which had caused a traction motor to fall off.[203] Siemens won the refurbishment contract for the repair of the gearboxes. These problems could mean a huge loss of trust in the reliability of Kawasaki products at LUL

They recently won a manufacturing contract for 428 new generation Metrorail cars known as the Series 7000 cars at a cost of $886 million for Washington Metro. They were selected based on having the best overall technical proposal, as well as the lowest cost. The delivery schedule calls

[200] Cf. KHI Online (19.02.2011)
[201] Cf. KHI Online (20.02.2011)
[202] Cf. Kawasaki Rail Car Online (20.02.2011)
[203] BBC Online article from 11.05.2004 (21.01.2011)

for the cars to start arriving on Metro property in 2013, and undergo a rigorous, months-long inspection process.[204]

Strengths:

- Experience with delivering bogies to London Underground
- Track record in New York

Weaknesses:

- Problems on the Central and Waterloo & City line bogie frames and gearboxes which caused huge repair cost and outfalls
- Not easily accessible for the customer
- No networking activities in associations or elsewhere in London have been detected

[204] Cf. Washington Metropolitan Area Transit Authority Online (20.02.2011)

3.5 THE MACRO-ENVIRONMENT

The customer, Transport for London and his subsidiary London Underground Ltd., operate within a special environment. This surrounding not only affects him, but also all the competing suppliers. To list possible influencing factors for any kind of business partnership, the macro-environment is analysed according the PESTEL-model as described in chapter 2.1.1.

3.5.1 THE POLITICAL ENVIRONMENT

With a population of 7.6 million people in mid-2008 London is the biggest metropolitan area of Europe.[205] Queen Elizabeth II is the sovereign and has the executive authority in a constitutional monarchy. The last elections for her majesty's government were held 6th May 2010 and brought a coalition of Conservatives and Liberal Democrats. The change of the governing parties brought a spending review. The treasurer negotiated the cuts of the budget including public investments such as spending on new rail infrastructure. Due to the economic value of the tube for London, but also for the whole country, the government spared the tube upgrade programme from austerity measures.[206] The next elections have to be held within the next five years. Therefore, the risk of changing governments and with it changing financial support of the public infrastructure projects has to be kept in mind.

3.5.2 THE ECONOMIC ENVIRONMENT

Economic growth: London is the financial centre of Europe and was struck by the 2008 financial crisis and the following economic crisis very strongly. The graph in Figure 20 shows the development of the gross domestic product.

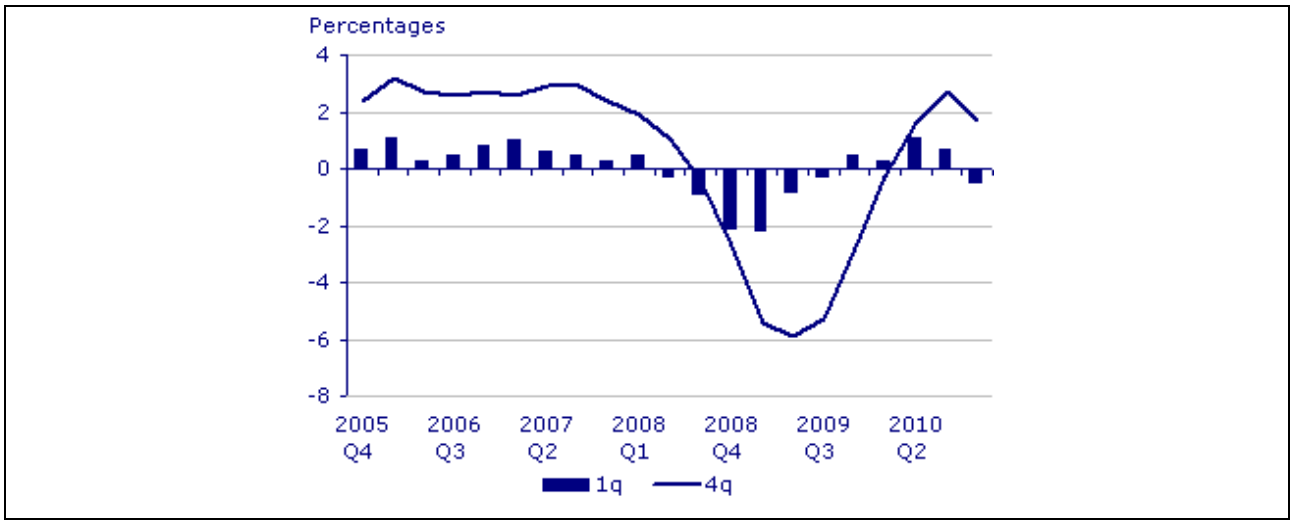

Figure 20: Development of Gross domestic product from 2005 to 2010
Source: Office for National Statistics Online (20.01.2011)

[205] Cf. Office for National Statistics Online (18.01.2011)
[206] Her Majesty's Treasury Online (12.11.2010)

Although the economy seems to recover, in the fourth Quarter of 2010 the GDP decreased again by 0.5%.[207]

Exchange rate: The UK is not part of the European monetary union and still has the Great Britain Pound (GBP). In the last five years, the exchange rate of Euro to GBP fluctuated between 0.66 and nearly 1 Pound per Euro (GBP 0.9742 in December 2008).[208] Because of the long time between the first negotiations and the final contract conclusion currency fluctuation risks have to be taken into account.

Consumer Price Index (CPI): As an internationally comparable measure of inflation, the CPI shows that the UK inflation rate in December was above the provisional figure for the European Union. The UK rate was 3.7 per cent whereas the EU's as a whole was 2.6 per cent.[209]

Unemployment rate: In the period of October until December 2010 the UK had an unemployment rate of 7.9%. This figure has been stable in last year.[210]

3.5.3 THE SOCIAL ENVIRONMENT

Passenger satisfaction: Passenger comfort and acceptance is a big issue. London Underground conducts bigger customer surveys each year, but also on-going ones throughout the year.[211] A big issue for Londoners is the fact that the current deep tube stock has no air conditioning system installed. In 2006 the BBC reported measurements with temperatures of up to 47°C on the Central line.[212] In case of a longer stoppage, such high temperatures could pose a lethal threat, especially for elderly people. Passengers are also used to a high number of cushioned seats; otherwise acceptance of a new train would extremely decrease.

Ageing: According the office for national statistics, the population of the UK is ageing: by 2034, 23 per cent of the population is projected to be aged 65 and over compared to 18 per cent aged below 16.[213]

Urbanization: From 2003 to 2008 the population of London increased 3.5 per cent compared to 3.1 per cent in the whole UK. [214]

Unions: The National Union of Rail, Maritime and Transport Workers (RMT) is Britain's fastest growing trade union, representing more than 80,000 members in almost every sector of the transport industry, from mainline and underground rail to shipping and offshore, buses and road freight.[215]

[207] Cf. Office for National Statistics Online (20.01.2011)
[208] Cf. The European Central Bank Online (12.11.2010)
[209] Ibidem (25.02.2011)
[210] Cf. Ibidem (18.02.2011)
[211] Cf. Transport for London Online (27.02.2011)
[212] Cf. The British Broadcasting Corporation Online (12.08.2010)
[213] Office for National Statistics Online (18.01.2011)
[214] Ibidem
[215] The National Union of Rail, Maritime and Transport Workers Online (20.01.2011)

In 2010 Transport for London had a lot of troubles and outfalls due to tube drivers striking.[216] This further fuels the debate for driverless trains.

3.5.4 THE TECHNOLOGICAL ENVIRONMENT

Various technological changes are influencing the business case. Most important are **Innovations in processes and production techniques:** Cost efficiency competition in the industry led to the automation of production processes. In modern bogie production sites welding robots gain importance. The automation of production steps led to the increasing demand for common parts. The shortening of lead times triggered the current trend to change from project specific design to the development of product platforms.

Materials: The trend for environmental friendliness led to light weight developments challenging the material standards. Composite materials and aluminium become more and more interesting as alternatives to steel, not least due to the price advantages. The popularity of permanent magnetic motors rose due to the improvement, the increasing stability and especially the affordability of permanent magnets. The higher energy density of the new magnets e.g. of NdFeB, as shown in Figure 21, enables high-torque-drives.

