WAREHOUSING IN UKRAINE

A comparison of warehouse location preferences with Europe.

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University of Twente

GRADUATION REPORT

UNIVERSITY OF TWENTE

Enschede - The Netherlands

Faculty of Engineering Technology
Construction Management & Engineering

TEBODIN UKRAINE

Kyiv - Ukraine

Consultancy department

Warehousing in Ukraine

A comparison of warehouse location preferences with Europe.

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January 2007

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Place / date	Enschede / January, 2007	
Version / status	1.1 / Final	

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Cover illustration: partly from website University of Twente [2006]

ACKNOWLEDGEMENTS

Most theses are the result of a collaborative experience, involving both direct and indirect efforts and responses of many people; this thesis is no exception. First, I would like to acknowledge the debt I owe to my supervisors at the University of Twente: Mr. Hans Voordijk and Mr. Sirp de Boer. I have learned a lot from working with them. Their enthusiasm stimulated me to get involved in this assignment, to go abroad with it and to proceed with great motivation during the whole graduation process. I would like to thank Hans for getting me acquainted with the field of Supply Chain Management and sharing his knowledge with me in a very interesting and open way. I would like to thank Sirp for his knowledge about and experience in international projects, which, once again, contributed to a 'safe' start in an unknown country. In addition, I would like to thank the University for its financial support via the Twente Mobility Fund.

Secondly, I must give substantial gratitude to Tebodin Ukraine, especially in the person of Mr. Andrey Sosnovsky. As director of Tebodin Ukraine, he was willing to give me a chance, not only to do my research in cooperation with a reliable and experienced company in Ukraine, but also to get acquainted with his great colleagues. Also, I would like to thank my supervisor Mrs. Anna Dukhno. As a senior consultant, she introduced me to the world of Tebodin Ukraine and, when she had time, shared her knowledge and thoughts with me. Many other colleagues followed her example and, all together, it made my stay at Tebodin worthwhile. I have experienced a great time working with them and I believe that I could not have chosen a better company to cooperate with. I am grateful for the additional financial support from Tebodin Ukraine, which made my stay in Ukraine possible.

Finally, I would like to thank everyone else who contributed to my graduation. Among them are Mr. Aswin Derks, Mr. Hans de Korte and Mr. Benno Grimberg. Also, my good friends and fellow students, who explored, commented and discussed my thoughts with me. A task that is also completely exercised by my dear, loving family, I knew I could count on them. A shelter in Kyiv was offered by a family to which I owe many thanks. Alla Boyko and her family provided me a second home, took good care of me and shared many things that contributed to my understanding of the Ukrainian culture. One person in particular is very special to me: my girlfriend Marina. She was always there for me, not only to translate or to guide me through the daily life in Kyiv, but also when I needed mental support or a good laugh. She supported me incredibly in giving her love to me, which gave me energy for my graduating and for giving her my love in return.

Without doubt, there will be errors and over-simplifications in this report, for which I take absolute responsibility, as is customary. I hope that the rest of the material will stimulate insights and new thoughts into the field of European warehousing.

PREFACE

Another milestone is yet to be reached: the finalization of my study Civil Engineering & Management at the University of Twente is almost done. It will be my second study since my study Civil Engineering at bachelor level and already during that graduation, I knew I would proceed studying. Since then, years followed each other up in fast tempo and soon I will take my first steps into society, putting my knowledge into practice.

A knowledge that, of course, is still young, but encompasses a broad field thanks to the multi-disciplinary subjects within the Construction Management & Engineering department of my university. During my ample two-year stay at the university in Enschede, I gained new friends, new experiences and new fields of interest. From the latter point of view, I got acquainted with the field of Supply Chain Management, due to some specific courses. Although it mainly encompassed supply chains in construction, management of the goods flow, whether in construction or general logistics, is a new discipline I would like to investigate.

I am pleased that I could combine my interests in Ukraine with my curiosity for a new challenge regarding my graduation assignment. It was clear from the start that the university offers two experienced and international oriented supervisors who where as enthusiastic as I was for searching a graduation assignment in a new discipline and in Ukraine. Furthermore, I found a reliable and construction-related company in Ukraine with interesting services and a challenging work field. Tebodin Ukraine offers an inspiring work environment where interests from both personal sides could meet and develop in a satisfying cooperation.

There is a good possibility that, in future, I will combine both construction process management and supply chain management, and engage in the management of supply chains in construction. Both work fields offer interesting challenges!

For now, I invite you to read this report and hope it will meet your interests and contribute to your knowledge about recent developments in the European supply chains.

J.J. Verlinden BBE
January 2007

SUMMARY

The primary role of warehousing is to make sure that the (new) regional consumer markets are effectively incorporated in a company's global supply chain of products and services. It also plays a vital role in providing a certain level of customer service and in the overall costs of a company's logistic system. The objective of this research is (1) to develop a model to support warehouse site selection decisions based on logistic services and (2) to provide insight in the theoretical and practical implications of the model by analyzing the European and Ukrainian market of warehousing. The problem statement focuses on (1) the developments in the European and Ukrainian market of warehousing and (2) the effect of logistic activities on warehouse site selection decisions. To investigate this, emphasis is put on specialist literature in a desk research and a case study in the form of a cross-sectional survey and expert interviews. The considered literature is related to site selection models and the concept of warehousing. To get more detailed information about the Ukrainian market of logistics, a survey among local (international) logistic service providers is executed and interviews are held with experts on Ukrainian logistics.

Logistics activities that originally belonged to the portfolio of the manufacturer are outsourced to third parties and there is a shift in activities towards the warehouse. Centralization plays a major role in cutting the costs of logistics, and decentralization (local presence) is important to incorporate local markets into the global supply chain and to meet customer service requirements. So, logistic service providers should be aware of the European network, by thinking global, managing at European level and acting local. Sectors related to logistics (real estate, engineering and consultancy companies) are growing throughout Europe and Ukraine, and there is an increasing need for additional supportive services. Today, the Ukrainian consumer market is a part of the global supply chain of products and services.

The decision of selecting optimal sites for warehouses has significant effects on types of transportation, the markets to be served, customer service level and logistic costs. In literature, interest is divided in two kinds of approaches regarding warehouse site selection: either on the selection of certain criteria or on the site selection process itself, taking into account certain criteria as deciding factors. In general, criteria are selected according to financial, transportation, marketing, operational or service considerations. Most literature lacks explicit consideration of the influence of warehouse roles and performed activities on site preferences. In none of the reviewed articles, warehouse roles and activities are named as an important location factor, nor are they taken into account in the site selection process. It is believed that especially the activities performed in warehouses today, ask for specific support from its environment that goes beyond (for example) the presence of infrastructure, work force and the market size. A model indicating that changes in the environment of a factory has its influence on the role of the considered factory is used to address the effects of the changing role of warehousing on

the primary location driver *and* the site competence, necessary to support a warehouse in its specified role. The model explicitly considers the influence of warehouse roles and activities on site preferences, initiated by market developments. In this way, the warehouse type and activities are seen as important location factors, and can be taken into account in the site selection process.

The developed model suggests, among others, a relation between the warehouse activities and the site competence. Although survey results show that market proximity is the primary reason why warehouses are established throughout Europe, in future access to skills and know-how becomes more important. The survey also revealed that the level of sophistication of the offered services throughout Europe and Ukraine will increase. However, Ukraine still asks for a tailor made approach when it comes to logistics, due to the transition status of the country. The present inefficiency of local logistic service providers is believed to be caused by an unbalance between the level of sophistication of activities and skills, experience and knowledge of modern supply chain management to support them. The survey respondents indicated a need for technical expertise or advanced technology as the most important implication on site competence following an increase in level of sophistication. This need originates in the increased use of modern technologies in logistic activities.

The model appears to be useful to support location decisions, especially because it involves the warehouse activities offered in the process. For theory it means that more attention should be paid to the type of logistic services offered. It appears that when the activities are so complex or varied, the warehouse does not function well in an environment with too low support. Excellent infrastructure and the lowest costs possible will always be the most important factors in location decisions. In case several options remain after taking these selection criteria into account, the model can simplify decisions about the possibilities left. It can serve to make a distinction between the available land plots at sublevel. That distinction is based on the site competence of the land plots.

In essence, site competence should be approached in such a way that location decisions are justified according to the *required* site competence for warehouses to operate effectively in their considered role. During the site selection process, it is important to consider whether there is a need to involve the client's activities with regard to the management and technology. The influence of these activities on required environmental support can be taken into account some time during the site selection process. This theory also sheds a new light on the widely used classification system of warehouses. At the moment, the added value of such classification system is low for it only compares different existing warehouses on their designed systems. An adapted classification system, considering site competence, can make sure that a client's activities and future plans fit in a suitable environment and warehouse design.

SAMENVATTING

De primaire rol van een warehouse is om ervoor te zorgen dat (nieuwe) regionale afzetmarkten effectief worden opgenomen in het wereldwijde distributienetwerk van een bedrijf. Bovendien bepaalt het voor een groot deel het niveau van consumentenservice en supply chain kosten. Het doel van dit onderzoek is tweeledig. Enerzijds heeft het als doel een model te ontwikkelen ter ondersteuning van locatiekeuzes voor warehouses, gebaseerd op de aangeboden logistieke diensten. Anderzijds om inzicht te geven in de theoretische en praktische implicaties van het model door middel van het analyseren van de Europese en Oekraïnse markt. De probleemstelling richt zich dan ook op (1) de ontwikkelingen in de Europese en Oekraïense warehousing markt en (2) op het effect van logistieke activiteiten op locatiekeuzes voor warehouses. Om dit te onderzoeken is er gebruik gemaakt van specifieke literatuur in een bureauonderzoek en van praktisch materiaal uit een case studie. De beschouwde literatuur gaat over locatiekeuzemodellen en het warehousing-concept. Om meer gedetailleerde informatie te krijgen over de Oekraïense logistieke markt is een enquête uitgevoerd onder logistieke dienstverleners in Oekraïne. De bevindingen zijn aangevuld met informatie uit expertinterviews over Oekraïense logistiek. Samen vormen zij de case studie.

Logistieke activiteiten welke oorspronkelijk tot het portfolio van fabrikanten behoorden, worden uitbesteed aan derden en er vindt een verschuiving plaats van activiteiten naar het warehouse. Centralisatie speelt een belangrijke rol in het reduceren van logistieke kosten. Decentralisatie is van belang om lokale markten op te nemen in het wereldwijde distributienetwerk en om te voldoen aan een bepaald service niveau. Daarom moeten logistieke dienstverleners zich bewust zijn van een netwerk op Europees niveau door te denken op wereldniveau, te managen op Europees niveau en door te handelen op lokaal niveau. Logistiek gerelateerde sectoren (zoals ontwikkelaars en ingenieurs- en consultancybureaus) zijn in opkomst in Europa en Oekraïne, en de behoefte aan ondersteunende diensten is groeiende. Vandaag de dag is ook de Oekraïense consument opgenomen in het wereldwijde distributienetwerk van producten en diensten.

Beslissingen over de optimale ligging van het warehouse heeft gevolgen voor het gebruik van transportmodaliteiten, afzetmarkten, het serviceniveau en logistieke kosten. In de literatuur lijkt de interesse voor deze vraagstukken zich vooral te verdelen in twee benaderingen: het bepalen van criteria of het selectieproces zelf, waarbij bepaalde criteria als doorslaggevende factoren functioneren. Over het algemeen worden de criteria geselecteerd op basis van financiële, transport, marketing, operationele of service overwegingen. In de literatuur ontbreekt de expliciete overweging van de invloed van de rol van een warehouse en de activiteiten op locatie voorkeuren. In geen van de onderzochte artikelen worden deze twee aspecten genoemd als belangrijke locatiekeuzefactoren. Aangenomen wordt dat juist de activiteiten die vandaag de dag worden uitgevoerd in warehouses, specifieke ondersteuning uit de omgeving nodig

hebben. Deze gaat verder dan de aanwezigheid van infrastructuur, arbeidskrachten of de omvang van de afzetmarkt. Ferdows geeft in een door hem ontwikkeld model aan dat veranderingen in de omgeving van een fabriek invloed hebben op de strategische rol van die fabriek. Op basis hiervan is als eerste de invloed van een veranderende strategische rol van een warehouse op de zogenaamde 'primary location driver' onderzocht. Ten tweede is de invloed op de locatiecompetentie (nodig om een warehouse te ondersteunen in zijn rol) onderzocht. Het nieuwe model beschouwt expliciet de invloed van de warehouse rol en activiteiten (beïnvloed door ontwikkelingen in de markt) op de locatievoorkeuren. Het soort warehouse en de activiteiten worden zo gezien als belangrijke locatiekeuzefactoren.

Het model suggereert een relatie tussen de activiteiten in het warehouse en de competentie van de locatie. Nabijheid van de afzetmarkt de belangrijkste reden waarom warehouses zijn gevestigd door Europa, maar de toegankelijkheid van kennis en kunde wordt volgens de enquêterespondenten steeds belangrijker. De enquête laat ook zien dat het niveau van ontwikkeling van de aangeboden diensten zal toenemen. Door de ontwikkelingsstatus van het land vraagt Oekraïne om een toegespitste benadering als het gaat om logistiek. De inefficiëntie bij veel logistieke dienstverleners wordt waarschijnlijk veroorzaakt door een disbalans tussen het ontwikkelingsniveau van activiteiten en de kennis van modern supply chain management om deze diensten te ondersteunen. De behoefte aan technische expertise of geavanceerde technologie is volgens de enquêterespondenten de belangrijkste implicatie op locatiecompetentie als gevolg van de toenemende complexiteit van activiteiten (door het gebruik van moderne technologieën).
Het model ondersteunt locatiekeuzes door het in beschouwing nemen van de aangeboden logistieke diensten. Voor de literatuur heeft dit als gevolg dat er meer aandacht besteed kan worden aan de soort logistieke diensten welke worden aangeboden. Het blijkt dat wanneer de activiteiten complex of gevarieerd zijn, een warehouse niet goed functioneert in een omgeving met te weinig (technische) ondersteuning. Optimale infrastructuur en de laagst mogelijke kosten zullen altijd de belangrijkste criteria zijn voor locatiekeuzes. In het geval dat er meerdere opties overblijven na toepassing van deze criteria, kan het model de keuze vereenvoudigen. Het maakt onderscheid tussen de beschikbare locaties op subniveau, gebaseerd op de competentie van de beschikbare locaties.