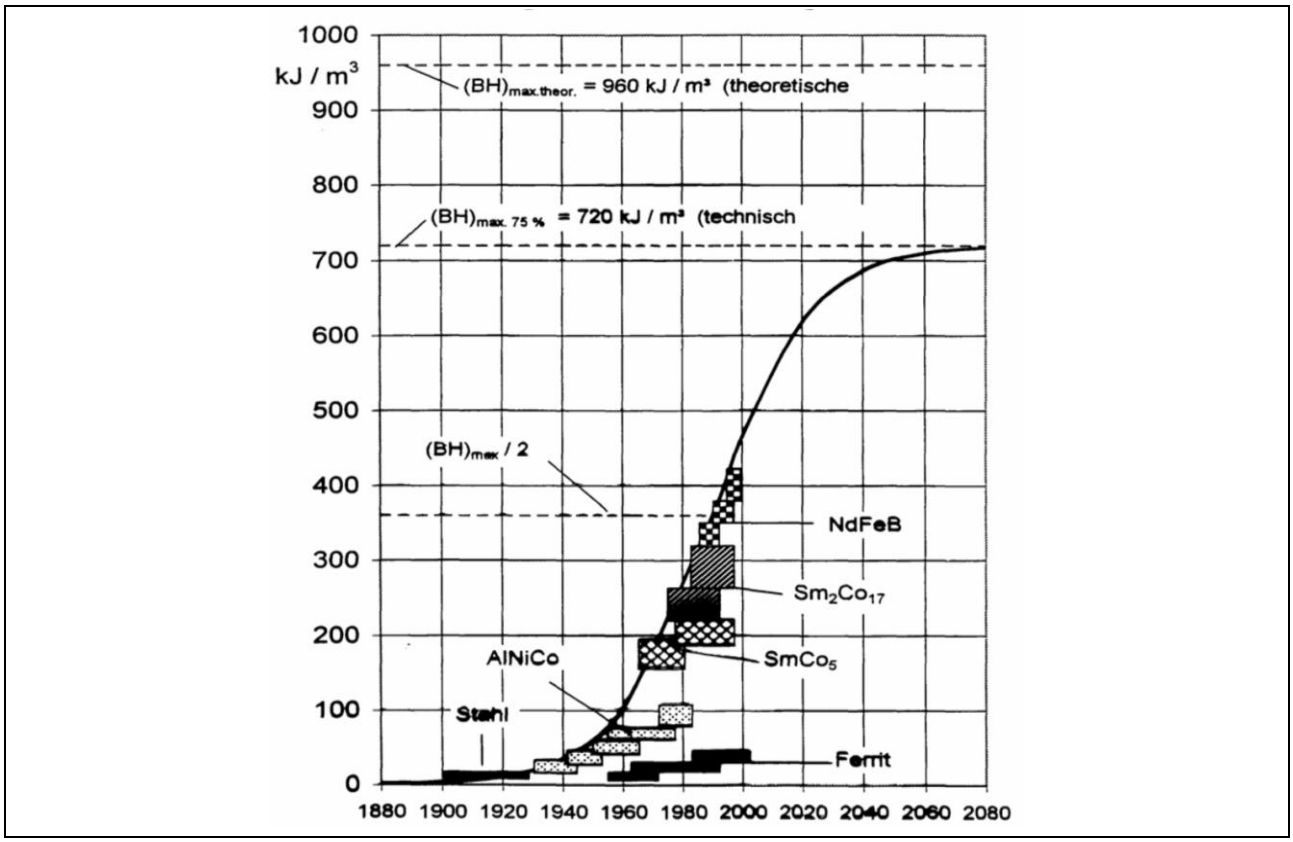

Figure 21: Development of permanent magnets and the future potential
Source: Siemens internal presentation

[216] Cf. The British Broadcasting Corporation Online (15.12.2010)

3.5.5 THE ECOLOGICAL ENVIRONMENT

Energy consumption: In 2009/10 the total of the electricity supplied to London Underground was 1,163 GWh with a renewable energy percentage of 17 per cent. Each tube passenger produced 78.9g CO2 per km travelled.[217]

Pollution: As depicted in Figure 22, the total greenhouse gas emissions in the UK fell 8.1 per cent from 1990 to 2003, whereas the emissions due to transport and communications rose by 48.4 per cent. This field bears a high emission reduction potential.[218]

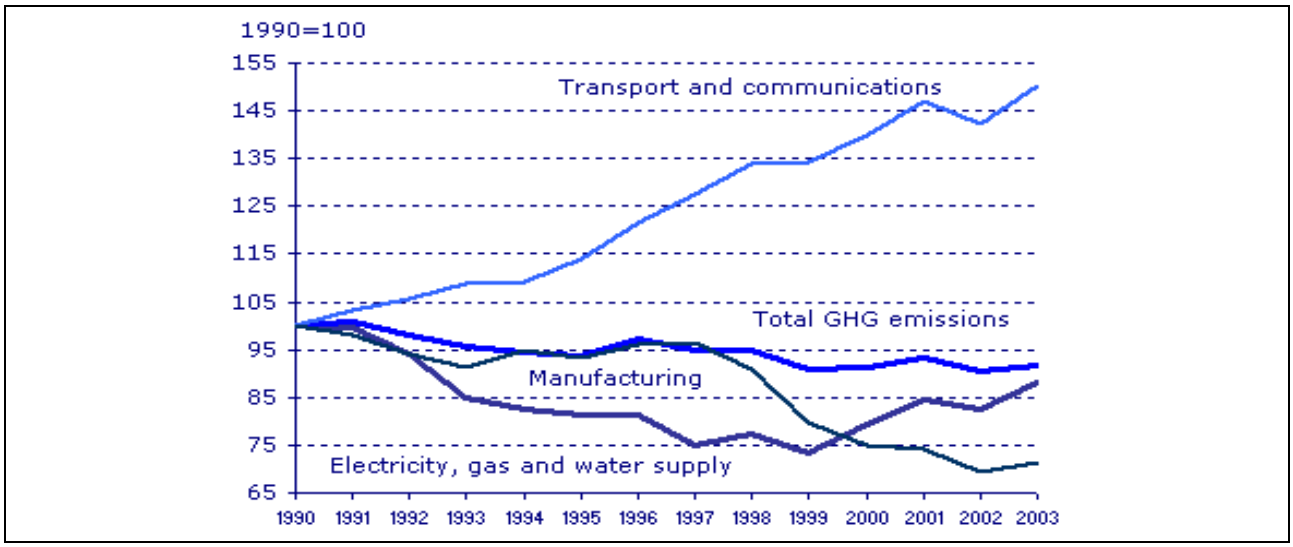

Figure 22: Greenhouse gas emissions in the UK, 1990 – 2003
Source: Office for National Statistics Online (18.01.2011)

3.5.6 THE LEGAL ENVIRONMENT

Legal standards and taxation: are in accordance with the EU law. The office of rail regulations sets the safety standards and is responsible for the approval process.[219]

Congestion Charge - City tolling system: To liquefy the jammed streets in London and to reduce air pollution, Ken Livingston, the former Mayor of London introduced a congestion charge for motorised driving within special city boundaries in 2003. The daily charge is 10 GBP but there are exemptions among others, for greener vehicles emitting below 100g/km of CO2, hybrid and electric vehicles. The introduction of this city tolling system also led to a slight increase of people using public transport instead.[220]

[217] Cf. Transport for London, Online (03.11.2010)
[218] Cf. Office for National Statistics Online (18.01.2011)
[219] Cf. Office of Rail Regulation, Online (25.02.2011)
[220] Cf. Transport for London, Online (25.11.2010)

3.6 PORTER'S FIVE COMPETITIVE FORCES

This chapter analyses the strength of the competitive forces in the business case, based on the theory described in chapter 2.1.5. An overview of the players in the market is given in Figure 23. The estimation of the strength of the various actors is based on the competition and customer analysis but also on discussions with Siemens employees.

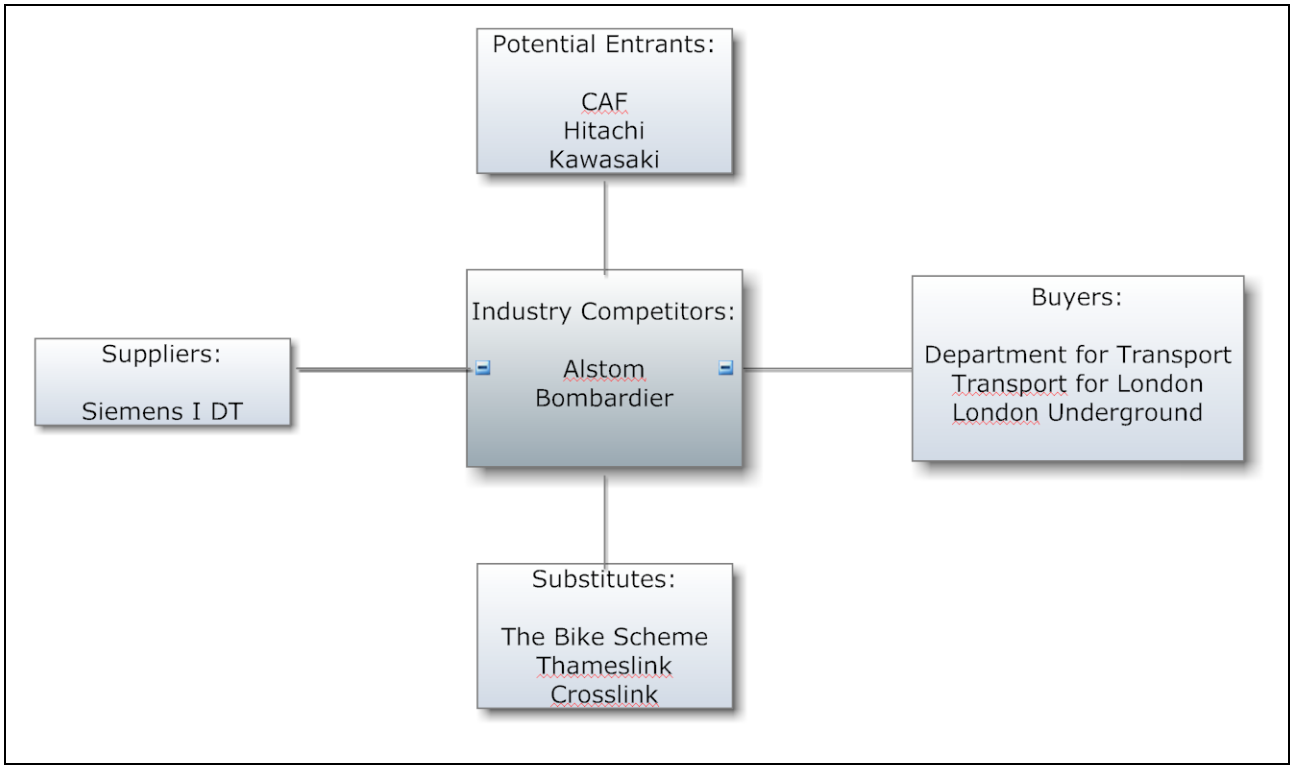

Figure 23: The five competitive forces in the Business Case
Source: own, based on Porter M. (2004) p. 6

3.6.1 BARGAINING POWER OF THE CUSTOMER

The London Underground System is the oldest in the world. But selling rolling stock to LUL is not only a prestigious business, but due to the overall purchase volume a huge chance to increase market share in the metro market. Hence, a lot of manufactures are interested to make business with LUL. This big rivalry would very likely lead to a price war, with the customer as the real winner. LUL is aware of this situation and is currently evaluating the different procurement models to ensure that competition is held up as long as possible. The model shall encourage manufactures to invest in the development of a sophisticated solution upfront to mitigate the risk of on rail adaption and failures due to immature design. A too extensive procurement process could also alienate smaller and financially less stable producers. Overall, the bargaining power of the customer can be estimated as extremely high.

3.6.2 RIVALRY WITHIN THE INDUSTRY

Past market activities and the participation in the design study can be seen as a major advantage for further bidding activities. It will be hard for other companies to close the gap. Assumptions about the rivalry within the industry are based on the competitors' relation to the customer and their urge to win the business case

Bombardier will definitely fight strongly to keep their market share. This is beyond others due to the good channels to the customers and political influence in their local employer role. Recently published articles which accent the continuous growth of Bombardier in the UK market underline the importance of new contracts and orders to ensure the employment of staff especially in the production site in Derby. The good performance in the design study further enforces this position. Any chosen strategy should be double-checked according possible retaliation from Bombardier Transportation.