Locatiecompetentie moet zo benaderd worden dat locatiekeuzes gerechtvaardigd worden volgens de *benodigde* locatiecompetentie van warehouses, om effectief te kunnen opereren in hun strategische rol. Wellicht is er behoefte aan het beschouwen van de activiteiten van een klant (het management ervan en de gebruikte technologie) in het locatiekeuzeproces. De invloed van deze activiteiten op de benodigde ondersteuning uit de omgeving dan tijdens het proces aan de orde komen. Deze theorie laat ook nieuw licht schijnen op het veel gebruikte warehouse-classificatiesysteem. Op dit moment is de toegevoegde waarde van een dergelijk systeem erg laag, omdat het alleen maar bestaande warehouses op hun ontwerpkenmerken vergelijkt. Een aangepast classificatiesysteem, waarbij omgevingsfactoren in meer detail worden overwogen (locatie competentie), kan ervoor zorgen dat de activiteiten en toekomstplannen van een logistieke dienstverlener plaats kunnen vinden in een gepaste omgeving.

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1 RESEARCH DESIGN

This section focuses on the overall design of the research by explaining the background, objective and problem statement and the research strategy used. It starts with an introduction and concludes with an overview of the structure of this report.

1.1 Introduction

The theme of this thesis is warehousing in Europe. Warehousing is part of the concept of Logistics Management (LM), originally known as Physical Distribution Management. When considering the developments in supply chains for the last decade, it becomes clear that warehousing plays an important role in it. A well-organized supply chain is important to support a company's business strategy. Examples of general developments are the growing diversity of products, a power-shift towards buyers, outsourcing of activities, product life cycles becoming shorter and globalization [Van Goor et al. 1996]. In addition, and more recently, the removal of trade barriers, deregulation and increase in goods volume transported internationally causes many companies in the European Union (EU) to re-evaluate their distribution structures [Stefansson 2004]. Due to the expansion in 2004, the original EU-countries (referred to as EU-15) experienced more competition and on an extended level: namely on Pan-European basis. The role of warehousing is to make sure that the (new) regional consumer markets are effectively incorporated in a company's global supply chain of products and services.

New markets entered the union of free movement of goods and capital and supply chain networks were altered to enter the new Central and Eastern European (CEE)-markets. The liberalization of trade and investment between CEE and the EU has led to a relocation of production activities [Toubal 2004]. Already during the 90s, several manufacturers positioned themselves in the most promising CEE-countries [HIDC 2003]. In addition, some logistics service providers (LSPs) entered one or more CEE-countries before 2004. Low labor costs were (partly) responsible for the relocation. Nowadays, low labor costs seem to be a short-term advantage [Graham & Sahling 2004, Frost & Sullivan 2004] as labor costs will rise steadily with the economic development of these countries.

Although it is not part of the extended EU, interest in Ukraine is growing, as it is an attractive transit country for goods from Europe, Asia and the Middle East. Its logistics market shows turbulence and is developing at high speed; revenues for the transport industry in 2005 increased by 12% to 3 billion Euro compared to 2004 [AIBC 2006a]. Attracted by low labor costs and possibilities for export to other countries, many international companies are approaching Ukraine.

The focus of this thesis is on the developments in warehousing aspects like activities and locations in both the European and the Ukrainian market. The relocation of production activities and altering of supply chain networks influenced and still influence aspects of warehousing. Also in Ukraine, it is clear that companies like international third-party

logistics (3PL) providers want facilities that complement and extend their Pan-European supply chains. Because of these developments, the engineering and consultancy (E&C) company Tebodin Ukraine is curious for chances in the market and needs information about the market of logistic services in Europe, its main trends and facility requirements needed to support the activities. Eventually, Tebodin Ukraine wants to extend its services and meet the requirements of potential international investors.

1.2 Background

1.2.1 The role of a warehouse

Following Lambert et al. [1998] warehousing can be defined as *that part of a firm's logistics system that stores products (…) at and between point of origin and point of consumption, and provides information (…) of items being stored*. This definition points at different important roles of warehousing. First, as it is part of a company's total logistics system, warehousing plays an important role in the movement of products from point of origin to point of consumption. Therefore, warehousing can be seen as an integral part of LM linking different activities together. Secondly, warehousing encompasses the storage of all kinds of products, like raw materials, parts, goods-in-process and finished goods. Depending on the nature of the product to be stored, there are many possibilities to store them. These range from just a shed in the garden to a state-of-the-art, professionally managed warehouse (see appendix A for use of this term). Why companies hold inventories in first place and how much, is widely commented in the literature [Bowersox & Closs 1996 chapter 8, Lambert et al. 1998 chapter 4, Van Goor et al. 2003 chapter 7] and will not be discussed here. Thirdly, warehousing provides information about the stored items. This also fits in the concept of LM for it encompasses the flow of information about the inventory handled. The information is used by the management to make strategic decisions (concerning the allocation of logistics resources over an extended time in a manner consistent and supportive of overall enterprise policies and objectives) or operational decisions (to manage or control logistics performance). Either way, it is important to consider the logistics system as a whole: a decision causing transport costs to rise but reduce inventory costs makes sense [Pfohl 1997]. Specific Warehouse Management Systems (WMS) are available on the market to provide information on the status, condition, and disposition of the stored items. These can support the decision making process.

By combining the above roles, warehousing plays a vital role in providing a certain level of customer service and in the overall costs of a company's logistic system. In a broad sense, customer service is the measure of how well the logistics system is performing in providing time and place utility for a product. Good customer service supports customer satisfaction, which is the output of the entire marketing process. The warehouse, its assigned activities and location, has a major influence on transportation, stockholding and other costs. Thus, the existence of a warehouse can only be justified as it can provide cost or service advantages [Korpela & Tuominen 1996]. It involves getting the right product to

the right customer at the right place, in the right condition and at the right time, at the lowest total cost possible [Lambert et al. 1998]. Today, in all of these and in related elements the market shows turbulent developments both on the supply and the demand side. All kinds of products and services are available to effectively and efficiently support the storage facilities, to accurate, simplify and speed up the information flow and measure or adapt the output of the logistics system as good as possible to consumer demands. Due to an increasing interest in improving inventory turns and reducing time to market, the role of distribution increasingly focuses on filling orders rapidly and efficiently.

1.2.2 Changes in logistics

Hesse [2002a, 2002b] investigated indicators of structural change in logistics over the past few years and (among others) its effects on warehousing. He stresses that the recent developments in logistics are an outcome of economical structural changes and that logistics will influence the structural changes as well [Hesse 2002b]. It emphasizes the presence of considerable dynamics in the logistical sector. At macro level, the process of globalization causes spatial expansion of the economy, more complex global economic integration and an upcoming network of global (product) flows and (logistics) hubs. Due to the introduction of the Single European Market in 1992, politics of deregulation and liberalization are present and economics and monetary are unified. As a result, the logistic sector experiences less regulation, an expanded market area and accelerated competition. Warehousing will play an increasingly vital role in positioning and implementing the regional consumer markets in the global supply chain of products and services.

At meso level, a power shift in market relations from a supplier-dominated to a buyer-oriented market can be discovered, associated with new and increasing inter-firm competition. More examples of sectoral changes in logistics are the rise of service economies, the increased share of goods with high value and low weight and the upcoming of related high-tech and knowledge based sectors. The flow of goods, information and finance can be managed and controlled in a more integrated way, due to the introduction of new information and communication technologies. Increased sharing of data among trading partners will dramatically improve the ability to predict demand [Kirschbraun & Bomba 2000]. Warehousing will be increasingly automated in favor of the efficient flow of goods and information.

At micro level, the growth (in demand) of logistics services in general causes an increasing demand for distribution space. LSPs need to compensate the loss of storage and stock-keeping activities abandoned by manufacturers and retailers [Hesse 2002a]. To accommodate the economic growth, an increasing number of facilities and locations will be needed. Kirschbraun & Bomba [2000] believe traditional warehousing will change: *'The act of warehousing exists because companies are unable to predict demand and prefer to provide a buffer for themselves that accommodates spikes and lulls in the sales process. (…) Aggregate demand for traditional warehousing space should decline over time, as the enabling technology is widely adopted and implemented. (…) However, as the new*

technology enables continual movements of products in the supply chain, the need to stack inventory begins to diminish. Traditional storage space must start housing activities that involve more horizontal movement rather than vertical stacking (…).'

1.3 Objective and problem statement

The previous section reveals that the changing role will have its effects on the warehouse location (and design) requirements of companies involved in logistics. It is important to describe the role of warehousing and the influences on warehouse location decisions. A framework with a focus on these specific elements of warehousing will contribute to this research. The theoretical contribution of such a framework is the development of a model that relates the changing role and activities of warehouses to the environment of the warehouse. The practical contribution is to use the outcomes of the model applied in practice, for determining the specific needs of LSPs in facility design and allocation. This, ultimately, is useful for the logistics related activities of Tebodin Ukraine. Therefore, the objective of this research is *(1) to develop a model to support warehouse site selection decisions based on logistic services, and (2) to provide insight in the theoretical and practical implications of the model by analyzing the European and Ukrainian market of warehousing.*

The objects to be researched are the available site selection theories and the theory about the concept of warehousing. Research of the European and Ukrainian market of warehousing provides the context in which the developments in warehousing take place. The research model is as follows (figure 1-1):

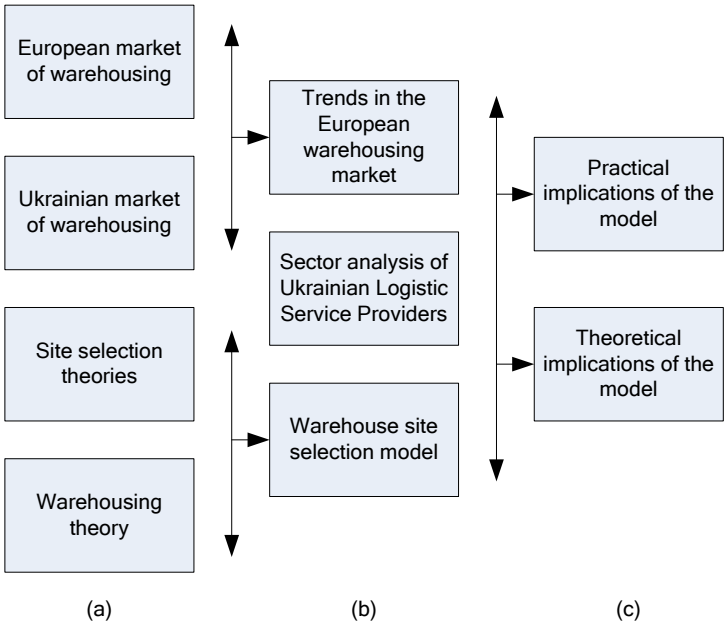

Figure 1-1 Research model

The research model can be described as: *(a) Investigation of the literature about site selection and warehousing, and the context in which the developments in warehousing take place will result in (b) a warehouse site selection model and insight in the trends in*

the European market of warehousing. A sector analysis of the Ukrainian logistics services in comparison with both the warehouse site selection model and the trends in the European market will result in (c) theoretical and practical implications. Yet, little is known about the difference in developments in the European and Ukrainian warehousing market and how they relate to each other. This insight is necessary to analyze the theoretical and practical implications of the model. Namely, the market developments are expected to have influence on the type of activities offered by logistic service providers. In turn, little is also known about the effect of these activities on warehouse location decisions. As follows, and also based on the research model, the problem statement can be put down in two central questions:

1. What are the developments in the European and Ukrainian market of warehousing?
2. What is the effect of logistic activities on warehouse site selection decisions?

The first question focuses on the context in which the developments in warehousing take place. It is important to investigate the change in supply chains in the EU because they will have a significant influence on the warehousing concept. Because little is known about warehousing in Ukraine, the Ukrainian market is highlighted with respect to doing business and elements of the warehousing concept. Furthermore, it is necessary to get insight in the E&C activities Tebodin Ukraine undertakes concerning warehousing. To answer the second question, relevant literature in warehouse site selection needs to be investigated. If there is no model available to support warehouse site selection decisions based on logistic services offered, it needs to be developed. The next step is to perform an in-depth analysis of the Ukrainian logistics market by surveying experienced LSPs. This analysis will be compared with both the model and the general developments in European warehousing. Consequently, both theoretical and practical implications of the used model need to be outlined, also with regard to the E&C activities of Tebodin Ukraine.

1.4 Research strategy

The execution of this research is structured in accordance with a certain strategy based on the framework used, the objective of this research and the problem statement. In this thesis, the emphasis is put on specialist literature in a desk research and, constituting the empirical part, a case study supported by a cross-sectional survey and expert interviews. The considered literature is related to site selection models and the concept of warehousing. Furthermore, the desk research focused on market reports and relevant articles. To get more detailed information about the Ukrainian market of logistics, a survey among local (international) LSPs is executed and interviews are held with experts on Ukrainian logistics. The results of the case study are compared with the model, as described in the framework. Also, insight is gained in developments in the Ukrainian logistics sector. A representative selection of LSPs is made and an enquiry is sent to them. With the survey, the model is applied and the companies are asked about their possible intentions to expand their business activities. In addition, a representative selection of Ukrainian logistics experts is made for the interviews.

1.5 Structure of this report

The second chapter of this report provides information about the context of this thesis. Supply chains in Europe and developments in the European market of warehousing are discussed. Furthermore, this chapter discusses the act of warehousing and doing business in Ukraine. It concludes with an overview of the engineering and consultancy activities in the field of warehousing practiced by Tebodin Ukraine. Chapter three describes the theoretical background of this thesis. It encompasses past and recent research in the field of warehouse site selection criteria and processes. In addition, a model is explained on which a major part of this thesis is based and by combining this with the previous theories, a new approach is suggested. In chapter four the empirical part to support the new approach is discussed, by outlining the structure and use of a survey and expert interviews.

The fifth chapter collects different data and presents the results of both the survey and the expert interviews. These results are combined with the suggested approach and the findings will be discussed in chapter six. This chapter focuses on the theoretical and practical implications of the used model, based on the survey and interview results. It also considers the usefulness of the findings for Tebodin Ukraine and suggests different points of attention regarding the engineering and consultancy activities. The impact of the latest developments on location decisions and warehouse design are the main subjects. Finally, chapter seven closes with conclusions according to the research questions and recommendations for further research.

2 CONTEXT

This chapter highlights developments in the European and Ukrainian market of warehousing and outlines Tebodins relevant E&C activities towards warehousing.