Alstom: Although Alstom shows big interest in the project, they have not performed too well in the design study project. According price and energy efficiency Siemens is currently quite competitive.

3.6.3 THREAT OF NEW ENTRANTS - POSSIBLE MARKET INTRUDERS

Hitachi has been invited from LUL for further cooperation. Their effective cost management and their good prices definitely pose a threat. Good references on recent projects in the UK, such as the class 395 show their ability to perform. Alistair Dormer, Managing Director, Hitachi Rail Europe, stated about the project: "*It was an important milestone for us and our first opportunity to fully demonstrate the calibre of our high quality rolling stock that we can offer the UK and Europe*". In a video, he further points out that they want to expand their deliveries to the UK market, offering rolling stock products from Metro to High Speed.[221] Overall Hitachi should not be underestimated as a potential and strong London metro-market intruder.

CAF are strongly innovative and is focused on their core competence - rolling stock. They differentiate from the competitors by not having a big overhead due to a multi-business structure. Hence, they are very flexible and can offer lower prices.

Kawasaki Rail Cars: So far there are no distinct signs of interest from Kawasaki Rail cars in doing further business with LUL.

3.6.4 THREAT OF SUBSTITUTE PRODUCTS

There is no threat of substitute technologies such as monorail or VAL to be introduced in London. These systems demand high infrastructure investment. Based on this reason, also an increase of the tunnel size for the smaller deep bored lines is not very likely to happen in the next 20 years. There is a small threat of substitute projects receiving public funding instead. Other big projects on public transport in London are:

[221] Cf. Hitachi Online (30.11.2010)

The Bike Hire Scheme: In summer 2010 the Mayor's cycle hire scheme was introduced for GBP 140 million, with 6,000 cycles available in central London. The public bike hire system is sponsored by Barclay with GBP 25 million. In the first four month it has proven to be an enormous success. 1.8 million journeys including 20,000 every weekday have been made across the city. The hire scheme will expand further east in time for the 2012 Olympics. When completed, the expanded scheme will cover 40 miles (65km) of the capital and about 8,000 hire bikes will be available.[222]

Crossrail and Thameslink: In 2007 the west to east Crossrail and the north to south Thameslink heavy rail schemes have been approved and are competing for public financial support. They are even partly designed to disburden the London Underground System and shall contribute to cope with the expected passenger growth. Siemens has tendered for the Thameslink heavy rail scheme and is still in the race, but the contract award is still outstanding. The invitation to tender for Crossrail has not been sent out yet, but is expected in March 2011.[223]

3.6.5 BARGAINING POWER OF THE SUPPLIERS

Prices, terms of delivery and special conditions can only be negotiated after the assignment of a contract with a tangible number of pieces. Basically the dependence on external suppliers of technically high developed parts can be estimated as very high. Representative for the whole range of the potential suppliers, the market strength of Siemens I DT and Knorr Bremse Group is evaluated.

Siemens Industry Drive Technology (Siemens I DT): For Siemens I MO RS, main cost drivers of the bogie are the Motor and the Inverter both being delivered from Siemens I DT, which is a partner organisation of Siemens I MO RS and can be seen as an internal supplier. Due to the fact, that they are a monopolistic supplier for the new development the price pressure is very high and there is no competition improving this situation.

Knorr Bremse Group: Knorr is a very strong and international acting supplier of brake systems for railway and utility vehicles. In the last decades they acquired competence in door systems, air conditioning technology, derailment detection and control systems. Operators ask more and more exclusively for Knorr braking systems. This is due to the good end customer relationship Knorr maintains. They further impart creditable that they are competent to deliver reliability for this safety essential product.

[222] The Guardian Online, news article (01.12.2010)
[223] Information from Siemens Managers

3.7 SWOT ANALYSIS

The introduction of Syntegra in London has the strengths, weaknesses, opportunities and threats stated in the table below. This only depicts a first estimation and is based on the market analysis and especially the gathered information from the evaluation of the strategic triangle. Table 13 reflects main arguments and makes no claim to be complete.

Strengths	**Weaknesses**
• Strongly innovative • Tested, tangible solution • Flexible frame, short wheel base • Light weight, small installation space • Energy efficient (gearless PMM drive) • Two independent drives – no unnecessary truing of the second wheel set • Good reputation of German engineers • Track record • Nothing done wrong yet: stable reputation	• Siemens has a big overhead which slows down decisions • The technology driven invention might not be customer focused enough • Four inverters worsen the Mean time before failure (MTBF) • Over engineered • No rolling stock manufacturing site in the UK • Lack of networking activities in the UK
Opportunities	**Threats**
• Demand for sustainable/energy efficient solutions • Differentiation from Competitors, no other company has a direct drive solution • Winning the public • Financial strength • System approach • Performance Contracting • To establish good customer relationship	• Intense Competition • New low price market intruders • Intruders offering marketable supercapacitors or brilliant HVAC solution • Loosing pioneer status with Syntegra to competitors due to slow market launch • Competitors follow the better strategy • Negative perception of the high unsprung masses • High evaluation of active/passive steering concepts • High risks of high grade information and the high amount of units

Table 13 SWOT Syntegra
Source: own, based on assumptions

4 MARKETING STRATEGIES

The highly advanced development stadium of the rail industry globally and especially in the UK makes it difficult to be successful with one specific marketing strategy as suggested by Porter. It rather requires a combination of various efforts to round up the whole picture of a good deal. This chapter describes marketing possibilities in the four P's described by Porter and McCarthy (depicted in chapter 2). It suggests activities which performed together strengthen the position before an invitation to tender has been announced as well as strategies and tactics to pertain a competitive advantage.

As described in the theory chapter, the two basic questions are:

- What brings TfL/LUL benefit?
- What makes Syntegra or any other Siemens solution unique?

To find an answer to these questions, the generic strategies approach also finds consideration: the focus is described in the following subchapter; technological differentiation from the competition is discussed in chapter 4.2 product and the cost leadership, subchapter 4.4 lists possibilities concerning the price.

4.1 PLACE

With a good track record on multiple units in the UK and supplying 16.000 jobs, Siemens is positioned quite well on the UK market. Further reasons for the focus on London to introduce Syntegra and possibilities of designing the distribution policy are described hereafter.

4.1.1 FOCUS

The focus on London to introduce Syntegra as the most experienced and oldest Metro operator in the world is a good strategy because London is perceived as a role model in new developments. Winning London as the key customer, to enter the market with Syntegra is highly prestigious and pursuits the bigger goal to attract other customers.

It is also expected to trigger a change of standards in the tendering process within the entire Metro market if it can be managed to work together with London Underground Ltd. and Transport for London on a new and improved bid invitation model giving modern and energy efficient solutions a chance to win.

The specific technological constraints make it necessary to create a special design, that won't be applicable on any other Metro network in the world. On the one hand, the high number of units still makes this lucrative, on the other hand it bears the threat of high risk contingencies in case of failures.

4.1.2 SALES REPRESENTATIVES

To smooth the way for Syntegra in London it is also important to convince the Siemens sales employees who are directly cooperating with the customer. It is essential to have somebody on site that has the technical background and know-how to mitigate uncertainties of the customer concerning risks. This person further has the task to fully understand the technical specifications and to communicate them back to Graz. An on-going feedback loop between London, Graz and Vienna is inevitable for the success.

4.1.3 LOCAL CONTENT

It is definitely a disadvantage that in contrast to Bombardier Siemens has no bogie production site in England. Political interference for the preservation of jobs is possible. Counter-arguments can be created by an intelligent appearance corroborating the economic force of Siemens in the UK and by strengthening the business case with English suppliers and new investments in the region.

4.1.4 SIEMENS PAVILION

Currently Siemens invests GBP 30 million in a pavilion in East London, set up and built before 2012 – the year when the summer Olympics will take place in this specific area named Green Enterprise District. This completely new building will comprise an exhibition and conference centre. According the company homepage Siemens expects to yearly attract 100,000 visitors to enable community involvement in the discussion about sustainable solutions and green technologies. The Siemens Pavilion (Figure 24) will be base of 230 Siemens employees who will work in buildings covering an area of 3,687m^2.[224]

Figure 24: Design of the Siemens Pavilion to be built in London 2012
Source: Siemens Online (12.12.2010)

[224] Siemens UK Online (22.01.2011)

How to use the Siemens Pavilion for this business case?

This could be a great opportunity to present the new platform with a mock up and to get an early contact point of the future passengers with the new design. Social media can be used to attract people. Especially if the public is involved and asked about individual opinions this has a high potential for customer integration.

4.1.5 NETWORKING

As depicted in chapter 2.2.3, networking is nowadays a helpful tool which has to be used systematically and structured to strengthen the competitive position in a market. The following list of networking opportunities makes no claim to be complete.

Networking opportunities organized by Print Media

- The editor of modern railways magazine James Abbott initiated a railway executives club in 2003, where he is still Club Secretary. The **4th Friday Club** as it is called meets about five times a year for an informal lunch in a Restaurant in London to enable the attendees to get to know each other and to network.[225]

- The RAIL magazine organizes a similar event called the RAIL 100 Breakfast Club.[226]

Associations

The British rail industry and university alumni of the branch regularly meet at events of several associations. The rolling stock sales staff of Siemens plc. in London is the local face to the customer, a participation in events or even as speakers is a possibility to meet with the customer and the whole industry.

A business case related event organized by the Chartered Institute of Logistics and Transport (CILT) for example is going to take place in March 2011, when Mike Brown, Managing Director of London Underground will talk about the upgrade work that is currently being done on London's Tube network in the form of new rolling stock, signalling and stations work as well as preparations and readiness for 2012. An event of interest, organized by the Institution of Mechanical Engineering (IMechE) would be e.g.: the Autumn Technical Visit to Zurich, Switzerland in November 2010 including a site visit of Bombardier Transportation AG. Further, the IMechEs Annual Dinner is a wine and dine event to meet people of the industry.[227]

Some of the very active associations are listed below, Table 14. Most of them are institutes which support academics to achieve their Chartered Engineer title, but operate as area network as well. For their members they offer access to their libraries and to the database of various market researchers. Regular seminars, workshops and events provide further vocational

[225] The 4th Friday Club (20.10.2010)
[226] Cf. The Rail Magazine (12.11.2010)
[227] Cf. The Institute of Mechanical Engineering

training. These occasions enable discussions between participants and a get together of the industry sector.

Associations	
Name	**Details**
The Railway Study Association:	"The Railway Study Association provides a forum for the exchange of experience, knowledge and opinion on issues relating to all aspects of the railway industry."[228]
The Institution of Railway Operators (IRO):	"In brief, the IRO exists to advance and promote the safe, reliable and efficient operation of the railways by improving the technical and general skills, knowledge and competency of those involved in rail operations"[229]
The Young Railway Professionals:	"To endorse Institution organized events which seek to inspire professionals and encourage networking."[230]
The Chartered Institute of Logistics and Transport (CILT):	"CILT UK is the pre-eminent independent professional body for individuals associated with logistics, supply chains and all transport throughout their careers and has 20,000 members."[231]
The Institution of Mechanical Engineering (IMechE):	This association is very active in the transport sector and has a lot of members who are working for TfL and LUL. Malcolm Dobell, Head of Train Systems at Transport for London, has been chairman of IMechE in 2005.
The Institute of engineering and technology (IET):	IET also has a special railway network section including a young professionals group, both organizing events and speeches to rail related topics.

Table 14: Railway related Associations in the UK
Source: Own, based on Internet research

Additional contact possibilities are:

- The London Transport Museum Friends is a charity with over 3,000 members, supporting the Museum and having regular meetings.[232]

[228] The Railway Study Association (12.11.2011)
[229] The Institution of Railway Operators (25.10.2010)
[230] Young Rail Professionals (20.01.2011)
[231] The Chartered Institute of Logistics and Transport (11.11.2010)
[232] Friends of the London Transport Museum (10.10.2010)

- The London Underground Railway Society brings monthly news and has monthly meetings with speakers.[233]

- Fairs usually also offer a good opportunity to get in touch with the customer. Chapter 4.3.4 lists UK fairs addressing the transport industry.

4.2 PRODUCT

The product itself is the core selling point and the main key to meet the customer's needs. The overall package has to differentiate a company from its competitors. Therefore differentiation criteria of the product are discussed in detail, as well as the various possible design concepts and the possibility to test one of these concepts with a prototype on the spot.

4.2.1 DIFFERENTIATION

Possible starting points for differentiation from the competition are quality; time; branding and customer relationship.[234]

Higher quality: In the customer survey, Siemens was performing best in the categories track record, honesty, accessibility of staff and acts best to seem competent, having a lot of expertise. The quality of the product got the rating very good, neck-and-neck with Hitachi. For London Underground the following quality criteria are challenged.

- Functionality: "Journey Time Capability" (JTC) defines the maximised capacity and speed and was required at the last invitation to tender (ITT) – every tube line has a specific score. It is very likely that the new ITT will have these requirements as well.[235]

- Stability: The stability of permanent magnets for the whole life time of a train is not proven yet.

- Reliability: The performance of Syntegra has been tested with the prototype operating in Munich but the whole life cycle reliability cannot be proven without a train on the tracks for the full time. A compromise has to be found together with the customer. If a maintenance contract is going to be awarded together with the purchase of the trains, performance contracting can be a possibility to guarantee reliability.[236]

- Aesthetics: Siemens already cooperates with established and well known design fabrics to increase the emotional connection with the product. The development of the Inspiro platform was supported by BMW Designworks USA. Light effects create a nice ambience.

[233] The London Underground Railway Society (10.10.2010)
[234] See Chapter 2.2.2.3
[235] Siemens internal Information
[236] See Chapter 5.2

Further steps to increase the quality of the product can be measurements on the track, which are supporting the technical solution and are a good point of contact to the customer as well. Precondition is to define at an early stage which parameters and data input is needed to be able to deliver the best match.

Time: Siemens is leading in the perception of the customer concerning delivery on time. This reputation also counts for the honesty of negotiating realistic dates. Siemens is not perceived to promise things that cannot be kept later. This fact also differentiates Siemens from competitors, especially because LUL recently made bad experiences with the delivery of the Victoria line with Bombardier.

Branding: Overall, the branding of Siemens is quite well. In the UK it is associated with words like: professional, efficient, solid, good and competent. But also with less charming attributes such as transitional, Germanic, conservative and tied to technology. The negative associations usually connect with the pricing and the complexity of the multi-business conglomerate. The brand perception of Siemens will not be influenceable for this single business case. What can be systematically designed is the branding of Syntegra. The promotional activities mentioned in chapter 4.3 can set a course.

Customer Relationship: Setting up a strong and positive customer relationship is a very promising approach. According to a sales manager at Siemens UK, the English railway business relies on good customer relationships. Human resources in the rail industry rotate within the different companies and people who were project partners a few years ago are on the customer side in the next project. Trust and good reputation are key aspects to win or lose a contract and to be able to push the limits in negotiations.

To be able to offer a subjectively added value, a company has to be very close to the customer. The benefit for the customer would be the lower tendering costs if he awards the whole range to one supplier at one point in time.

4.2.2 CONCEPTS

At the current moment the final decision about the technological approach has not been made. Therefore this chapter discusses the pros and cons of the different product designs.

Syntegra with passive steering

Pro:

- The strongest competitor goes for a passively steered design
- Passive steering alone is no differentiation from the competitors
- UK universities value savings from less track wear extremely high

Contra:

- Syntegra has a very short wheelbase, therefore the further improvements based on a steering concept have to be proven if they are worth the effort

- A passively steered Syntegra would have even higher contingency risks than the established Syntegra

- The increased complexity would raise the price and the life cycle costs

Syntegra low complexity (similar to the design study concept)

One approach to achieve overall cost leadership could be to avoid costs with low complexity of the product. Fewer parts mean lower purchase costs and a minor probability of failure. The competitors' concepts show a high orientation in the direction of complex systems including mechatronic actuators. A simple design has the chance to stand out the crowd with high reliability figures.

Pro:

- Smaller dimensions are ideal for the smaller installation space in the tunnels in London
- Competitors seem to go for a rather complex design – this means a good differentiation criteria
- Less LCC without passive steering and compared to the conventional design approach
- No other competitor has a direct drive concept with that much testing experience

Contra:

- Siemens might not convince the customer that the concept has no higher track wear and rolling contact fatigue than the competitors concepts
- Higher calculated contingency risks due to less proven design

No Syntegra? – Conventional design

An adaption of an established design, like the SF 1000 bogie to the special requirements of London underground is a technical risk mitigation strategy. However, it is very likely that the special constraints concerning tracks and installations space necessitate a complete new design.

Pro:

- lower risk contingency leads to a lower calculation of guarantee cases, hence lower initial purchase prices
- lower threat of losing reputation through failure

Contra:

- low technological differentiation from the competition
- higher LCC and energy consumption
- risk of high appraisal of track wear mitigation efforts

Another approach would be to offer a frame mounted permanent magnet motor with gearbox. Although this solution combines various technical disadvantages, such as the higher life cycle cost and the frictional losses it can be seen as a more iterative introduction of unfamiliar

technologies. Further examinations why the competition seems to follow this strategy are recommended. The most promising approach is to design a special platform for London, with variants considering the differing constraints in the various lines. However too many variants would explode the costs and decrease the cost efficiency.

4.2.3 PROTOTYPING

In the past, London Underground had a lot of prototypes on their tracks. The prototyping companies have gained experiences but have not always be chosen as the final supplier. Also for this business case LUL is considering one or more pre-serial trains from various suppliers. It is most likely that LUL is financing these trains. In the funding agreement letter, published after the spending review in October 2010, Philip Hammond the Secretary of State for Transport stated that the delivery of a prototype for a low energy, higher capacity train for Piccadilly and Bakerloo Lines is planned for 2015.

If more than one company gets the contract to supply Prototype-trains, for the supplying companies remains the risk of being left with the one-time off costs. However, investments in a Prototype or taking risks in financing the project have to be seen as an investment into the implementation of a new technology. The chance of gaining a technology leadership position is a trade-off for possible financial loss.

4.3 PROMOTION

This chapter lists various possibilities to be used in the communication mix. The combination of the right means has the objective to make Siemens and Syntegra be perceived positively in the market.

4.3.1 TECHNICAL VISITS

Not only the media, but also the customers value to get more insight to what their suppliers do and how they work. This also gives an impression, if the style of production matches the customer's style. Technical visits can be organized by the company itself, for example in the course of introducing new technological developments to the media and prospective customers. As an example, Alstom used the Citadis tram forum to show potential customers their production and testing facilities. The UK situation with the high number of railway associations further offers the possibility of a less direct approach. The disadvantage is to be less able to control the participation of these visits.

4.3.2 MAGAZINES

Scientific publications are an important tool to show competence. Research projects together with the British universities, especially on the rail contact fatigue topic are one possible approach to publish in the UK media. But also general descriptions of Syntegra and the direct drive are important to trigger discussions within the industries. They are helping to challenge existing

standards in the mind of people. Not least due to the long history, the UK rail news market is very advanced. All of the most common print media have a web appearance, what facilitates research on their key issues. Table 15 lists the popular magazines in the UK where articles about new technologies and achievements as well as advertisements can be placed:

UK (Online) Print News	
Magazine	**Details**
railwaygazette.com/	International perspective, also publishes Rail Business Intelligence for senior managers
railtechnologymagazine.com/	The independent technical trade journal for the UK rail industry.
railmagazine.com/	Fortnightly printed magazine
modern-railways.com/	News, views and analysis on today's railway, printed monthly. Also publishes the Railway Dictionary.
The Modern Railway	Also published by the editor of modern railways this only printed version addresses especially the businesses with background information on politics, finance and technology in the UK.
railnews.co.uk/	Monthly rail industry newspaper, delivered free of charge to many work locations. Has a special Metro section.
railpro.co.uk/	Rail Professional is circulated free of charge each month to people that work within the rail industry.
therailengineer.com/ railstaff.co.uk/ railwaypeople.com/rail-news/	Both monthly staff newspapers, delivered free of charge to those in the industry. The railwaypeople.com is an online platform for the rail employees.
railwayherald.com/	Weekly free online-only (PDF) magazine
transportinfo.org.uk/	Daily round-up of transport-related news links
transportxtra.com/	News from the “Local Transport Today” and the “new Transit” two biweekly magazine

Table 15: Rail magazines popular in the UK
Source: own, based on Internet research

Especially recommended for the release of professional articles are “The railway gazette” and “Modern Railways” due to their big readership and significance. “The modern Railway” is an

important source for market specific information. “Railnews” has a special Metro section, but rarely talks about technological innovations than more about strike actions and business figures in the rail industry.