2.1 Introduction

The purpose of this chapter is to provide insight in the context in which developments in LM nowadays take place. Both the European and the Ukrainian market provide the context. Developments in these markets are important for the objective of this research. Especially the reconfiguration of European supply chains had a major effect on warehousing in Europe. In either way, the latest developments in logistics caused the Council of Supply Chain Management Professionals to revise their definition of Physical Distribution Management. Nowadays they use the term Logistics Management instead. LM is *that part of Supply Chain Management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements* [CSCMP 2006].

2.2 The European market of warehousing

2.2.1 Supply chains in Europe

In general, manufacturers settle down for mainly two reasons: (1) to produce for the local/regional CEE-markets or (2) to produce for the European or even global market [HIDC 2003]. For manufacturers in CEE, a good supply chain network is needed to distribute their products back to Western Europe. More and more they rely on LSPs, like 3PL, to take care of supply chain logistics [Maltz & Dehoratius 2005]. Not only do they have well-structured Pan-European distribution networks but also expertise in different logistical activities. Especially the transport of goods and warehousing are outsourced logistical activities by manufacturers [Eyefortransport 2006a]. It saves them from going into major investments in labor, assets and technology when they lack a good distribution network by their own. Important factors when outsourcing such activities are the management by the 3PL and insight in costs.

LSPs settle down either for collecting and distributing goods from and to Western European countries/markets or providing local distribution of goods to customers in CEE-countries. Delivering services in new geographic regions and maintaining profits under price pressures from customers are the two biggest challenges 3PLs meet [Eyefortransport 2005]. Furthermore, the European market shows growth for 3PLs and services offered, and Eastern Europe is one of the main regions with potential for growth. Opportunities for growth can be especially found in the area of reverse logistics, global freight management, fourth-party logistics and IT/technology solutions. Based on above, manufacturers and LSPs have four options, outlined in figure 2-1 (source base-map:

Magnusson [2006], adapted). The location of the manufacturing facility and the consumer market is shown, as well as the direction of the produced goods guided by LSPs.

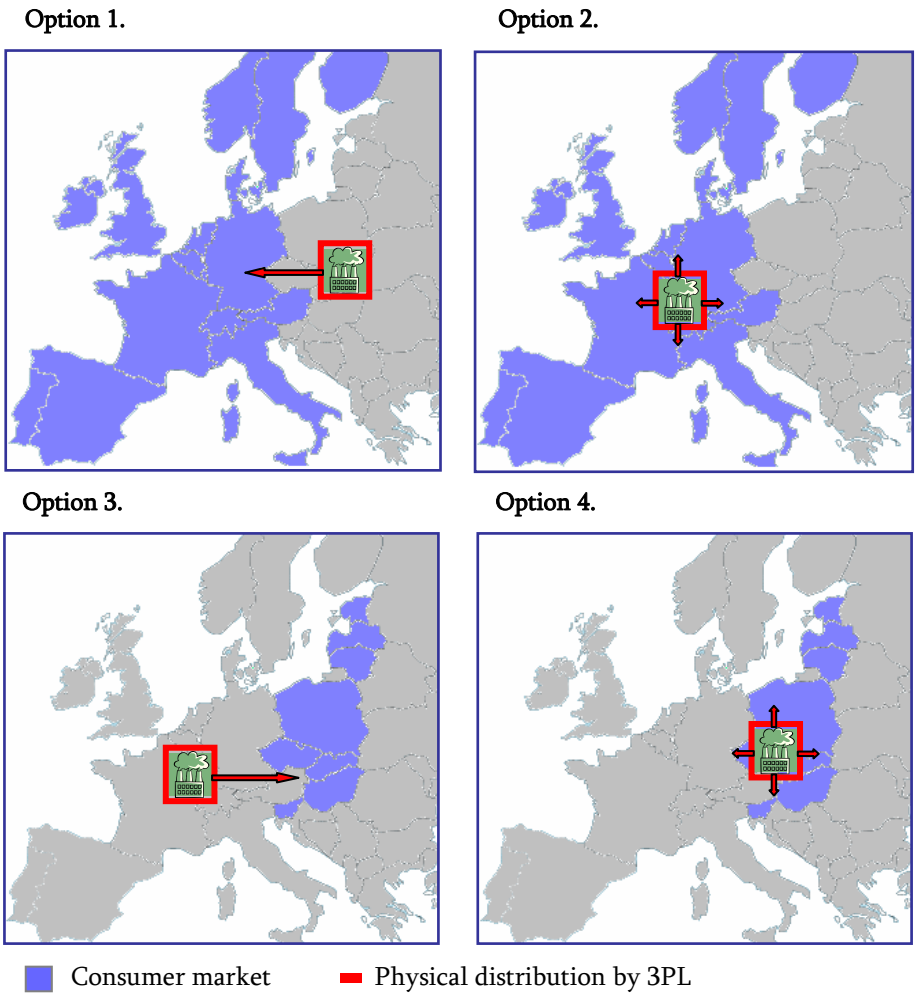

Figure 2-1 Different options to serve Western Europe and the CEE-markets.

The first option for manufacturers is to replace their production location to one or more CEE-countries while 3PLs take care of the physical distribution to move the finished products to Western Europe; the second option is to remain in Western Europe and focus on that market. LSPs can take care of the physical distribution; thirdly, the already settled manufacturers in Western Europe start exporting their products to CEE-countries, either by themselves or with help of the existing distribution networks of 3PLs. Due to future changes in the institutional setting of the ten "accession countries" (AC-10), i.e. adapting to EU standards, a substantial export potential exists for the EU-15 countries [Fuchs & Wohlrabe 2005]; the last option is that 3PLs expand their business to one or more CEE-countries to take care of local distribution for either a local manufacturer or a foreign manufacturer who settled in the considered country.

In relation with the previous part, a certain development can be seen in the configuration of European supply chains. In general, three basic European supply chain structures can be distinguished. The first one is the classical structure, which aims at specific countries, with each production location having its own warehouse. It is a fragmented structure, due

to the local (stock) management and use of local logistics service providers. This approach lacks central European supply chain visibility and makes the supply chain difficult to manage. See figure 2-2 for an overview (derived from HIDC [2003 p. 28], adapted).

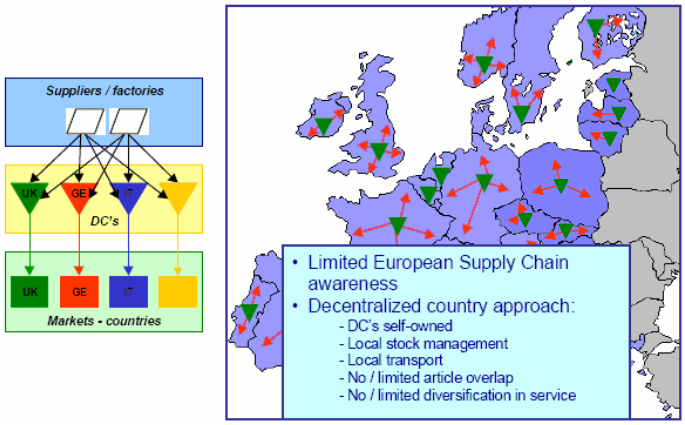

Figure 2-2 Classical European supply chain structure

In the last decade, the first structure evolved into a more cost efficient centralized concept with a Pan-European focus. The European Distribution Center (EDC) fulfills a main role in the concept of central European distribution, which is driven by the removal of trade and transport barriers between EU countries, the opening of new markets in Eastern Europe, the acceptance of a single European currency by most EU-countries[1], emergence of pan-European service providers and the development in IT and communication systems supporting supply chain management [Skjoett-Larsen 2000]. With EDCs, acting as a distribution point to at least five different European countries and of which 50% of the goods is produced in a different country [De Koster & Warffemius 2002], total logistics costs can be lowered and inventory control and customers service improved [BCI 1997]. As noted earlier, these services are typically outsourced to LSPs, because they have well-developed distribution networks and expertise. Also more attention can be paid to Value Added Services (VAS) and specification according to country requirements. In figure 2-3 an overview is provided (derived from HIDC [2003 p. 28], adapted).

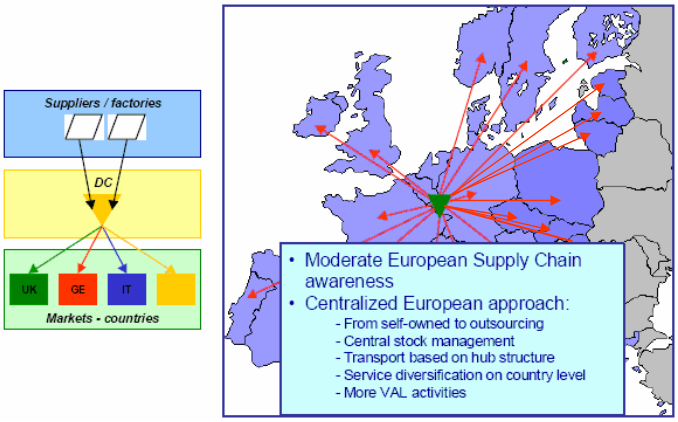

Figure 2-3 Cost-efficient European supply chain structure

[1] None of the AC-10 countries have reached the EU requirements yet to introduce the Euro. At this moment, Slovenia makes the first steps and is likely to introduce the Euro in 2007 [European Commission 2006a].

Nowadays, lead-time, reliability and time-to-market are driving the supply chains towards meeting customer service requirements. Local presence is needed to provide short delivery times while the management of the supply chain takes place on central level to control the total supply chain. The third European supply chain structure which is able to develop these competences is the hybrid structure. In this structure, an EDC is typically located close to main ports and main consumer markets in Western Europe, to keep the supply chain costs low. To be close to the most prominent customer or distant markets, local warehouses are incorporated in the network. Mostly managed by LSPs, they serve local customers requirements. LSPs play an important role in this structure, providing transport, facilities and VAS. The primary benefit of such structure is that it provides the opportunity to combine key features of centralized and decentralized structures [Leenders & Johnson 2000]. Figure 2-4 provides in an overview of this structure (derived from HIDC [2003 p. 29], adapted).

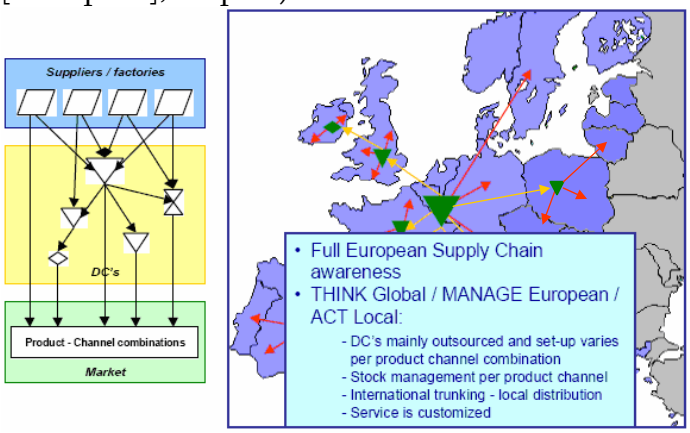

Figure 2-4 Hybrid European supply chain structure

Furthermore, multi-modal transportation to and from CEE-countries will increase, due to the EU-policy for enhancing the use of multi-modal transport in the pan-European supply chains. Rising fuel prices, road pricing and congestion [ING Real Estate 2006] contribute as well. To relieve the ever more congested roads, transport by railways and waterways should become major counterparts in transportation mode decisions by companies. Nevertheless, proximity to highways remains the key priority in (international) warehouse location decisions [Graham & Sahling 2004] and plays an important role in the development of supply chains towards CEE.

2.2.2 Developments in European warehousing

The re-configuration of existing and the establishment of new Pan-European supply chains influenced warehousing as part of the physical distribution. Using Hesse [2002a, 2002b], who investigated indicators of structural change in logistics and its impact on warehousing, this influence will be approached at three different levels.

Macro level

Especially when companies trade on a larger scale since the expansion of the EU, warehousing needs to link all kind of new activities together in order to bring products

from Western Europe to CEE-countries or the other way around. The demand for a high customer service takes the activities within the warehouse beyond simply storing goods. They need to take place on locations close to transportation corridors (by road, rail, air or water) which link the gateways of trade with the large consumer markets. Two developments can be distinguished regarding these locations.

On one hand the goods flow tends to be centralized by the establishment of EDCs on strategic locations in Western Europe, serving the European market. These locations are major freight hubs [Hesse 2002a] like large airports. Because of the general growth of trade and the reconfiguration of supply chains towards CEE-countries, the importance of these hubs is increasing. As a result, location requirements change. Access to excellent transport conditions and relatively cheap land for increasingly large facilities are important site selection factors. In addition, the term European Logistics service Center (ELC) is used, because more and more initially developed EDCs act as a service center to facilitate the flow of goods [NDL 2001]. This is the consequence of the shift in activities towards the warehouse, pushed by manufacturers, distributors and retailers [Maltz & Dehoratius 2005]. As a result, a wide range of VAS-activities need to be housed in a suitable environment (i.e. in a warehouse on the right location and with the right management).

On the other hand, and due to the consumer oriented market, globalization calls for a local market approach, thus bringing warehouses and their activities closer to the consumer. Also, because the distances between the ELCs and customers in CEE-countries are too far to keep a certain level of customer service, regional fulfillment centers need to be established in CEE-countries. While in Western Europe a high level of customer service is crucial, in CEE-countries requirements like lead-time and delivery reliability are not yet that stringent [HIDC 2003]. As a result, warehousing in Western Europe needs to take place close to the major client companies or customer markets, while in CEE other location criteria like low location costs are important.

Meso level

A general development is the power shift in market relations from a supplier-dominated to a buyer-oriented market. This is associated with the rise of service economies and the upcoming of logistic related sectors. One of them is the upcoming real estate industry in logistics. This industry became aware of the significance of the logistics business, due to the demand for land as a consequence of changing quantitative dimensions and qualitative user requirements [Hesse 2002a, 2004]. Today, the logistics real estate industry is more diversified and specialized, and prime yield reach a level of eight percent per annum [Hesse 2004, Jones Lang LaSalle 2006b].

By now, the 3PL is a well known party in the European logistics market. The 3PL manages and executes a particular logistics function, using its own assets and resources, on behalf of another company [Eyefortransport 2006b]. In the course of time, deep informational technology skills and deeper analytical skills were required to achieve

supply chain leadership. This caused the emergence of the Fourth-Party Logistics Provider (4PL), also called Lead Logistics Provider (LLP) or Logistics Service Integrator [De Koster & Delfmann 2005]. In the global market, outsourced logistics create more of a partnership critical to success than a supplier/customer relationship. LSPs in the global market understand that this new concept is vital to boost their cost savings, enhance their cash flow and improve servicing levels for getting their products to market. Typically, a 4PL functions as an intermediary by managing the supply chain on behalf of the customer; provides complex, customized services for optimization of the clients supply chain; and is neutral and trustworthiness in a close relationship with the client, which involves access to confidential and important information.

There is a tendency for major players in the distribution business to control as many parts of the logistics chain as possible [Hesse 2002a] for extending their service portfolios and geographic coverage, either by taking over another company, by expanding current services or by forming strategic alliances [McInerney 2003]. For example: Maersk took over P&O Nedlloyd, raising its market share in the global shipping industry to 17% [Khandker 2006]; Deutsche Post World Net took over the UK-based Exel and became global no. 1 in air freight, ocean freight and contract logistics [DHL 2005]; the German Deutsche Bahn AG took over the American global freight forwarder Bax Global, being a complementary for its logistics subsidiary Schenker [Schenker 2005]. In addition, strategic alliances are increasingly important in providing more value added services at a lesser or comparable cost. They can be established with warehouse operators, global carriers or companies who manage the flow of information through the supply chain [McInerney 2003].

Especially when it comes to location decisions and design of warehouses, engineering and consultancy companies play an important role. These companies often use computer software to present their clients virtual warehouses, in which they can plan every square feet of space as efficient as possible. Nowadays, these designs can be used for simulation. In such way, different alternatives can be modeled, simulated, and the statistical outputs can be compared to determine the most feasible design [Gross & Associates 2003]. Nowadays, manufacturers can transport their products easier into CEE-countries. There is a tendency to involve 3PLs for their Pan-European networks and expertise in different logistics functions [HIDC 2003, Maltz & Dehoratius 2005, Eyefortransport 2006a].

Micro level

New patterns of demand and supply, forthcoming from the dynamics in the logistics market, raise the demand for new types of DCs. The so-called “High Throughput Centers” need to consolidate the materials flow efficiently, with a focus on increasing product flow and decreasing stocks. In addition, more activities are directed towards the warehouses and the level of sophistication raises, as new technologies meet the new requirements of the customer, like decreasing lead time. Being more efficient requires more information on which strategic and operational decisions are based. That information is generated by the use of a WMS. WMSs are integrated in most of the warehouses to come towards the

need for detailed insight in product flows. These systems are even linked to other computer-based systems in other sections of the supply chain (for example in trucks), thus providing a complete overview. In most cases, information is also available for clients who can address it via online internet applications. For example, orders can be placed online and sendings can be 'tracked and traced'.

In Europe, VAS take place on a wide scale and most LSPs offer one or more VAS to meet customer demands. Today, chances for growth of logistic services can be found in providing technology / IT solutions, reverse logistics, global freight management and 4PL/LLP services [Eyefortransport 2005]. The VAS often require coordination of several warehousing activities and communication with suppliers and customers [Maltz & DeHoratius 2005]. Therefore, modern warehouses see front-line labor and supervision as critical to successful performance. Training the employees in multiple activities provides the needed flexibility in warehouses. Also the implementation of new technologies is critical to meet the proactive attitude of modern warehouses. To improve accuracy and control of inventory flows, hardware options like Radio Frequency tagging and improved bar code scanning become more important. Because of the increased flow of information and its importance, the LSPs often use WMS for real time visibility of the supply chain. In this way they can make sure that important decisions concerning logistics are made correctly and in time.

The size of warehouses is gradually increasing due to the shift of activities towards the warehouse and centralization of product flows. The growth (in demand) of logistics services in general also causes an increasing demand for distribution space. Bigger warehouses ask for bigger land plots. According to Hesse [2002a], this space can be found particularly in suburban and exurban areas. This development has a few reasons: in these areas, land plots are often larger and cheaper in comparison with the urban core; the access to major transportation infrastructure is usually much better, due to the locational advantage of freeways and intersections; suburban sites also provide for a flexible and 'robust' environment for 24hr operations.

2.3 The Ukrainian market of warehousing

2.3.1 Doing business in Ukraine

After the enlargement of the EU on 1 May 2004 Ukraine is now a direct neighbor of the EU through Poland. Although Russia has always been the largest single trading partner of Ukraine, a shift can be discovered towards the European market [USAID 2005]. With 31,2% of all trade, the EU was the major trade partner of Ukraine in 2004 (followed by Russia, 29,4%) [European Commission 2006b]. Through the implementation of the so-called EU-Ukraine Action Plan, trade barriers will be reduced and through non-discriminatory, transparent and predictable business conditions, simplified administrative procedures and by the fight against corruption the investment climate will be improved [EU 2005]. The greatest challenge to Ukrainian exports is an outdated institutional

framework, as with many other issues, inherited from the former Soviet Union [USAID 2005]. The main challenge Western companies face anticipating on changes and unfamiliar national cultural values [Fuxman 1997]. Companies need to be alert, patient, and understanding towards the culture.

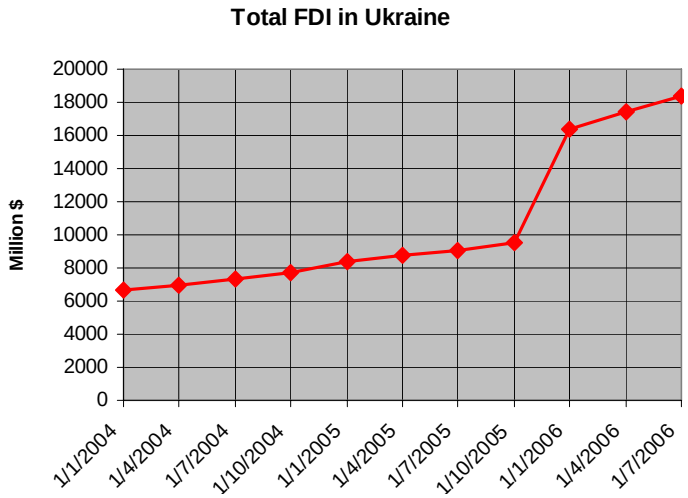

Figure 2-5 Developments of FDI in Ukraine

With January 2004 as a reference, Foreign Direct Investment (FDI) in Ukraine steadily increased every year, see figure 2-5[2]. It seems that neither the Orange Revolution of end 2004 [Motyl 2005] nor the unexpected outcome of the March 2006 elections[3], influenced the FDI (see appendix B). The major increase in FDI by the end of 2005 is mainly caused by Germany, thanks to the purchase of the Krivoy Rog steel company by the Anglo-Indian steel company Mittal through a German subsidiary [Auswärtiges Amt 2006].

In general, international companies are reserved to enter Ukraine for lack of insight in trade regulations and suitable (building) partners. International transport companies already present in the Ukrainian logistics market are the German Kuehne+Nagel, the French FM Logistic and the Dutch Frans Maas. These and other companies hastily utilize chances in an attempt to meet local, regional and global demands. However, there is a shortage of good storage capacity and distribution agents [Van Trommelen 2005]. The infrastructure in Ukraine is in a bad condition [Khakhliuk 2003, AIBC 2006a], but the 100% privatized road transport sector is developing [LP 2006]. Road transport takes up 22% of cargo share in the Ukrainian market. The main task of local transport companies, especially involved in international haulage, is to ensure that their vehicles meet international standards. Most of them use trucks which meet the Euro 3-norm [AIBC 2006b], although the EU already introduced the Euro 4-norm as a standard since 2005 (and the Euro 5-norm as from 2008) [VROM 2006]. Despite these developments, in several cases, their trucks are being used without regard to the specialized nature of the vehicle [Taylor 1997, author's observation]. Although much slower than road transport, rail transport takes up 77% of cargo share and the railway density of Ukraine is one of the highest among other 'Commonwealth of Independent States' (CIS)-countries. It is the

[2] Source data from State Statistics Committee of Ukraine [2006].

[3] The new cabinet is based on a coalition of leftist and pro-Russian parties [Kyiv Post 2006].

expectation that railways will remain the main (by volumes) freight transportation branch on middle and long distances [LP 2006].

2.3.2 Warehousing in Ukraine

Macro level

The act of warehousing in Ukraine is only developing since the last decade and tends to concentrate around the capital Kyiv for its central location and presence of potential clients. By the settlement of some leading international LSPs, it seems that the Ukrainian consumer market is implemented in the global supply chain of products and services. The network of global (product)flows, initially extended towards CEE, now also reaches into Ukraine, but mainly through regional fulfillment centers. The presence of ELCs , like in Western Europe, is not relevant. Main reasons are the transition status of the country (thus lacking the need for a distribution structure with modern Western characteristics) and the preference of other CEE countries over Ukraine for the exploitation of such centers. Because Kyiv is the most developed city in Ukraine considering warehouse real estate [Real Estate Ukraine 2006 p. 36], it is an useful example to describe the status of the logistics market. For the fifth year in a row, the demand for quality warehouse premises grows faster than supply and the deficit reflects in high rent rates. The average rental rates around Kyiv raised by 10-15% since 2004 and now reach $7-10 per m^2 per month in professional warehouse premises, in average higher than other capitals in the CEE region.[4]

Supply of warehouse premises in Kyiv constitutes for the major part of reconstructed and old facilities in industrial zones, with characteristics far from the requirements Western companies demand. Professional warehouse premises of a large format are very few on the market and in general, the quality is poor. Development of new, modern warehouses continues to be limited due to a major shortage of land (with the proper status) with resulting high prices per plot, the closed and non-transparent land acquisition procedures and the complex and time consuming process of gaining the necessary permits and documentation from local and state authorities. In addition, LP [2006 p. 54] states that 'Ukrainian logistic operators were (…) ready to accept leases at prevailing market rates (…) and started to develop their own projects. Being proactive, Ukrainian (LSPs) gained an obvious competitive advantage over their western counterparts – they had at their disposal new warehouse premises. Therefore, after facing growing competition, western (LSPs) were forced to adjust their positions and to synchronize their requirements with the existing market conditions.'

Economic development in Ukraine, additional demand from large industrial and retail enterprises expanding their presence in the country, the tendency to outsource logistics towards 3PL-providers and the increasing scale of operations of logistics operators will drive demand up, especially for modern warehouses. Although, this is only to be called

[4] Unless specifically indicated, the information presented in this section is based on market reports from Collier International [2005], Logistics Platform (LP) [2006] and Real Estate Ukraine [2006].

realistic in case of elimination of political risks, continuing income growth and stability of national currency. The year 2005 was characterized by substantial political risks related to the discussion of possible re-privatization and to general economic slow-down [LP 2006]. Today, uncertainty prevails, as the political arena is turbulent following the outcomes of the March 2006 elections. Consequently, it seems to make LSPs avoid investment [Collier International 2005].

Most of the cargo flow arrives at Kyiv from western directions (the right bank of the river) and are predominantly distributed on the right bank. The most popular location for a warehouse is close to the Ring Road on the right bank (see appendix C), for it has the best possible road and truck access. Heavy traffic conditions are seen as an obstacle for an effective functioning of a warehouse situated on the left bank. However, the importance of eastward cargo flows adds attractiveness to the warehouse premises on the left bank. The major shortage of land results in a decrease of location requirements; almost every location is preferable, as long as there is a suitable plot available with the right land status. Surprisingly, neither Ukraine's biggest airport (Kyiv Boryspil) on the left bank of the river nor Gostomel Airport[5], 25 km from the right bank, are seen as attractive locations for a logistics hub. It is likely that, together with the lack of centralization in ELCs, there is no need (yet) for big logistic hubs. Possibly, the (speculative) development of a large air cargo terminal at Gostomel airport, which is said to be comparable in size and capacity to the air cargo hub in the French Toulouse [US Commercial Service 2005] will attract more logistic activities to a central point.

Meso level.

It is probably due to their experience in the buyer-oriented market in the West, that the international LSPs in Ukraine prefer locations close to the customer. Following the footsteps of the big multinationals, local LSPs are increasingly paying attention to customer service and locate their warehouses close to the market (see also appendix C). The rise of service economies is not yet that stringent as in other CEE countries, mainly due to the transition status of the country. However, related sectors to logistics are in rise with the development of the country and the growing need for additional services. The logistics real estate sector is mainly dominated by big Western multinationals, trying to utilize opportunities as much as possible (yields have been estimated at 14-16% [Real Estate Ukraine 2006]). In addition, local developers have begun to discover the opportunities within this market and exploit this with new developments [Colliers International 2005].

Since the last decade, E&C companies play an increasingly important role in the Ukrainian logistics market. Not particularly because of their expertise in warehouse design, but more because of guiding projects according to Ukrainian specific regulations. When it comes to location decisions, Ukraine-based E&C companies have knowledge of

[5] Ukraine possesses a fleet of the world's largest air freighters (Antonovs-124s and Antovovs-225s) which are able to land on Gostomel Airport.

procedures and availability. They have also insight in the ruling Ukrainian norms; in most cases, they are inherited from the former Soviet Union and stricter in comparison with European norms.

The tendency for Ukrainian manufacturers to outsource logistical activities to 3PLs is growing, particularly because of the warehousing space of 3PLs. As a majority of them uses WMS-systems, there is also a growing market for companies specialized in such software. The LSPs in Ukraine can be divided in three groups. The first group consists of local LSPs, who are expanding their current services to meet the (steadily) increasing demands from their clients. Typically, they have either more than 10 years experience or are relatively young (between 0 and 5 years of experience). The second group encompasses the self-settled international LSPs, who build their own warehouses and network due to lack of suitable (building) partners. Today, they take up a small part of the market, but due to their experience and well-managed distribution structures, that amount is increasing in hinder of the first group. The last group consists of company alliances between international and local LSPs.

Although, strategic alliances take a lot of effort to be established, both parties could benefit of the combination of local and international knowledge and experience. Ukraine has had difficulties forming new moral and ethical standards in business [Fuxman 1997] and, consequently, partners may not have experience yet with the Western business ethics. However, in combination with increasing FDI, due to improved laws and regulations, these Ukrainian companies can be seen as interesting partners. "Verhoeven Logistics" provides a good example of a success story. This Dutch-originated LSP started transport connections between the two countries in 1998, and participated in 2005 for 50% in the Ukrainian LSP "TV-Trans". The local LSP already had a high quality warehouse [Verhoeven Logistics 2006]. Nowadays, Verhoeven Logistics has two temporary-bounded warehouses, three custom brokers and two customs offices. For the future only growth is expected and the company recently purchased a 6,5 ha plot nearby Kyiv's international airport Boryspil to come towards the growing (international) demand for logistics services.

Micro level.