4.3.3 AWARDS

Awards show potential customers the capability to deliver excellent solutions, trigger positive news articles and are therefore an important public relationship tool. An overview about the most important awards handed out in the UK is given in Table 16.

UK Rail Awards		
Award	**Next**	**Details**
railbusinessawards.com/ Rail Business Award	17.02.2011	The Rail Business Awards is awarded in association with the monthly magazine Rail Professional and open for all companies in the UK passenger and freight rail industry
natrailawards.co.uk National Rail Award	15.09.2011	The National Rail Awards are organized by the rail magazine. One has to apply to get awarded.
mxawards.org/ Manufacturing Excellence Award	23.11.2011	The Institution of Mechanical Engineering Manufacturing Excellence Award is not focused on the Railway Industry.
4thfriday.co.uk/ The Golden Spanner	November 2011	The Modern Railways Golden Spanners awards are based on statistical data and acknowledge the reliability of UK fleets.
railstaffawards.com/ The Rail Staff Awards	29.10.2011	The Rail Staff Awards acknowledge individual efforts and contributions to the rail industry

Table 16: Rail industry awards
Source: own, based on Internet research

In November 2009 Siemens received a Golden Spanner for the reliability of the Class 444 trains from South West Trains.[237] Steve Scrimshaw, Managing Director of Siemens I MO RS in the UK won the Rail Business Manager of the year award in February 2011.[238]

[237] Siemens UK Online (20.12.2010)
[238] Cf. Rail Business Award Online (23.03.2011)

4.3.4 FAIRS

Fairs usually not only offer to present the company on the market, but are a good chance to meet industry players and to sense general opinions in talks and discussions. Considerable fairs and conferences concerning the UK market are listed in Table 17.

Rail Fairs		
Fair	**Next in**	**Details**
innotrans.com	18.-21.09.2012 Berlin, Germany	InnoTrans is the biggest, international trade fair for rail transport technology. It takes place every other year.
railtex.co.uk	14.-16.06.2011 London, UK	Railtex is an exhibition of railway technology, equipment and services in the UK.
traffex.com	29.-31.3.2011 Birmingham, UK.	Traffex is the pendent for the whole transport industry Siemens offers a twitter service to follow the news about the company's participation.
National Rail Conference	not announced	In 2010 there were speakers of TfL, the office of rail regulations and Network Rail at this one day conference. More details at www.railmagazine.com.
Open data & Transport	11.02.2011 London, UK	This conference has the goal to improve the availability of transport data to the public, operators and suppliers for more efficiency. People from TfL are listed as speaker.
railtech-europe.com	29.-31.03.2011 Amersfoort, NL	Railtech-Europe is an international conference & exhibition on Rail Technology. The most innovative new products get awarded
uitpdubai2011.org	10.-14.04.2011 Dubai	The UITP (International Association of Public Transport) World Congress and Mobility & City Transport Exhibition in Dubai moved from Vienna to Dubai to reflect the fact that the growing markets are found in Africa and Asia not in Europe any more.
International transportforum.org	25.-27.05.2011 Leipzig	The International Transport Forum is an annual summit. London Underground sends Geoff Dunmore, Network Security Manager as speaker

Table 17: Rail Fairs
Source: own, based on internet research

4.3.5 INTERNET

Web appearance: The demonstration the bogie competence centre in Graz and of Syntegra in the Internet is definitely capable of development. A possibility for rail operators to inform themselves on new developments and to get special technical support for the service and maintenance of their fleets is a good chance to keep in touch with the customer. The Bombardier bogie operator forum is an example for the realization of such a contact point.

Rail Forums: Although they are mostly used by fanatics, rail forums deliver a passenger feedback for the performance of trains. Some of the complaints can be used as design inputs.[239]

LinkedIn: As per January 2011 3,722 employees of Transport for London are signed on at LinkedIn, a professional social network with more than 90 million members in over 200 countries around the globe. It is a very vocational, social network, with people posting their job history and references. TfL even publishes Job offers like the position of a "Senior Project Manager - Tube Upgrades" on the network. LinkedIn can serve as a source of information to find out which position special people working at the customer or the competition hold and what their tasks are. There are also special groups of people with the same interests to discuss topics and exchange news. For example Malcolm Dobell (LUL) is a member of a group called "Metro and Rail projects" with 5.132 members as per March 2011.[240]

Facebook: With over 500 million users (as per 20 July 2010) Facebook is definitely the most powerful social network at the moment. A lot of businesses try out the new possibilities Facebook groups offer to support a brand, a market launch or just to make potential customers aware of their homepages. Very popular are contests where people get the possibility to take an active part, for instance as models, with photographs or with their writing skills. [241] Although supporters of the competition used Facebook to promote the award of a contract, this approach does not seem to be the appropriate forum to do business.

Youtube: Videos on Youtube could be used to achieve a better acceptance from the passengers and to create an atmosphere of positive expectation for the introduction of a new tube. Since people are using the tube daily, they highly relate to their choice of transport. On the 24th August 2010 a 1:20 minute video of the Siemens Inspiro concept for the Metro in Warsaw was posted on Youtube by an unknown source. Within two months it had 40.000 hits and people were discussing it on the comments wall.[242] According the access statistics, special video channels, such as the Alstom WebTV do not seem to be worth the effort.

A special objective for promotional activities is to mitigate insecurities about track wear and rolling contact fatigue of the design. The reduction of wear based on a short wheelbase and lower rotational masses has to be recognized in the academic and public calculation models. Articles in magazines and speeches on fairs and conferences can be the right platform to

[239] Cf. Rail Forums Online (20.12.2010)
[240] Cf. LinkedIn Online (20.12.2010)
[241] Cf. Facebook Online (30.10.2010)
[242] Cf. Youtube Online (30.10.2010)

discuss this topic. To show the track record and reliability of Siemens, awards are valued the most, as well as word of mouth recommendations. To achieve a good public opinion about Siemens and their products, the pavilion is a good opportunity to show what Siemens does. This could be combined with the chances social media bears.

4.4 PRICE – COST LEADERSHIP

The determination of the price is not possible at this point of time, where no technical specification for the invitation to tender has been announced. Cost efficiency steps can be taken to strengthen the market position, but interdependencies with the differentiation strategy and other activities have to be avoided.

This business case has definitely potential to reach a good **economy of scale**. The one-off cost such as for a prototype train development and operation and the setup of a project team are paying off in case of a contract assignment.

The **economies of scope** can be exploited if a follow up refurbishment project or a contract for the maintenance and service of the fleet comes from the good customer cooperation. This is very likely to happen in case of good performance with the train delivery.

With the high number of units and the continuous delivery of trains in the next 15 years, cost efficiency based on **a learning curve** is most likely. A framework contract can give the best circumstances for further advancements of the product.

To determine the price in a transparent way, **target costing** is a well-established method. Allocating values to the functions specific parts fulfil help to assign budgets for research and development. One approach is to determine together with the customer values for the various maintenance methods. Objective is to find out if developments in direction of a more sophisticated maintenance strategy, such as diagnostics methods are requested. This helps to answer the question if the company shall follow a life cycle cost leadership or try to be the cheapest referring to the costs of acquisition.

4.5 ATTACKING THE LEADER

The three most important requirements which have to be given to successfully attack the leader are a sustainable competitive advantage, proximity in other activities and some impediment to leader retaliation.[243]

The **sustainable competitive advantage** of Syntegra is the efficiency edge due to the lack of the gear box.

According the UK customer survey, the **proximity in other activities** is given as well:

[243] See Chapter 2.2.5

Technology: the technological performance of Bombardier, Alstom and Siemens is perceived by the customer as quite homogenous. Siemens has the good reputation of German engineering but needs to listen carefully to the customer's needs.

Marketing: In the customer relationship sector, Siemens has to close a gap to the rivals. A lack of technical knowledge from the customer side is often counterbalanced by trust. The best technological solution might not win if the mutual trust is not sufficiently managed.

Leader Retaliation: The last contract award showed that Alstom are no good sportsmen. It ended up in a legal dispute, where they threatened to go through all levels of jurisdiction. This would have cost a lot of money. Siemens had to do preparatory work without being sure that the judge would not appeal against the contract. It is hard to prepare for any kind of leader retaliation, but it is important to conduct compliant business integrity to not be an easy target.

The marketing mix for the business case in London should consist of a good positioning on the spot, with networking activities in the local associations and the usage of the new Siemens pavilion for brand and product awareness. Further the correct product has to be chosen according the estimation of the customer needs based on good customer relationship. The product is best promoted locally in the railway related magazines and presented on fairs. Arguments for a possible higher price have to be found and justified. The marketing mix has to be reviewed according leader retaliation.

5 BUSINESS MODELS

This chapter evaluates the adaptability of the business models presented in the theory chapter to the business case. These statements are only a first estimation as a decision basis for profound examinations. Further validation is needed to mitigate risks. The business models which are depicted in detail are the downstream business model, the performance contracting and alliances. Another very popular business model which has been used for rolling stock and public infrastructure investments is to sell-and-lease-back. Due to the excellent credit rating of the customer, he is not too enthusiastic about an external financing of the purchase. Therefore this model is not discussed any further.

5.1 DOWNSTREAM BUSINESS

The precondition for going downstream with a business is a high installed base versus the new units bought and the relatively high life cycle cost and operational cost compared to the acquisition. WISE and BAUMGARTNER list in their article the installed-base-to-new-unit-ratio, for the metros very similar product locomotives, with a value of 22 to 1.[244]

The precondition that the sale of a product accounts for only a small portion of overall revenues is definitely given in the business case as well. The splitting of annual cost of locomotive operation is shown in Figure 25.

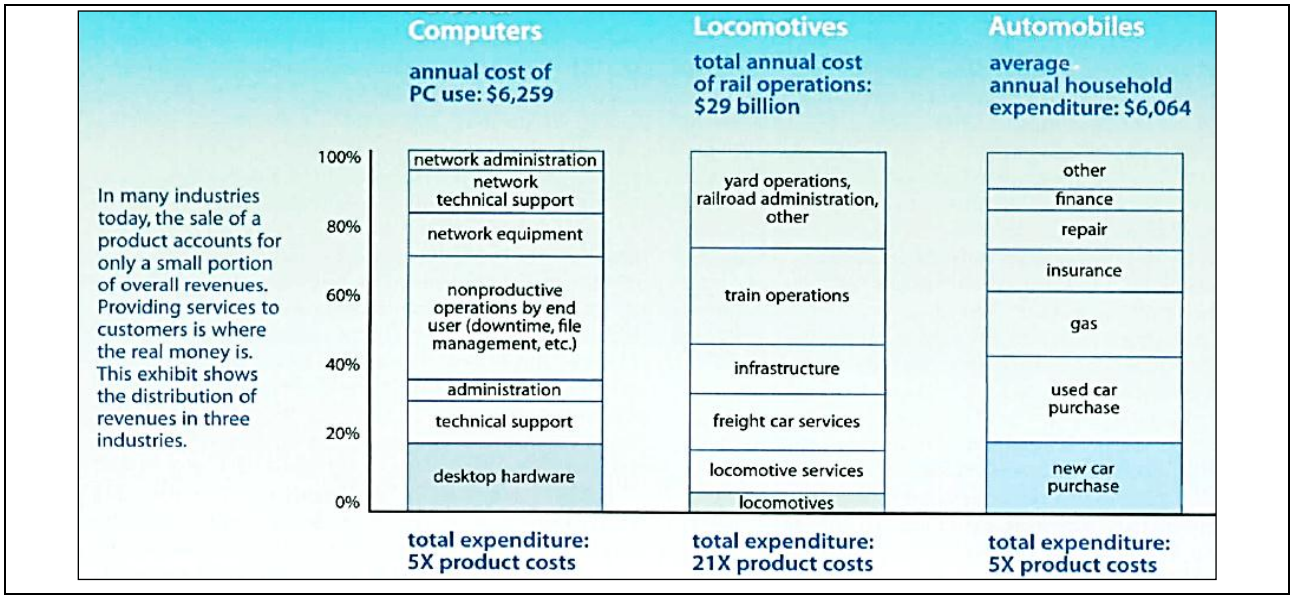

Figure 25: Splitting of the annual costs of various products
Source: GartnerGroup, Association of American Railroads, Federal Highway Administration Office of Highway Information Management, Railroad expenditures are for Class 1 railroads

[244] Wise, Baumgartner in Harvard Business Review (9-10/1999) p.134

Since there is definitely potential for downstream business, a closer look will be taken to the customer and his situation. In 2001 TfL conferred the responsibility for the acquisition, service and maintenance of their fleets to the PPP companies. They always kept the duty of operating the metros. Although the PPP's are reintegrated at TfL, Alstom and Bombardier still fulfil their maintenance and service contracts of the fleets and LUL has not regained these competences. Therefore it is very likely that the customer expects not only an offer for the purchase of the new fleet, but also for support through the product life cycle with a guarantee of product availability. What can be said against the opportunity of getting a long-term maintenance contract is the fact that the situation in London is very complex: unions, expensive setup cost and no experienced workers.

Apart from the meanwhile classical maintenance and service business other downstream activities could enhance the offer:

Embedded services:

For example to offer a remote diagnosis surveillance and linked to it a sophisticated data analysis tool. This tool could not only gather information about performed maintenance task and actual wear, but also gives recommendations about the best point in time for the replacement. If the stock data is connected to this system, the tool could also trigger spare parts purchase.

Comprehensive services:

Siemens Financial Services would provide the structure to support the offer with reasonable financing. However, the customer stated, that his own AA+ rating makes it unattractive to get the money from a third party.

Integrated solutions:

The 2004 born initiative Siemens One is an attempt to not only offer single products but full range offers which tackle various customer needs with the power of a multiple business corporation. Parsons Group International, the former LUL consulting company wants to persuade London to follow a system approach. In their opinion, buying just a new train would miss out saving potentials compared to following a more holistic thinking. System boundaries like tracks, signalling, electrification and scheduling are only some of the various starting points.

Distribution control:

There are no intersystem distribution channels which could be skipped. Taking over control of operating the Tube in London is not really an option due to the lack of profit that can be generated in public transport.

The interest and need of downstream opportunities has to be clarified within a good customer relationship. Only in case of close collaboration these chances can be detected and verified.

5.2 PERFORMANCE CONTRACTING

The basic constraints for performance contracting are given: the acquisition of a new asset with a derived value and relatively small purchase cost compared to the life cycle cost such as for operation, maintenance and spare parts. The measurement and prediction of the savings is very hard to predict.

Financial Model: The financing of this model usually consist of the savings from the modernization of the asset. The baseline is the existing fleet. What makes it hard to compare is the fact that the new trains will have a completely new configuration and there are going to be more trains operating with a higher frequency than the old ones. Once this baseline is set, in the case of Syntegra in London these cost savings could come from:

Maintenance: Less spare part cost due to the decreasing number of bogies from the articulation, the gearless drive system and double used bearings. The direct drive with four inverters makes it possible to do the turning of the tires for only one axle. The differences in diameter can be balanced. Hence the wheels have to be exchanged less often.[245]

Energy: Energy prices for the UK industry currently lay at 10 Euro-Cents per kWh and have been relatively stable for the last three years. Gas prices have been at EUR 5.94 per GJ and have dropped 25% in the last three years.[246]

In 2008 TfL needed 1,163 GWh of electricity. Their Greenwich gas turbine plant produced 105MW with a fuel consumption of 197,077 litres gasoil used per year.[247]

It is very difficult to forecast the development of electricity prices in the next 40 years, especially because of the automotive trend to switch from combustion engines to electrified drives. To increase capacity without the urge to increase the power supply additionally saves costs for the operators and avoids disruption of the operation due to construction work. These savings can be measured, but are a one-time alleviation and no source of continuous instalments.[248]

Track Wear: Syntegra promises less track wear based on the shorter wheelbase and less stiffness in curves. The measurement of the savings is difficult. Tracks are often not exclusively used by the single lines. For example the Bakerloo line tracks are also used by National Rail services and the District line also partly operates on the Piccadilly line railways. Therefore damages which occur due to stresses and strains such as rolling contact fatigue and abrasion cannot directly be allocated to the wear of a specific train.[249]

The financial risk of the concept lies very much in on the supplier side. The production costs are not covered straight away, but only through regular instalments. The question of the ownership

[245] Cf. Siemens internal Information
[246] Cf. Eurostat Online (20.11.2010)
[247] Cf. Transport for London Online (25.11.2010)
[248] Cf. Siemens internal Information
[249] Cf. Transport for London Online (25.01.2010)

of the trains has to be clarified. In case of keeping the ownership on the manufacturers side a big threat is that Londoner metros are a very specific design and it would be hard to find another operator who could use the trains on his lines in case of an early termination of the contract. Another cracking point is the necessary constant insight into the financial figures of the operator. It has to be verified that the customer has no fear of showing these details to externals.

Further the performance contracting has to fit to the contracting structures in the tender; otherwise there is the danger of disqualification of the bid. A prototype train would be a great chance to verify the savings.[250]

5.3 FORMING ALLIANCES

A manager involved in the buying centre of LUL stated at the last Milestone Meeting of the Design study, that LUL is searching for a solution where the competition is kept alive, but also the suppliers feel comfortable with.

To meet this customer request and to avoid stressful and exhausting competition on the other hand forming alliances can be a good compromise. A contract award to a cooperation of manufacturers is very common in the rolling stock market and has to be taken into consideration.

Product alliances in terms of one company supplying the bogie and the other one the car case have been made quite often in the past. They are not favoured by the suppliers. There are problems with the interfaces and fear of know-how drainage. If the consortium shares the amount of trains built the economies of scale and the learning curve are going to be less effective.

Cooperation with local manufacturers for the supply of components or maybe even for the development of new parts could mitigate the advantage of Bombardier to have a UK bogie and car body production site.

Service alliances could make sense in case of a maintenance contract. Using existing facilities and already trained staff facilitates the setup of the service.

Promotional alliances in terms of offering a technical visit on Siemens production site organized by a UK association are an opportunity to attract the interest of people in the industry. An advantage of the externally organized visit is the neutral flair. A disadvantage is that the participation in these visits cannot be controlled and might also attract members of the competitors.

Pricing collaboration agreed between two or more companies is prohibited.[251]

[250] Cf. Siemens internal Information
[251] Holmes (2004) p.267

Altogether, a new business model is a good chance to break up old structures and conservative thinking. Especially service and life cycle cost oriented approaches such as performance contracting bear a big chance to enhance the strength of energy efficient and service reduced offers with higher investment cost. The business model has to be adapted to the specific situation of the customer. Standards of the tendering process, but also of the ascertainment and evaluation of operational expenses are challenged.

6 CONCLUSION

Basically this thesis' objective was to find steps to improve the marketability of a highly innovative product in a very traditional and developed, but forward looking market. An aggravating factor is that the product, a bogie for metros, is a very safety relevant component for rolling stock, which is in use for approximately 40 years and life-time behaviour for some parts is hard to predict.

Market analysis

The application of the theory on such a specific business case bears some adjustment challenges. There is only one customer, London Underground and he has a complex buying centre structure.

The expected number of cars London has to acquire to guarantee availability and reliability of the public transport is huge. The customer is open to new technology and is willing to change the supplier. But the competitive constraints are quite ungracious: Siemens has yet only won a small refurbishment project with London Underground Limited and the rivalry in the market is already rather high. Also other entrants are eager to win their own piece of the cake.

An analysis of the railway industry is rather challenging. Companies have a high awareness of protecting their intellectual property. The competitive analysis is primarily supported by publications and the companies' web appearances. Fierce rivalry of the suppliers, including legal measures led to the increasing importance of compliance measurements. This further narrowed the possible customer contacts. However there is always the feasibility of informal meetings with all the players and sensitive questioning enables market understanding.