The services offered in the Ukrainian logistics market differ depending on the provider. When the considered LSP is originated in the West, a complete range of services is offered in accordance to what is offered in Western Europe. The rapid growth of the logistics market since 5 years (related to the real estate developments), triggered more local LSPs to expand their national network and extend their portfolio. However, according to their websites, the services offered by local LSPs, if not influenced by a Western mother or sister organization, show relatively basic activities: storage on a good location, pallet handling, condition controlled storage, fire safety, order picking and also the use of WMS for basic information. Customer clearance support and VAS are services widely offered, but the latter remain rather limited to packing, repacking, sorting and labeling of products. Some offer consulting or services according to client specific requirements.

Possibilities for online tracking and tracing and special client access are not present among the local LSPs. Worth noting is that in some cases services as 'preparing product for promo-actions' and 'office/residential relocation' are offered, as well as LSPs giving an overview of the truck brands in their fleet of trucks. The warehouses used differ as much as the provider's services. Western companies rely on their experience and are responsible for new and more professional warehouses. A major part, 80% according to Real Estate Ukraine [2006 p. 34], of the existing warehouses are simple storage centers and do not reach the requirements of Western LSPs. When a local or international LSP intends to (re-)build a warehouse in Ukraine, and the local authorities approve his plans, the design has to comply with several Ukrainian standards. For many of the international LSPs, the former Soviet norms are surprisingly strict, resulting in more costs during the realization phase. In addition, international LSPs require compliance to European standards and in case of conflict, the most strict norms rule. Even (previously) made design drawings imported from the West need to be licensed according to Ukrainian standards.

In the past decade, the materials used for the design of warehouses, mainly consisted of bricks, concrete and metal roof sheets. Also due to the influence of international LSPs, the market is developing and steel structures as well as metal wall sheets are increasingly used. The Ukrainian market currently experiences problems with licensing the construction materials imported from other countries. Together with the material use, the size of warehouses is changing. The average requirements are typically for units ranging between 2.000 and 15.000 m^2 [Real Estate Ukraine 2006 p. 35], but due to the growth in demand, the increasing maturity of the market and the development of logistic complexes these figures will grow. Therefore, a warehouse can be newly built or expanded. In either way, the use of building materials offering a greater flexibility will increase. Expansions or changes in lay-out, handling materials or systems (due to changing requirements) need to be possible and realized easily.

2.4 Tebodin Ukraine and Warehousing

2.4.1 Project approach

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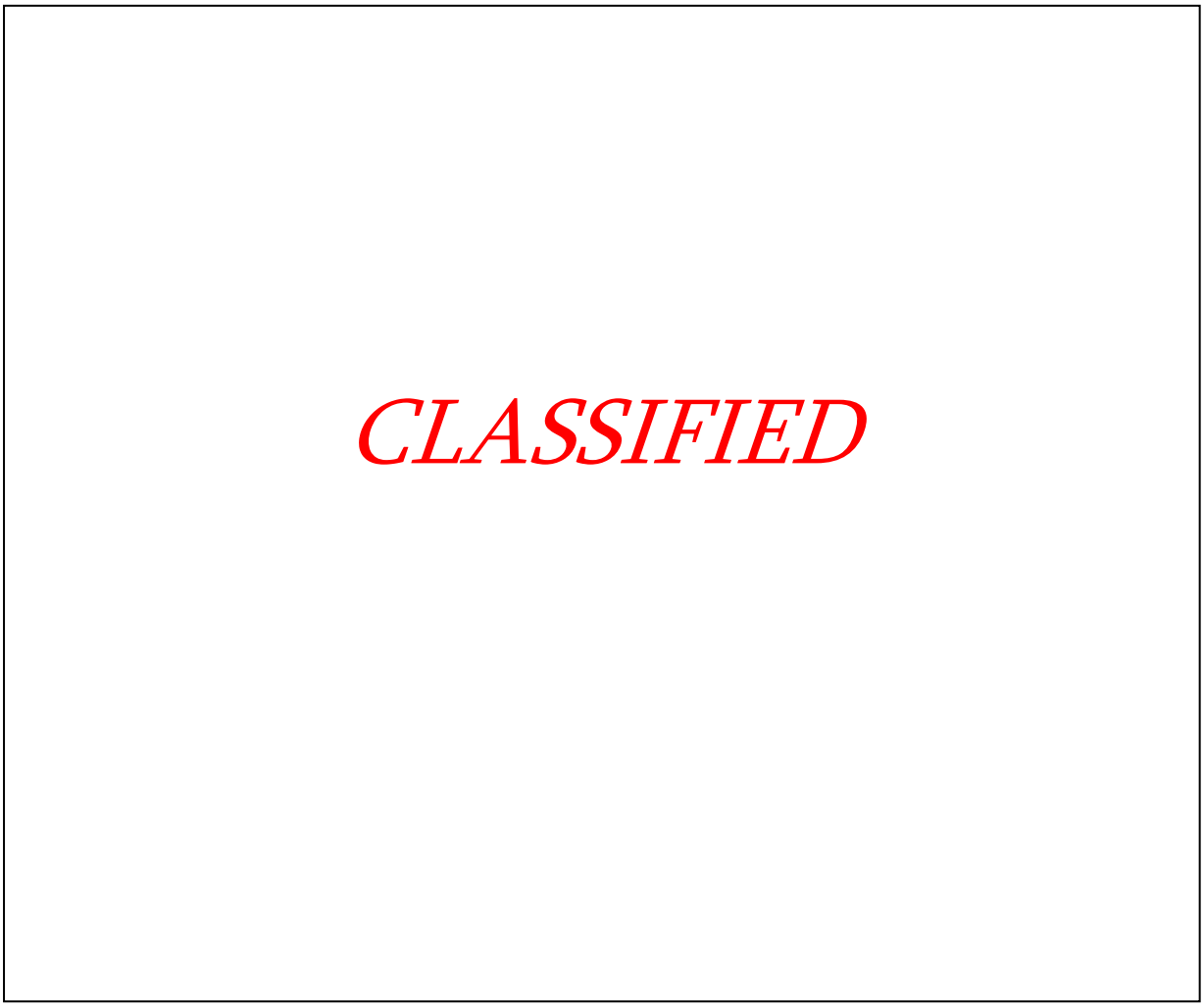
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3 THEORIES

This chapter provides insight in relevant elements of warehousing and considers theories that contribute to the warehousing concept. Firms' motivations to go abroad and the process and different criteria of warehouse site selection are explained.

3.1 Introduction

From the viewpoint of this thesis, it is important to provide insight why companies in first place choose to operate on an international basis as for distributing products or relocating production facilities. Well-known is Porter [1986], who stresses that internationalization of activities is a prerequisite for the continuity of many firms. Asmussen et al. [2005] posit that when using the term internationalization, it only pertains to the geographical scope of the firm's activities. When the division of labor takes place at international scale within that scope, one can talk about global specialization. Thus, a firm with a global supply chain is both global in scope and globally specialized.

Westhead et al. [2001] point to D'Souza & McDougall [1989] who see the ability to engage in exporting activities as a necessary ingredient to ensure survival and growth of new and small firms. They also give a complete overview of the different theories available for explaining why firms engage in international operations [Westhead et al. 2001 pp. 8-9]. One of them, Dunnings [1988], seeks to integrate internationalization theory with location-specific elements of international economies. Also used by Meijboom & Voordijk [2003], Dunning [1993] imposes an eclectic paradigm of international production, in which he stresses that firms will engage in international activities based on ownership-specific advantages (due to the property of certain intangible assets), internalization-incentive advantages (result from extending value-added inputs within the firm) and location-specific advantages (price, quality or productivity and lower international transportation and communication costs). These advantages can put a particular country (or region within) in favor above others. In addition, Oum & Park [2004] reviewed many articles to identify important determinants for choosing a specific host country by multinational companies. Among others, these are market size and economic growth, costs factors (like labor), location advantage in logistics, infrastructure and technological capability. The theory of Dunning also contributes considerably in explaining relevant factors in the (international) location choice of warehouses by companies involved in international activities. The type of warehouse and thus the activities performed within the warehouse play a major role in these decisions.

3.2 Warehouse site selection

In general, the main goal in warehouse site selection is to optimize customer service while minimizing costs associated with transportation, labor, real estate and taxes [Choomrit 2005]. Korepela & Tuominen [1996] state that the decision process for warehouse site

selection is complex due to the consideration of multiple, both tangible and intangible criteria. Moreover, the decision of selecting optimal sites for warehouses has significant effects on types of transportation, the markets to be served, customer service level and logistic costs [Shary 1984, Korpela & Tuominen 1996, Gourdin 2006]. Many researchers investigated this process and a considerable amount of literature is available to support warehouse site-selection decisions. In literature, interest seems to be divided in two kinds of approaches regarding warehouse site selection: either on the selection of certain criteria or on the site selection process itself, taking into account certain criteria as deciding factors. Both approaches will be reviewed.

3.2.1 Warehouse site selection criteria

The warehouse site selection criteria can be searched for in different areas. In general, criteria are selected according to financial, transportation, marketing, operational or service considerations. Cooper [1990] identified multiple criteria, among others: the total costs of the distribution system, market orientation, production operation, the nature of the product, the type of warehouse and local considerations. Lambert et al. [1998 p. 290] uses two perspectives: the macro perspective examines the geographical location of warehouses in a general area on global, national and regional scale, with emphasis on improving service and/or reducing costs; the micro perspective examines factors that pinpoint specific local locations within the large geographic areas. Lambert et al. also distinguish factors depending on ownership. The general difference in selection factors they use, is originated in whether the company has the possibility to determine the services by itself (private warehouse), or that it has to comply with the standard services offered by the existing (public) warehouse.

Chen [2001] selected five criteria for the most suitable location: investment cost, expansion possibility, availability of material, human resource and closeness to demand market. Atkinson [2002] points at transportation considerations as the most important criterion. It covers different aspects as proximity to customers, transportation costs, availability of long-haul drivers and proximity to transportation routes. Other criteria are labor costs and availability, real estate costs, taxes, incentives (from governments and economic development group) and utilities. In a survey among a large group of international companies, Oum & Park [2004] identified the following factors: market size and growth potential, geographic location and market accessibility, transport facilities, political stability, skilled labor and labor peace, flexible government and the presence of logistics service providers. Hesse [2004] names excellent transport conditions, cheap land, network composition, market size, zoning, economic development incentives, infrastructure provision and qualified workforce as important location factors. In an overview of recent applications related to warehouse site selection, Choomrit refers to the *Top 10 most powerful factors in location decisions* [Choomrit 2005 p. 5]. They are: reasonable cost for property, roadway access for trucks, nearness to customers, cost of labor, low taxes, tax exemptions, tax credits, low union profile, ample room for expansion and favorable attitude of community/residents to industry.

3.2.2 The process of warehouse site selection

In most literature, the strategy or framework used as starting-point determines in which area criteria are to be selected (for example financial, transportation or service considerations). Some go further and point out how (or when) they need to be used during the process. These vary from simplistic approaches, like the *center-of-gravity model* for locating a single distribution center [Van Goor et al. 1996 p. 247, Lambert et al. 1998 p. 293], to mathematical, heuristic and algorithmic models for all kinds of distribution networks. Lambert et al. [1998] refer to Hoover [1948], who suggests three location strategies for warehouses: the *market positioned* strategy locates warehouses nearest to the final customer; the *production positioned* strategy locates warehouses in close proximity to sources of supply or production facilities; and the *intermediately positioned* strategy locates warehouses at a midpoint location between the final customer and the producer. Ross [1996] refers to the eight-phase methodology of Schmenner [1982] for warehouse site selection. In eight steps, the process of site selection is considered and he rightly points to the commitment of several disciplines during the process. In addition, Hesse [2004] points to the (increasing) influence of brokers and developers on site selection and thus during the site selection process.

Korpela & Tuominen [1996] suggest an integrated approach to the warehouse site selection process, using the Analytic Hierarchy Process (AHP). It is a theory of measurement for dealing with quantifiable and intangible criteria, based on three principles: decomposition, comparative judgments and the synthesis of priorities (see appendix F). They use the theory to divide the warehouse selection process in four phases: defining the problem, defining the alternatives, qualitative and cost analysis and eventually choosing the best alternative. The choice of warehouse site is based on the overall service/cost-effectiveness of each alternative. Jayaraman [1998] presents the mathematical FLITNET-model[7], which jointly examines the effects of facility location, transportation modes and inventory related issues on the overall objective of minimizing the distribution design costs incurred by a firm. He recognized the relationship between the management of inventory, location of facilities and the determination of transportation policy simultaneously in a distribution network design environment.

Nozick & Turnquist [2001] relate the inventory stocking policy to warehouse location decisions. By integrating a fix–charge facility location model with an inventory allocation model the number and location of DCs, and what products to stock at each level are obtained. A considerable number of theories and applications of location analysis is reviewed by Hamacher & Drezner [2002], which resulted in an overview of all kinds of location problems and models (even hub location problems). Although various problems are approached, like regions where it is not allowed to place new facilities or that have barriers against trespassing, there is no explicit focus on the logistics sector. Jayaraman &

[7] FLITNET stands for: Facility Location, Inventory, Transportation NETwork [Jayaraman 1998 p. 474]

Ross [2003] developed the PLOT[8] system, divided into two sub-models. On the one hand, a strategic choice of deciding which warehouses and cross–docks need to be opened and functional in any given time period is considered. On the other hand an operational model is discussed which deals with the optimal flow of product families from warehouse through cross-docks to satisfy the customer demand. The objective of PLOT is to determine the best set of warehouses and cross–docks to operate while minimizing fixed costs, transportation costs from warehouses to cross–docks, and costs to supply products based on customer demands.

Klose & Drexl [2003] review work which has contributed to the (for that time) current state-of-the-art and state that the quality of the services depends on the location of the facilities. They summarize continuous location models, network location models, mixed-integer programming models and their applications. Also they give a broad classification of the different types of facility location models. Ridlehoover [2004] uses a Monte Carlo Simulation and risk analysis to determine the best economic-risk location with regard to the expected annual worth. The Monte Carlo Simulation is used to determine the costs and benefits of each site and the risk analysis considers labor, transportation and real estate appreciation for each site. Cheong et al. [2004] dissociate themselves from most logistic network design models that focus on customer demand independent of service time or level. They present a computational model in which customer demand, as part of the location problem, is segmented according to lead-time sensitivity of customers. Eventually, it allows users to decide which facility to open or close in response to different lost sales cost. Gourdin [2006] mentions three categories of warehouse location techniques: optimization models which are based on mathematical structure to provide an optimum solution within the parameters specified; simulations, which are mathematical representations of the logistics system that can be manipulated with a computer; and heuristics, considering only those locations with a reasonable chance of acceptance by the management.

3.3 The theory of Ferdows

3.3.1 Introduction

All the above-described methods for determining warehouse locations take marketing-, service-, transportation-, and/or cost-related factors into account and focus on the optimization of location decisions. However, they lack explicit consideration of the influence of warehouse roles and performed activities on site preferences. In none of the reviewed articles, warehouse role and activities are named as an important location factor, nor are they taken into account in the site selection process. Only Hesse [2004 p. 163] (casually) mentions that the size of the DC depends on its role, which has consequently an effect on the preferred site in spatial context. Yet, it is believed that especially the activities performed in warehouses today, ask for specific support from its environment

[8] PLOT stands for: Production, Logistics, Outbound, Transportation [Jayaraman & Ross 2003 p. 629]

that goes beyond (for example) the presence of infrastructure, work force and the market size. It seems that only Ferdows [1989] offers a theory to, eventually, come towards the suggested approach and the development of a model. Furthermore, it appears that the article by Meijboom & Voordijk [2003] is decisive to develop such a model. In their study why certain production and distribution facilities remain in Western Europe in spite of economic globalization, they distinguish companies' internal motives and business environment's (external) factors for international location decisions.

They draw on the international business approaches to specify the theory used by Dunning [1993], as highlighted in the introduction of this chapter, to firm level. They use Ferdows' concept *strategic role of a factory* [Ferdows 1989], who developed this theory for tracking patterns of change in the strategic role of a factory. It provides insight in the *internal motives* underlying international location decisions. Furthermore, Meijboom & Voordijk indicate that, considering the manufacturing nature of VAS in DCs, they are to some extent comparable with 'normal' factories. Therefore, considering the role of the international production *or* distribution facility, the primary location driver and site competence could be appointed.

In the same article, Meijboom & Voordijk derive *external location factors* with regard to the different business environments in which companies operate. These factors impose a moderating effect on the functioning of particular factory roles (i.e. the roles appointed by Ferdows), because they influence the internal motives underlying international location decisions. From the literature, they derived important factors referring to the market and industry structure:

- Stage in product life-cycle in relation to the use of a foreign factory, influenced by economies-of-scale relating for components, maturity of the product and the standardization of the product;
- Technology integrated in the firm's product;
- Responsiveness within the region of the market. Firms competing in industrial markets tend to locate close to buyers, among others, due to intangibles as assurance of supply, technical assistance, maintenance and stockholding;
- Transportation/logistics considerations.

The general environment of a company is also important to consider, like the influence of the macroeconomic context, political/judicial circumstances, national culture, level-of-education and technological climate. In addition, Korpela & Tuominen [1996 p. 170] point out that significant changes in the operating environment of a warehouse have their influence on the complexity of the decision process. They enlist:

- Demand for flexible services integrated with the customers' logistic systems;
- Realization of demand/performance interactions;
- Reduction of reaction and response times;
- Increased replenishment cycle lead times due to globalized sourcing channels.

3.3.2 Ferdows' model

Ferdows' theory is based on figure 3-1(derived from Vereecke & Dierdonck [2001 p. 21], adapted), in which six general roles of a factory can be distinguished as well as the three primary location drivers. With this model, Ferdows indicates that changes in the environment of a factory has its influence on the role of the considered factory.

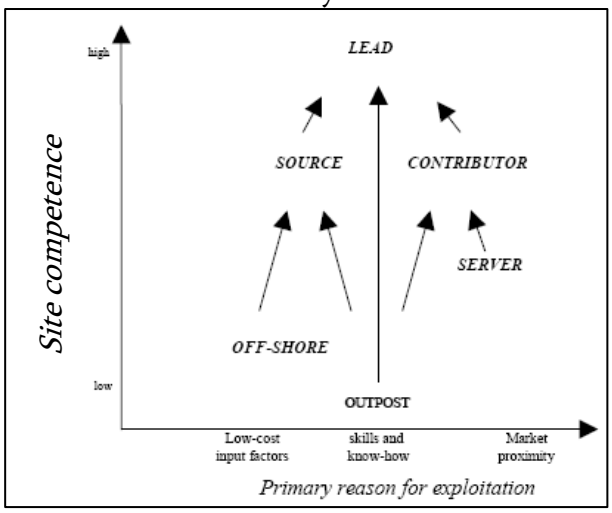

Figure 3-1 Typology of plants

Each role will be explained with help of the primary location drivers, based on Vereecke & Dierdonck [2001] and Maritan et al. [2004].

1. *Access to low cost production input factors.*
   Important for this 'driver' is the exploitation of low cost labor and the proximity to cheap raw materials and cheap energy. Capital is said to be of minor importance in the decision to locate manufacturing abroad.

   Taking advantage of these low cost production inputs are *Off-Shore plants*. Manufactured products or components are typically shipped to other facilities in the business unit. Minimum technical and managerial expertise required for production is maintained. No real engineering work takes place in these plants and the pattern of shipments is simple and not in the control of the Off-Shore plant management. A *Source plant* is also located to take advantage of low cost production inputs, but unlike an Off-Shore plant, there is both technical and managerial expertise at the site. This is necessary because Source plants tend to specialize in producing particular components or products, or in using particular production processes for other facilities in the business unit.

2. *Proximity to market.*
   When a factory is located close to a (foreign) market, it allows more rapid and more reliable product delivery and facilitates the customization of the product according to customer requirements. The reduction of financial and trade risks and the avoidance of trade barriers can also play a specific role.

A *Server plant* is located close to the market to manufacture a product for a local market. There is a relatively low level of technical and managerial expertise at the site. To some extent, managerial autonomy exists over material and information flow so that the plant can be responsive to local market needs. A *Contributor plant* is also located to serve a local market. In comparison to a Server, it has a higher degree of managerial and technical expertise at the site. In this way, know-how is developed and can be transferred to other facilities in the business unit. Like Source plants, Contributors specialize also to support other facilities.

3. *Use of local technological resources.*
   Local technological resources are external sources like universities, research centers, sophisticated suppliers, customers and competitors, but also from within the company like skilled employees (acting as an important source of technological transfer).

   An *Outpost plant* is located for access to local technology and information is collected from customers, suppliers, and competitors on behalf of the business unit. It does not have the managerial depth to act on this information but will pass it on to other plants to do so. A *Lead plant* is also located for access to local technology. In addition to collecting technological information for its business unit (like an Outpost), it uses the information to innovate and develop manufacturing capabilities. A high level of managerial and technical expertise is required at the site for support.

The last element in Ferdows' model is the site competence. *Site competence* refers to the extent to which specific technical activities that go beyond simply producing products are present at the site. These comprehend process engineering and improvement, product customization, after-sales service, decision-making on procurement and distribution and product development. Based on above, the next table can be derived locating each factory role in a cell (see table 3.1).

Table 3.1 Strategic roles of a factory

		Primary location driver		
		Access to Low Cost Production Input Factors	Use of Local Technological Resources	Proximity to the market
Site Competence	High	*Source*	*Lead*	*Contributor*
	Low	*Off-Shore*	*Outpost*	*Server*

In order to use above for determining the factors influencing warehouse location decisions (and not factory location decisions), the combination of site competence with one of the three primary location drivers should be combined with the different roles of warehouses within the warehousing concept.

3.4 The development of a new model

3.4.1 Embedding Ferdows' model in the research

It is useful to investigate to which extent the types of warehouses can be appointed to the concept of strategic roles used by Ferdows. The effects of the changing role of warehousing on the primary location driver *and* the site competence, necessary to support a warehouse in its specified role, can be investigated. These effects are possibly interrelated with the developments in warehousing activities in Europe and Ukraine. Thus, Ferdows' concept is used for tracking the changes in demand for specific site competence considering the roles of warehouses. This is the main purpose of developing a new model. This model needs to come towards the lack of explicit consideration of the influence of warehouse types and activities on site preferences. In this way, the warehouse type and activities are seen as an important location factor, and can be taken into account in the site selection process. In sum, it can be schematized as figure 3-2. By explaining the different elements in the schematization, insight is given how this approach will support this research.

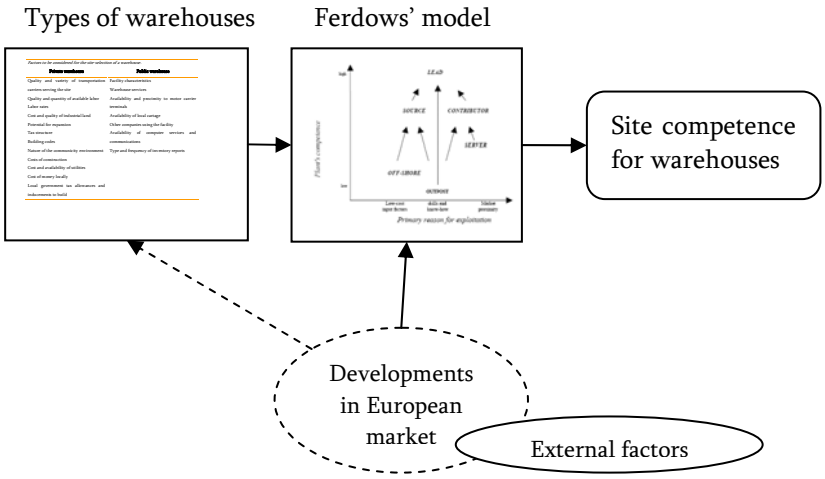

Figure 3-2 Embedding Ferdows' model in research

First, in the next section the different types of a warehouse will be outlined. Then the combination of these types with the concept by Ferdows will be explained.

3.4.2 Warehouse types

As expressed earlier, warehousing involves storing and/or handling products and in its physical form, this is done in a warehouse. A warehouse can perform many different functions; therefore, it is useful to distinguish types of warehouses. However, the available literature does not give a clear specification of warehouse types for there are three different points of view. The first is according to the function of the warehouse within the total supply chain. According to its function, the warehouse can hold a specific position

with regard to the previous or next step in the supply chain. Due to developments in these types, warehousing is seen increasingly from a "flow-through" point of view rather than a "holding" point. Secondly, the type of warehouse can be seen from ownership point of view (private or public). Developments point to a need for more flexibility and cost reduction, in favor of the so called (public) contract warehouses. Third, the type of warehouse can be typified according to its position in the market, for example a local or regional DC. For example, due to the Single European Market, interest in the EDCs increased [Van Goor et al. 2003]. Bowersox & Closs [1996] present different functionalities of a warehouse with regard to economic benefits and service benefits, in principle, coming towards the first point of view:

1. *Economic benefits* of a warehouse result when overall logistical costs are directly reduced by the use of such facilities.

   A warehouse can function as a *consolidating* warehouse, receiving and consolidating materials from a number of manufacturing plants destined to a specific customer on a single transportation shipment. In this way, several shipments to a specific market area are combined into one flow. Closely related to the previous function are the break bulk and cross-dock warehouses. The only exception is that there is no storage. A *break bulk* warehouse receives combined customer orders from single manufacturers and ships them to individual customers. *Cross-docking* involves multiple manufacturers who ship their products to the warehouse, at which the product is literally moved across the dock to be loaded into the trailer destined for the appropriate customer. Another function is the *postponement* function, due to performing processing and light manufacturing activities within the warehouse. After receiving a specific customer order, final processing is completed by label-adding and package-finalizing. Warehouses can also be used for *stockpiling*, providing an inventory buffer which allows production efficiencies within the constraints imposed by material sources and the customer.

2. *Service benefits* are the result of warehouses primarily justified on the basis of service, by improving the time and place capability of the overall logistical system.

   The *spot stock* warehouse is one of them. A selected amount of a firm's product line is placed, "spot stocked", in a warehouse to fill customer orders during a critical marketing period (like during the growing season for suppliers of agricultural products to farmers). A stock spotting strategy involves the warehousing of a narrow product assortment and placing stocks in a large number of small warehouses dedicated to specific markets for a limited time. In contrast, an *assortment* warehouse has a broad product line, is limited to a few strategic locations and is functional year-round. The service is gained by reducing the number of suppliers that a customer must deal with.

Almost similar to the break bulk concept is the *mixing* warehouse. Several different manufacturer shipments are unloaded at the mixing warehouse and service is gained because the inventory is then sorted to precise customer specifications. *Production support* warehouses provide in a steady supply of components and materials to assembly plants. Due to long lead times and significant variations in usage, stocks are justified. Warehouses can enhance market share by highlighting the (local) *market presence* of a firm. It is based on the perception that local warehouses can be more responsive to customer needs due to quicker delivery.

The warehouse types mentioned above can be extended with two, more recent types of warehouses: reverse logistic center and logistics service center. Although these functions can be part of a big warehouse, they have their own specific characteristics and purpose. Reverse logistics can be defined as *the logistical control of return systems for the re-use and recycling of finished products* [Stock 1992]. Since mid-nineties research and literature covering reverse logistics increased considerably, due to the development of reverse logistics as a research field on itself. Brito et al. [2002] provide in an overview of the scientific literature and practical implementations of reverse logistics, and Fleischmann [2001] investigated reverse logistics network structures and design. Seen from the total supply chain viewpoint, the purpose of a *reverse logistic center* is to accommodate the product and information flow concerned with reverse logistics activities. Even though the term is used by well-known companies [Panalpina 2005, DPWN 2005], there is no literature available[9] to define the precise function of a *logistics service center*. According to these companies, such center offers advanced supply chain processes (like quality inspection, just-in-time delivery, inbound material control, safety stock inventory management and returnable container management). The service level is supported by warehouse management systems and other IT-tools to improve handling efficiency, allow accurate part-level visibility and reduce costs for the customer.

3.4.3 Combining Ferdows' model and warehouse roles

The different warehouse types as described above need to be fitted to one of the six roles distinguished by Ferdows. By doing so, Ferdows' model is usable for tracking a change in warehouse site-selection factors due to market developments. With regard to the specific characteristics of both Ferdows' roles and the different warehouse types, a subdivision can be made to each category. The primary location drivers form the starting point for this subdivision, which makes it easier to subdivide the warehouses.

1. *Access to low cost production input factors.*
   Regarding their characteristics, the following warehouses are located in close proximity to low cost labor, cheap raw materials and/or cheap energy: consolidating warehouse; break bulk warehouse; stockpiling warehouse; assortment warehouse and production warehouse.

[9] In an attempt to define the functions of the considered center, no such literature was found.