The analysis showed that the railway industry in the UK is very developed and very organized. People from the industry meet regularly at events of associations and institutes, on fairs or conferences or at the granting of one of the several awards. The rivals with big market shares, Alstom and Bombardier are very active at these networking opportunities. They are chairing in some of the associations and organize technical visits to their sites. The other market intruders and Siemens are less or not at all active.

Marketing strategies

With a newly built pavilion Siemens strengthens its position in London. Various distribution possibilities emerge from this. I would suggest to using this new platform to present the new train as a mock-up upfront to the public. Social media can be used to attract people to come and see the new metro. This increases public acceptance and support. For the customer it is important to have competent contact people on the spot. The challenging technical constraints make it necessary to answer questions from the customer in a sufficient way, not least to show capability of the conduction of such a complex project.

The concept which seems to be most promising is the low complexity bogie. A smaller number of parts, light weight design with narrow axle distance triggers less maintenance cost. Low complexity also means a lower risk of failure and guarantees reliability. To mitigate risks a product prototype on the spot is very important for the success.

To better understand the customer and the industry, networking activities are indispensable. Recommended is a positioning of Siemens employees in the various railway related associations based in London. Seminars and workshops organized by these organizations are helpful to promote the new technology within the UK railway industry and to reduce customer prejudices and increase acceptance and awareness of the advantages. The good work of publications in magazines shall be continued.

Even if the new development promises more energy efficiency and maintenance savings, the price cannot be too high. Cost efficiency steps are important to stay competitive.

Business Models

One objective of the business models in this specific business case is to manage risks. The mitigation of risk for the customer by guarantees for example in form of performance contracting can be a competitive advantage. Performance contracting is a promising but very complex and hard to conduct business model. The acceptance of the customer is questionable.

Risk minimization on the supplier's side can be made by forming alliances. Alliances established especially in the area of components supply with UK manufacturers are a good argument against local job saving petitions from Bombardier.

Downstream business is a good possibility to open up new markets, but it comes along with a complete change in strategic thinking and creativity is needed to find a good package, which fulfils the customer's needs.

These three are only some of the possible business models. In the last years business model innovation has been seen as a very promising approach to offer something new to the market. Creative thinking and the courage to try out new things is inevitable to have success.

Perspectives

The next step is a functional planning for the conduction of tactics. Personnel assignment is as important as to make realization plans. The planning of marketing activities according time, action and competence has to be done. A project team with enthusiasm for the product and the market will have the power to meet the upcoming challenges of such a complex project. The decision on whether to go for a prototype train or not has to be made and which solution shall be offered. A deeper examination of performance contracting and possible other probably completely new business models can be recommended.

A scenario analysis of the possible movements of the competition could mitigate the risk of competitor retaliation.

Estimation

The analysis of a situation, the following estimation of the gathered facts and the recommendation of actions is a perseverative task a graduate engineer conducts in his or her career. In earlier times the problem was to find the information. Nowadays everybody is flooded with information through globalization, computerized statistical data and especially the free access to all kind of alleged knowledge on the Internet. The real know how lies in the content filtering of the essence.

The accomplishment of this thesis, both the theoretical explanations and the transfer into a practical realization showed me the importance of a structural approach. Even or maybe especially in areas where personal estimation and intuition finally tips the scale for decisions, the preparation and processing of facts and data to extract the essence is indispensible to make the right decisions.

From a strategic point of view it is still hard to say what the best approach is. Personally I think a low complexity; low cost approach with Syntegra is the right way forward. This technological solution has to be strengthened by scientific discussions within the industry.

In general one has to admit that a focus on such sophisticated customers comes with hard-fought and therefore risky business cases. It is recommended to evaluate the possibilities of building up strategic customer relationships in less competitive markets. The future biggest cities lie in the developing markets and threshold countries. These usually lack the infrastructure and the money, but the need is undeniable. However, I am absolutely grateful for the interesting insight into this exiting business. It was a thrilling experience to work on finding a solution for one of the most challenging problems these days: mobility in big cities.

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LIST OF ABBREVIATIONS

A	Austria
AC	Alternating Current
AG	Aktiengesellschaft
B2B	Business to Business
B2C	Business to Customer
BCV	Bakerloo Central Victoria Line
Bn	Billion
CAF	Construcciones y Auxiliar de Ferrocarriles
CAPEX	Capital expenditure
CILT	The Chartered Institute of Logistics and Transport
cf.	compare from confer
DC	Direct Current
DfT	Department for Transport,
ED	Electrodynamics brake
e.g.	exempli gratia, for example
EP	Electro pneumatics brake
g	grams
GBP	Great Britain Pound
GJ	Gigajoule
GWh	Gigawatt hours
Hz	Hertz
I	Industry, one of three sectors Siemens operates in
ICE	Intercity Express
IED	Inherent electrodynamics brake
IET	The Institute of Engineering and Technology
IMechE	The Institute of Mechanical Engineering (UK)
Infraco	Infrastructure Company
JIT	Just in time
JNP	Jubilee, Northern, Piccadilly Line
KHI	Kawasaki Heavy Industries
kJ/m²	Kilojoules per square metre
km	kilometres
km/h	kilometres per hour
kV	Kilovolt
kW/kg	Kilowatt per kilogram
kWh	Kilowatt hours
Ltd.	Limited
LUL	London Underground Limited
M	million
MO	Mobility, division under the Siemens Industry sector
MW	Megawatt
ÖBB	Österreichische Bundesbahnen
OPEX	Operational expenditure
p.a.	per annum

PFI	Private Finance Initiative
plc.	Public limited company
PPP	Public Private Partnership
PSM	Permanently energized synchronous motor
RMT	Rail, Maritime and Transport Union
RS	Rolling Stock, business unit under the Siemens Industry sector, division Mobility
SNCF	La Société Nationale des Chemins de Fer
SSL	Sub-Surface Lines
SWM	Stadtwerke München
TfL	Transport for London
TQM	Total Quality Management
UITP	Union Internationale des Transports Publics
UK	United Kingdom
USA	United States of America
V	Volt
VAL	Véhicule Automatique Léger, People Mover that uses rubber tyres to transmit vertical and horizontal forces in a track bound system