2. *Proximity to market.*
   More rapid, more reliable product delivery and facilitating customization of the product according to customer requirements are objectives of warehouses located close to the market. Emphasis is placed on the customer service level of the warehouses: cross-docking warehouse; postponement warehouse; spot-stock warehouse; mixing warehouse; market presence; reverse logistics center and logistics service center.
3. *Use of local technological resources.*
   Local technological resources are only relevant to those warehouses that actually use the derived information to improve processes or products. Emphasis can be put on the presence of sophisticated suppliers or customers, knowledge institutes or skilled employees.

Now, different warehouses are subdivided to one of the three primary location drivers. Most warehouses are located either for low cost reasons or for proximity to the market. The use of technological resources seems hardly to be a primary location driver for warehouses.

What remains is the division according to the site competence, for this purpose redefined as: *the extent to which specific technical activities that go beyond simply receiving, storing and/or shipping products are required at the site*. In this way, site competence concerns the, in essence, *primary function* of a warehouse as defined earlier in this chapter. And, more importantly, site competence is approached in such a way that location decisions are justified according to the *required* site competence for warehouses to operate effectively in their considered role. Decisions about warehouse location should thus be made with regard to the considered role of the warehouse and the support provided by the environment in which it will be located. Moreover, the model is then suitable for tracking changes in required site competence following the effect of market developments on warehousing activities. Ferdows qualifies site competence on a scale from low to high. The division of the different warehouse roles according to site competence is based on two dimensions. They are as follows:

1. *Type of activities* performed within the warehouse. The basic activities are receive, store and ship [Bowersox et al. 1996 pp. 419-420]. These activities can be extended with transfer, selection (pick & mix) and VAS according to customer requirements. Bowersox et al. [1996 p. 67] define VAS as *unique to specific customers and represent extensions over and above a firm's basic service program*. Among others, examples are adding, removing, recycling or changing packaging, labeling, air-conditioning or activities to complete the product [Ackerman 1989]. Also, activities to guide product return or recycling can be seen as VAS.
2. *Level of sophistication* of these activities. This refers to the extent in which advanced technology and/or technological skills are needed to perform the considered activities. Different ways of handling materials can be distinguished: mechanized, semi-automated, fully automated or information directed

[Bowersox et al. 1996 pp. 422-434]. Each of these asks for a certain level of technology. The technological skills required depend on the complexity of the activities, related to the used technology. In other words, it is the required level of managerial and technical expertise to support the considered activities.

The basic activities of each warehouse determine whether the warehouse requires a low or a high site competence. To structure it, the roles indicated by Ferdows are maintained. It does not imply that a certain warehouse only has one strategic role. As the type of activities or level of sophistication changes (dramatically), the warehouse function can be assigned to a new role. In its pure form, a warehouse that functions as a break bulk, stock-piling or production support warehouse does not require a high level of site competence. The activities are very basic, do not have a considerable technical component or do not ask for considerable managerial attention (for example when dealing with a single supplier). Although a cross-docking warehouse deals with multiple suppliers, the products move directly across the dock and do not ask for a lot of technical support. This is also the case for warehouses with a spot-stock function (narrow product line, not functional all year round) or market presence function (focus on presence rather than type of activities).

The consolidating and assortment warehouse require relatively higher technical or managerial attention (i.e. a higher site competence). The assortment warehouse has a broad product line and needs to be strategically located. A consolidation warehouse deals with multiple suppliers and asks for a well-structured approach to form a single transportation shipment. Often, the use of technology benefits these processes. During postponement often VAS are performed. These activities ask for high technical support in comparison to basic activities like stocking. A reverse logistics center is a relatively new concept and asks for a tailor-made approach. With regard to the characteristics of the mentioned warehouse types and the division to the required site competence by the two dimensions, table 3.2 can be derived.

Table 3.2 Strategic roles of a warehouse

		Primary location driver		
		Access to Low Cost Production Input Factors	Use of Local Technological Resources	Proximity to the market
Site Competence	High	*Source* Consolidating Assortment	*Lead*	*Contributor* Postponement Mixing Reverse Logistics Service
	Low	*Off-Shore* Break bulk Stockpiling Production	*Outpost*	*Server* Cross-docking Spot-stock Market presence

An increase or decrease in number or type of activities does not necessarily mean a change in site competence, because these activities might not need a considerable upgrade in used technology or management. However, when the level of sophistication of current activities (for example) increases or when extra activities that require a higher level of sophistication are added, the required site competence will increase. An increase in activities or sophistication level is believed to be caused, or at least influenced, by market developments. With this theory in mind, a new model can be developed based on table 3.2. That model is shown in figure 3-3. Each type of warehouse is assigned to a strategic role, based on the activities of the warehouse's its pure form. The concept that Ferdows uses is adapted and in its new form, it can be used for tracking the changes in demand for specific site competence considering the different roles of warehouses.

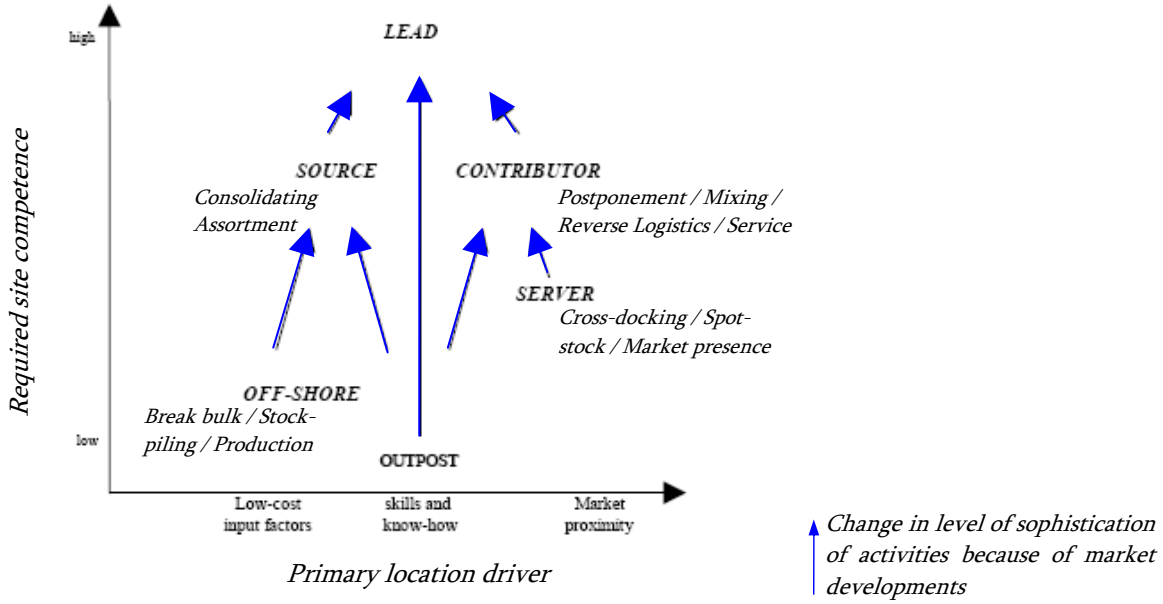

Figure 3-3 New theoretical model

This model explicitly considers the influence of warehouse roles and activities on site preferences, initiated by market developments. The site preferences are related to the required support from the environment in which the warehouse will be located, for example: technical expertise or advanced technology; managerial expertise; external or more specialized Human Resource Management; material-, machine- and software companies in close proximity; alliances with local companies; and facility support in close proximity. In this way, the warehouse type and activities are seen as an important location factor, and can be taken into account in the site selection process.

4 UKRAINIAN LOGISTICS SECTOR

This chapter outlines the methods for empirical data collection as used in this research. The case study consists of a survey among LSPs and interviews with experts of the Ukrainian logistics market.

4.1 Introduction

A case study provides information that is used as empirical input in the model. The objective is to broaden the insights in the European logistics sector with a focus on Ukraine and support different elements of the model, suggested in the previous chapter. According to that model, market developments will influence the level of sophistication of the activities of 3PLs. With help of the context in which these developments take place, these changes can be analysed. The survey provides insight in the change of activities from first hand (thus from 3PLs themselves). In addition, face-to-face interviews with experts of Ukrainian logistics lead to extra information about developments in the Ukrainian market. Another important element of the model is the primary location driver for establishing warehouses. In combination with the determined required site competence per warehouse type, it determines the change direction of the warehouse role as a consequence of market developments. Also, it is interesting to know if there are differences in primary location drivers for Western Europe, CEE and Ukraine. Furthermore, to (in)validate the developments in both the European and Ukrainian market of warehousing, the survey questions specific aspects of these developments. Aspects like types of warehouses in use, the consequences of VAS on warehouse design and opportunities and threats for growth of the 3PL market in Ukraine specific. The method used includes a survey, using a written questionnaire to question the respondent group. This saves considerable time. In a single period of time a strategically selected group of 3PLs answered questions regarding the aspects mentioned above.

4.2 Survey

4.2.1 The respondents

Nowadays, manufacturers more and more use the services offered by third-party-logistics providers, for their experience and existing Pan-European network. They provide warehousing activities, which makes them an ideal group of respondents in the survey-part. The list of respondents is initially based the top 100 of 3PL providers of the world, from Inbound Logistics [2006]. Within that group, all companies that are not active in Ukraine have been left out. This selection has been made after visiting the company's websites on global network information. The list was extended with 'pure' Ukrainian companies after consulting their websites, if available in English. The criteria that were used to come to the list of selected 3PL are as follows:

- Preferably, the 3PL should be enlisted in the top 100 3PL providers by Inbound Logistics [2006];

- The 3PL should be Western Europe or Ukraine based or originated;
- The 3PL must be active in Ukraine providing logistics services;
- The 3PL's website should be available in English language.

From all the sources, 25 potential respondents were identified. Each of them was asked to cooperate in the survey, initially by sending an invitation by email to one or more available company addresses and later by calling the companies first. In total, questionnaires were sent to 25 potential respondents. Among them are leading LSPs, both in European market as in Ukrainian market. Mergers and acquisitions of the past decade are responsible for the absence of some very well known brands in the list as shown in appendix G. Examples are ACR Logistics (nowadays Kuehne+Nagel), Exel (nowadays DHL) and P&O Nedlloyd (nowadays Maersk).

4.2.2 Design of the questionnaire

The general structure of the questionnaire is developed after consulting Solomon [2002], Websurveyor [2004] and Wright [2005]. The questionnaire consisted of 3 main parts (see appendix K). The first part was about 3PL in Western Europe and CEE. In this way, from the same group of respondents, a comparison can be made with the researched context. The second part focused on Ukraine, and the results could be used to compare with the context and with the results from the previous section. The third part gained general information about the respondent's company and closed the survey. Each part was further divided in different sections, encompassing specific questions. To some extent, these parts were based on previous surveys among 3PL providers conducted for India [Mitra 2005]. Extra information was provided via the 'extra information'-section to explain terms, concepts or the purpose of the question. Each part will be discussed here.

Part 1 section A: Primary location driver

Based on the main services offered and the presence in Western Europe, the respondent was asked to indicate the *primary location driver* for establishing their services in Western Europe and CEE. The question needs to be answered for 3 periods: 10 years ago or the time of establishing (when establishment was less than 10 years ago); current time; and in 10 years from now. Also the relative importance of this factor is asked. The objective was to get insight if a change can be tracked in the primary location factor and which one is considered to be most important.

Part 1 section B: Services offered and type of warehouses in Western Europe

The respondent was asked to tick the *services that it offers* in Western Europe, by indicating the level of sophistication of these activities. If the considered service was not offered, the respondent could indicate this. Also, the respondent needed to indicate if he expected a change in the level of sophistication. The objective was to assess the breadth and level of sophistication of the services offered in Western Europe. Next, the respondent was asked to list the types of warehouses currently being held in Western Europe, based on its main purpose. Room was provided to suggest different types of

warehouses and in such case, the respondent was asked to provide insight in the main activities performed in the different types of warehouses. The objective was to get insight in the developments of types of warehouses, which could have an influence on the warehouse roles in the model.

Part 1 section C: Services offered and type of warehouses in CEE
This section is a copy of the previous one, with the difference that the respondent was asked to tick the services that it offers in CEE. The objective was to assess the breadth and level of sophistication of the services offered in CEE.

Part 1 section D: Site competence and warehouse design
The respondent was asked to indicate implications of a change in level of sophistication of activities on the required site competence. Room was left to suggest other implications. The objective was to get insight in required site competence based on the activities performed in the warehouse. Furthermore, the respondent was asked to indicate and motivate in which warehouse design elements he expected a change, based on their own requirements. The objective was to strengthen the implications of certain warehouse activities on the environment and characteristics of a warehouse.

Part 2 section A: Logistical services in Ukraine
This section is a copy of sections A and B of part 1, with the difference that the respondent was asked to tick the primary location driver for and services that it offers in Ukraine. The objective of the first part was to get insight if there is a difference in primary location driver for Ukraine in comparison with those ticked for Western Europe and CEE. The objective of the second part was to assess the breadth and level of sophistication of the services offered in Ukraine, as they were expected to be different.

Part 2 section B: Warehousing in Ukraine
Because the questions about warehousing in Ukraine assessed a broader area than in part 1 of the survey, these were presented in a different section. The respondent was asked to list the types of warehouses being held in Ukraine and for which of these an increase in number was expected in the next 10 years. In both cases, room was provided to suggest different types of warehouses. Also, the respondent needed to provide insight in the two most preferable regions in Ukraine. For this, Ukraine was divided into 5 regions: North (Kyiv-region), South (Odessa-region), South-East (Crimea), East (Russian Border) and West (EU border). The objective was to provide in more insight in the Ukrainian market.

Part 2 section C: Threats to and opportunities for growth of the 3PL industry in Ukraine
In consultation with experts from Tebodin, threats to and opportunities for growth of the 3PL industry in Ukraine were enlisted and the respondent needed to tick the most important ones. Space was provided for the respondent to mention any other factor, which he felt was important. The objective was to get insight in the attractiveness of Ukraine for 3PL services.

Part 3: General information and finalization
This part focused on the company itself and aimed at getting general information about the company. The respondent was asked to give more information about European coverage of its services, either self established or through strategic alliances. In this way, the size and the extent of global reach of the respondent could be assessed. Next, the respondent could leave comments about the survey and its contact address if the company wanted to receive the results of the survey.

4.2.3 Starting up the survey

Four options were provided to complete the survey:

1. Online at a specific internet site for which the invitation was sent via email to selected respondents. Due to agreements with the responsible company for conducting the survey online, the survey was online available from August to September;
2. The questionnaire was available in Word-format, sent by email and returned via email. The respondent could choose between English or Ukrainian language;
3. The questionnaire was available on paper, sent by email/courier and returned via courier (also in English or Ukrainian language and only available in Kyiv);
4. It was possible to have a personal interview, together with a Ukrainian translator if necessary (only when the company was based in Kyiv).