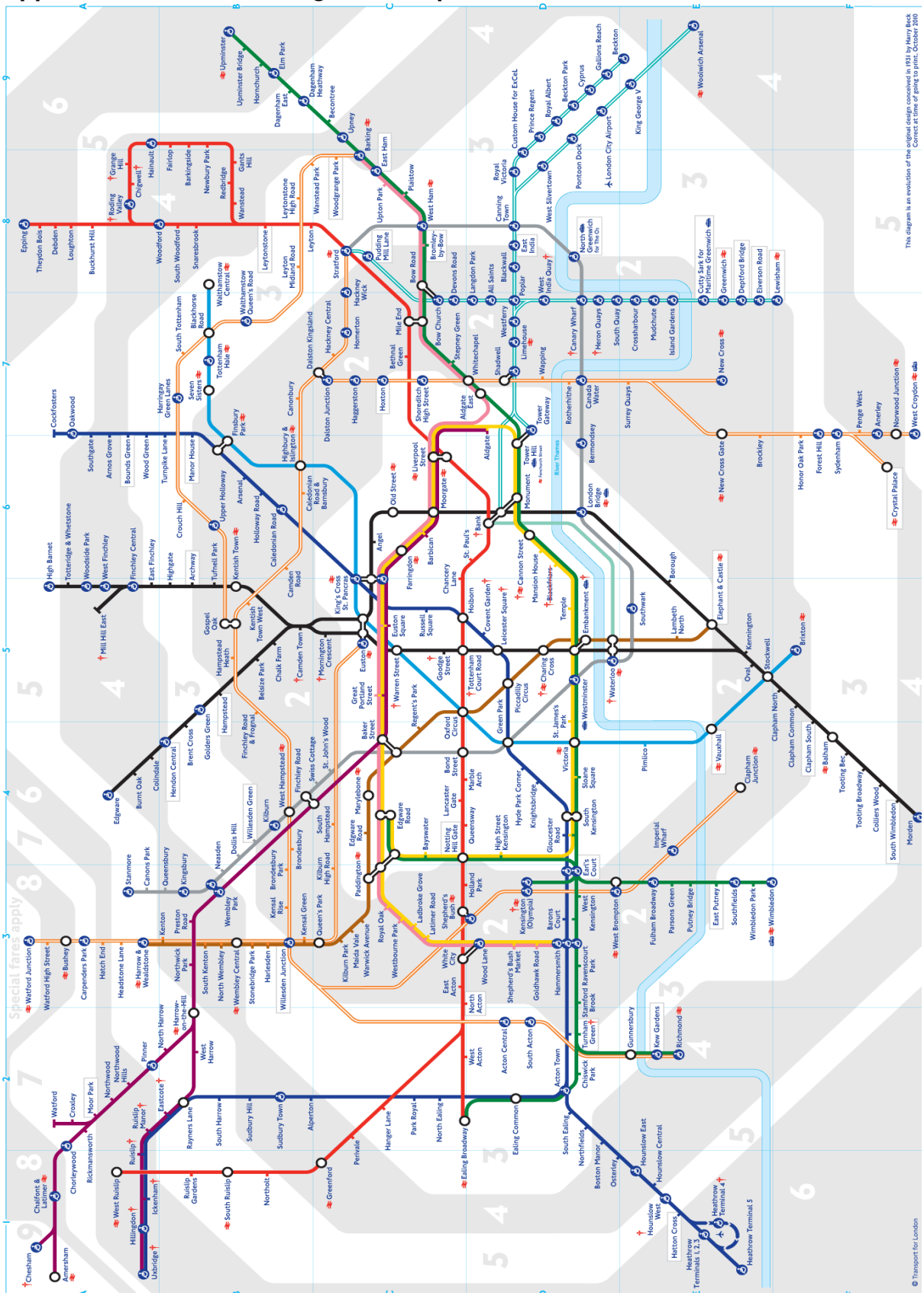
APPENDIX

Appendix A Passenger growth

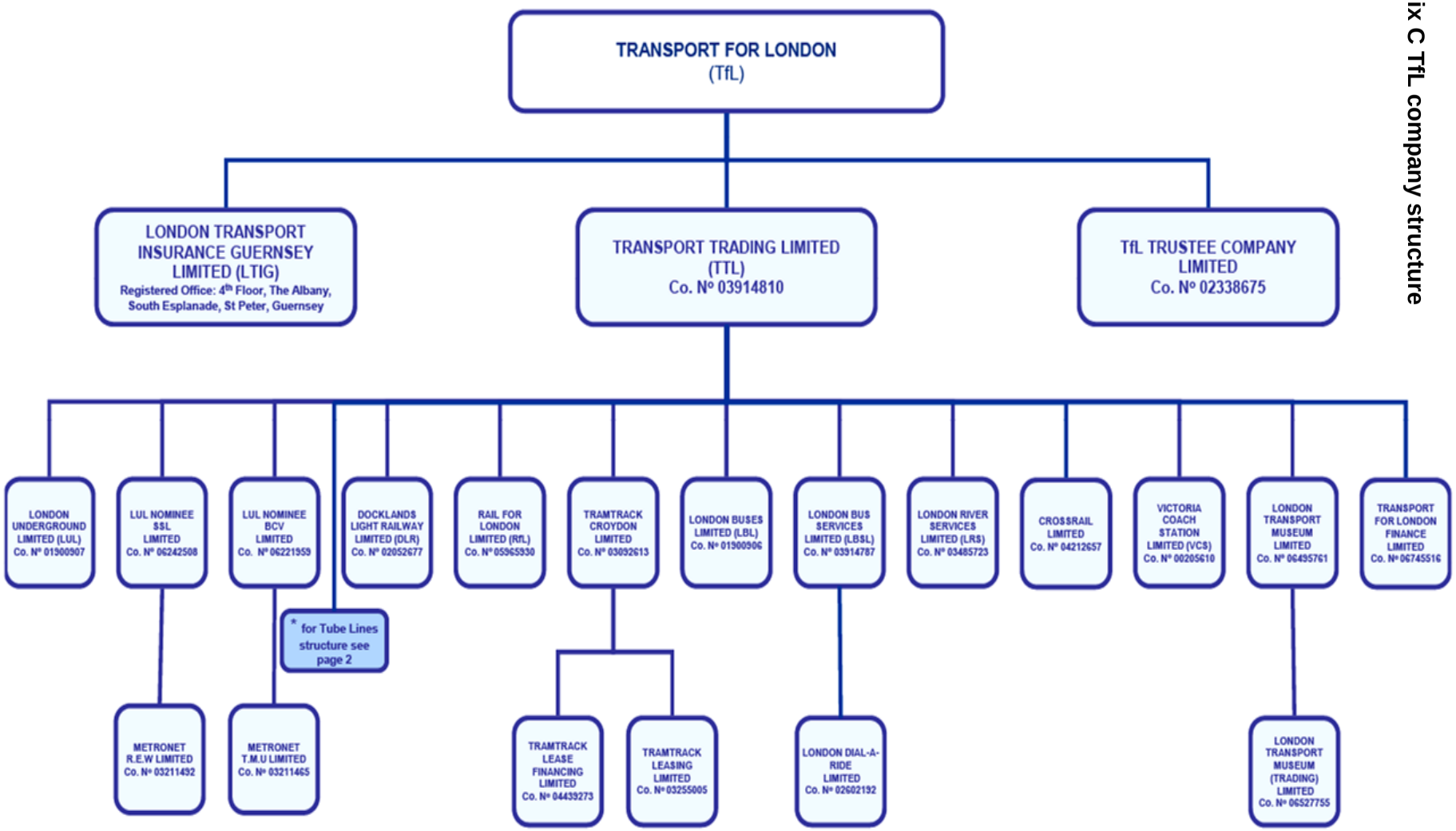
London Underground Passenger Growth			
	Passengers per year	increase	average increase
Year	in thousand	in %	In the last 10 years
1980	559	-5,89	-1,74
1981	541	-3,22	-1,79
1982	498	-7,95	-2,60
1983	563	13,05	-1,13
1984	672	19,36	0,93
1985/86	732	8,93	2,37
1986/87	769	5,05	3,79
1987/88	798	3,77	4,19
1988/89	815	2,13	3,98
1989/90	765	-6,13	2,91
1990/91	775	1,31	3,63
1991/92	751	-3,10	3,64
1992/93	728	-3,06	4,13
1993/94	735	0,96	2,92
1994/95	764	3,95	1,38
1995/96	784	2,62	0,75
1996/97	772	-1,53	0,09
1997/98	832	7,77	0,49
1998/99	866	4,12	0,69
1999/00	927	7,01	2,00
2000/01	970	4,64	2,34
2001/02	953	-1,75	2,47
2002/03	942	-1,15	2,66
2003/04	948	0,64	2,63
2004/05	976	2,95	2,53
2005/06	970	-0,61	2,21
2006/07	1.040	7,22	3,08
2007/08	1.096	5,38	2,84
2008/09	1.089	-0,64	2,37
2009/10	1.059	-2,75	1,39

Based on Passenger figures from Transport for London Online www.tfl.gov.uk (accessed 22.11.2010)

Appendix B London Underground Map



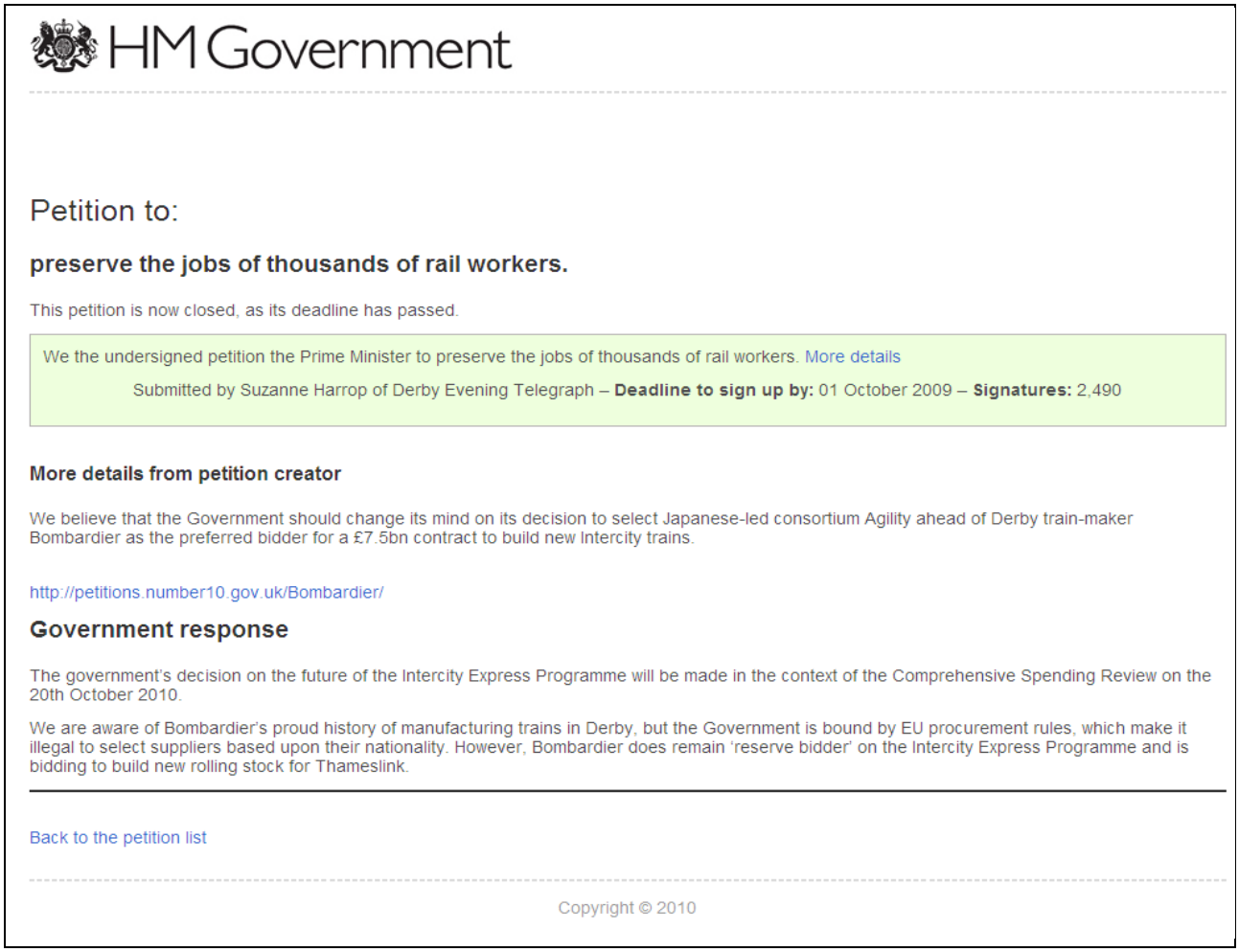
TfL SUBSIDIARY COMPANY STRUCTURE



Through London Bus Services Limited. TfL has a 25% interest in UK Tram Limited (Co. Nº5554196) a company limited by guarantee.

Appendix D Petition of Bombardier

Screen print of her majesty's government's answer to the petition of Bombardier to preserve jobs in the UK by awarding a contract to build new Intercity trains to Bombardier.



HM Government

Petition to:

preserve the jobs of thousands of rail workers.

This petition is now closed, as its deadline has passed.

We the undersigned petition the Prime Minister to preserve the jobs of thousands of rail workers. More details

Submitted by Suzanne Harrop of Derby Evening Telegraph – **Deadline to sign up by:** 01 October 2009 – **Signatures:** 2,490

More details from petition creator

We believe that the Government should change its mind on its decision to select Japanese-led consortium Agility ahead of Derby train-maker Bombardier as the preferred bidder for a £7.5bn contract to build new Intercity trains.

http://petitions.number10.gov.uk/Bombardier/

Government response

The government's decision on the future of the Intercity Express Programme will be made in the context of the Comprehensive Spending Review on the 20th October 2010.

We are aware of Bombardier's proud history of manufacturing trains in Derby, but the Government is bound by EU procurement rules, which make it illegal to select suppliers based upon their nationality. However, Bombardier does remain 'reserve bidder' on the Intercity Express Programme and is bidding to build new rolling stock for Thameslink.

Back to the petition list

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Her Majesty's Government, Online petitions at http://petitions.number10.gov.uk/Bombardier (accessed 30.10.2010)