In July 2006, a pilot test was conducted among the supervisors for comments on questions. In August 2006 the respondents were invited via email to conduct the survey online (conducting it online would save time in analyzing the results). After two weeks, a reminder email was automatically sent and after four weeks, the companies were approached by phone. When necessary the questionnaire was sent again, now only in Word-format and accompanied by a cover letter with more information about the survey. During the runtime of the survey, indistinctness's in questions could be addressed by email, which were cleared up as soon as possible.

4.3 Expert interviews

4.3.1 The respondents

To support the market developments on the Ukrainian logistics market, a few experts have been personally interviewed. In this case, five experts have been selected for their experience in and knowledge of the Ukrainian market of logistics:

1. Mr. Aswin Derks, branch manager of Verhoeven Logistics (an international LSP) in Ukraine. From the very start, Mr. Derks was involved in setting up a logistics business in Kyiv. With help of the Dutch government, Verhoeven Logistics started an alliance with a local LSP, TV-Trans. Over the years their business developed at high speed and Verhoeven Logistics already has plans for expanding considerably.

2. Mrs. Tatiana Klimenko, chief editor of the magazine 'Distribution and Logistics' (in Russian language). As a chief editor, Mrs. Klimenko has a broad overview of the Ukrainian logistics market and has insight in the developments of the past few years, is involved with local and international LSPs and knows what the Ukrainian market needs.
3. The third person is a professor in Supply Chain Management who teaches at a University in Kyiv. Due to his expertise and teaching experience, he has insights in the developments of the Ukrainian supply chains.
4. Mr. Hans Korte, expert involved in logistics. Mr. Korte is expert for PUM, an organization who posts Dutch senior-experts over the whole world on voluntary basis and to every company who needs it. With a very broad background in working for several big multinationals in countries all over the world, Mr. Korte was asked by Caravan (a very big Kyiv-based retailer) to advice them on their warehousing and logistics. In his function, he experienced first hand the way a Ukrainian company handles its logistics.
5. Mr. Benno Grimberg, former director of European Transport region Twente, the freight forwarder and shippers organization in the Dutch region Twente. Nowadays, he runs a project management and consultancy agency, bringing Dutch LSPs together with Ukrainian partners. For his work, he travels often to Ukraine and deals with local and international LSPs.

4.3.2 The questions

In principle, the expert is requested to share his or her view on the Ukrainian logistics market. The questions (as can be seen in appendix H) aim at getting insight in the developments in logistics in Ukraine in the area of: LSPs; real estate; logistic related sectors; warehousing; services offered; investment; future outlook; and other relevant matters. The questions are open, in this way the respondent can share as much information as they would like. In addition, two questions from the survey are used; these are the ones about threats and opportunities to growth of the 3PL market in Ukraine.

4.3.3 Start up

The first interview, with Mr. Derks, was held at September 7th 2006 in the office above the warehouse of Verhoeven Logistics in Kyiv. The interview with the second expert, a professor in Supply Chain Management, was cancelled after the person requested an inappropriate return gift. The second interview, with Mrs. Klimenko, was held in Kyiv as well, on September 12th 2006. This interview was arranged on a Dutch-Ukrainian business club meeting, which was attended on advice of Mr. Derks from Verhoeven Logistics. At that meeting, Mr. Korte made a guest appearance and spoke about his experience with Caravan. Not much later, an interview appointment was arranged with Mr. Korte and at October 30th 2006 the interview took place in Amstelveen. The last interview, with Mr. Grimberg, was held in Enschede at November 17th 2006.

5 DATA COLLECTION

This chapter outlines the results from the survey and expert interviews.

5.1 Introduction

The collection of data assists in coming towards information to draw the conclusions and recommendations on. First, the results of the questionnaire are outlined, divided according to the different sections used. Secondly, the results of the expert interviews will be discussed.

5.2 Survey results

The response on the survey among LSPs by De Koster & Warffemius [2002], as well as a research by Muilerman [2001] to which they refer, show that low response rates for logistic company surveys are not uncommon. This research is not an exception; from the 25 potential respondents, only nine questionnaires were returned. It turned out that the phone calls were crucial in the process of obtaining response. The Ukrainian market is still showing a very low transparency and as a result, most companies were not willing to cooperate for different (vague) reasons. To counter the reluctance problem of Ukrainian companies, the possibility was offered to leave questions open when the respondent did not feel like answering them due to confidentiality reasons. Surprisingly, some subsidiaries of Western companies were rude, not customer oriented and/or reluctant to cooperate. Possible reasons for this unexpected behavior could be: the cultural history of the country; the Ukrainian way of doing business; lack of knowledge; lack of experience with handling such requests; or lack of openness and feeling for customer service by most Ukrainian management (which also occupies most of the subsidiaries of Western companies).

5.2.1 Part 1 3PL in Western, Central and Eastern Europe

From the three suggested primary location drivers in question 1, proximity to the market is the most important motivation to establish warehouses in Western Europe 10 years ago (62%), see figure 5-1. Today, access to skills and know-how is equally important with the other two factors. In future, proximity to market is considered to be the primary reason to establish warehouses in Western Europe (75%). In CEE, proximity to the market is also considered to be most important (44%), but considerably less than in Western Europe. This is because access to skills and know-how is seen as important as well. In future, these two location factors are seen as the primary reasons for establishing warehouses in CEE (both 38%).

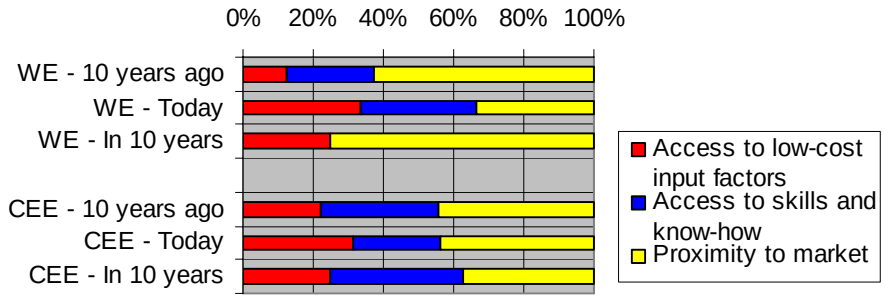

Figure 5-1 Primary location driver for Western Europe and CEE

When asked about the importance of the primary location factor, the respondents chose proximity to the market as most important for Western Europe, but access to low-input factors is close (see figure 5-2). Proximity to the market is for CEE the most important location driver.

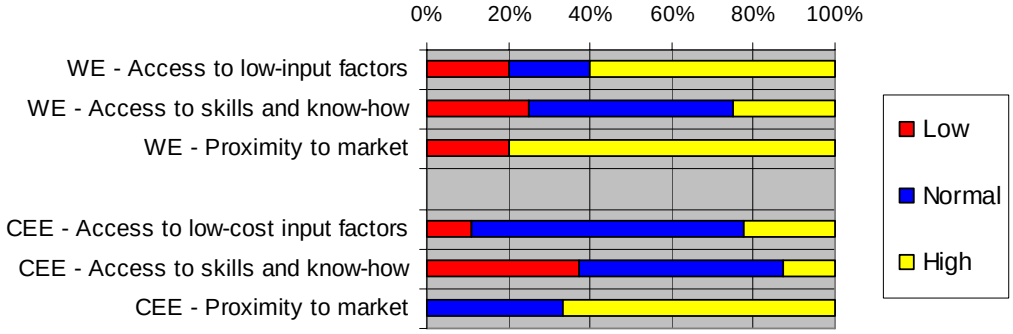

Figure 5-2 Relative importance of primary location driver for Western Europe and CEE

In general, the level of sophistication of services offered in Western Europe is at normal level (see figure 5-3), with the exception of air-conditioned environment and cross-docking. Modern services like completion, VAS, recycling or reverse logistics are offered on a limited scale.

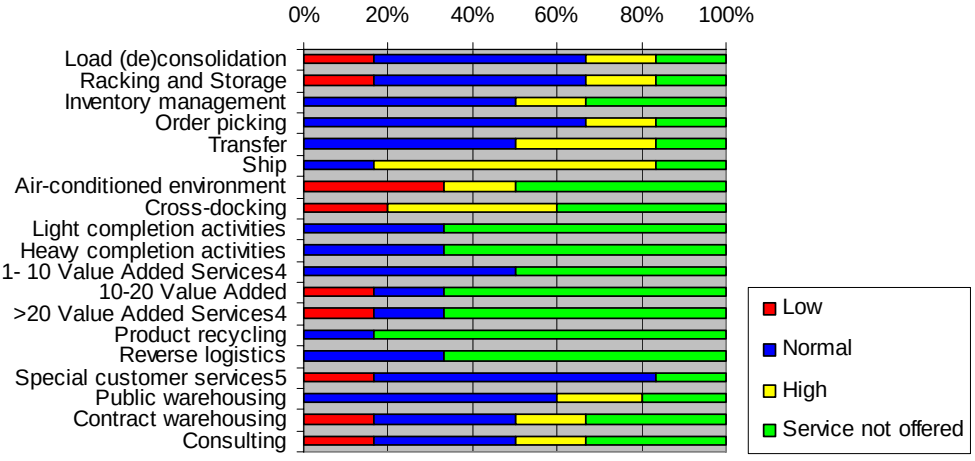

Figure 5-3 Level of sophistication of services offered in Western Europe

For the same activities, the level of sophistication will increase in general (see figure 5-4). The expectation is that in 10 years the modern services are still offered on a limited scale.

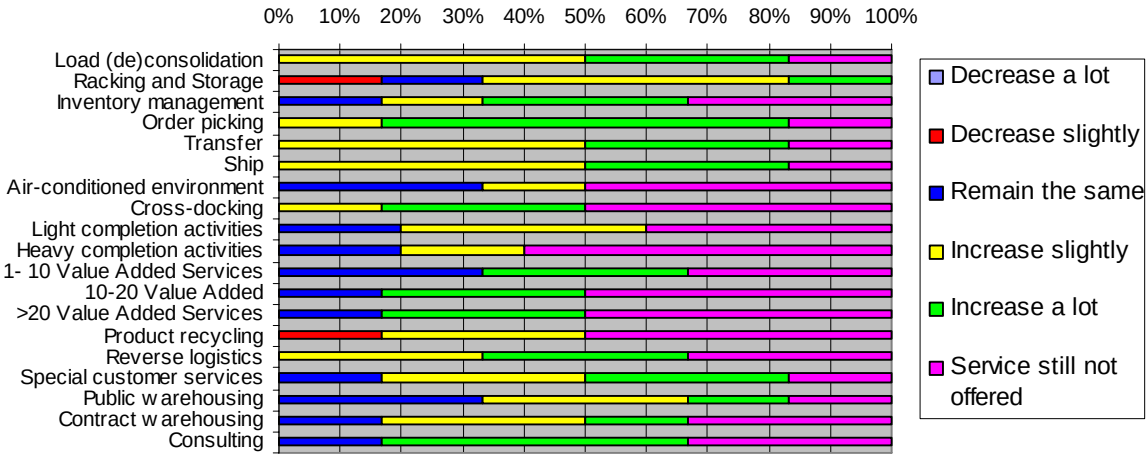

Figure 5-4 Expected change in level of sophistication next 10 years in Western Europe

When asked about the type of warehouses used in Western Europe, consolidation, cross-docking and logistics service center turned out to be the most used (see figure 5-5, the horizontal axis represents the number of responses).

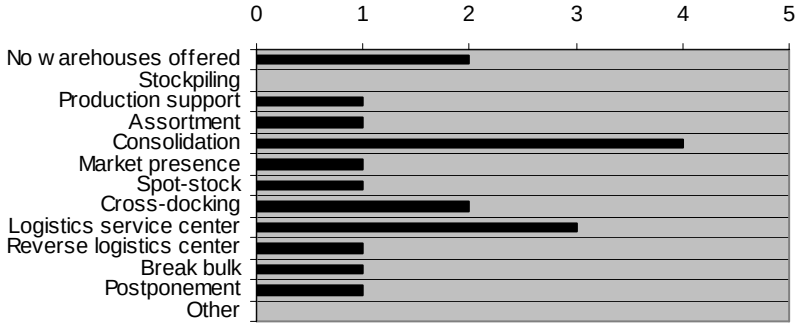

Figure 5-5 Type of warehouses offered in Western Europe

Also in CEE the level of sophistication is in general at a normal level, but there is more variation in the spectrum (more low and more high sophistication). Also, modern services are offered on a limited scale in CEE as well (see figure 5-6).

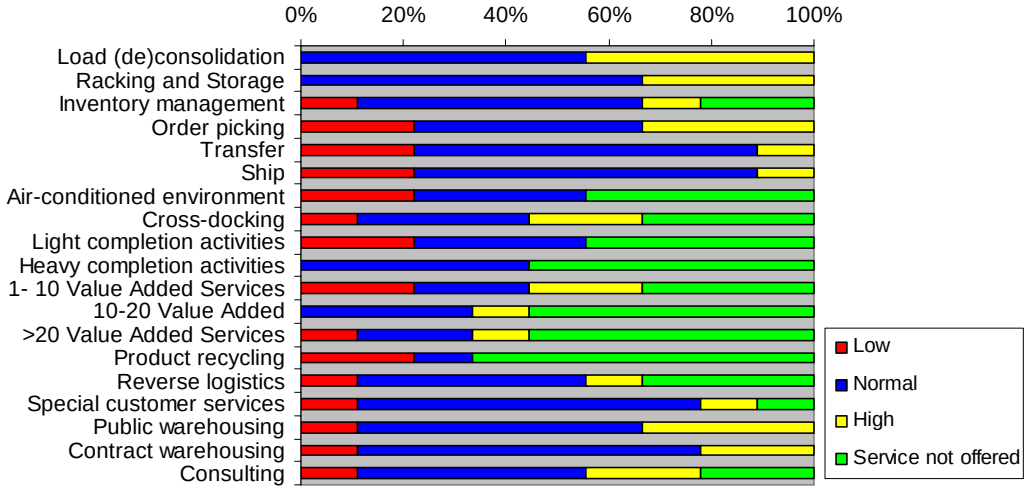

Figure 5-6 Level of sophistication of services offered in CEE

Like in Western Europe, the level of sophistication in CEE is expected to increase, but at a higher rate than in the West (see figure 5-7). Some modern services will not be offered on a wide scale. An increase in VAS is seen up to ten activities.

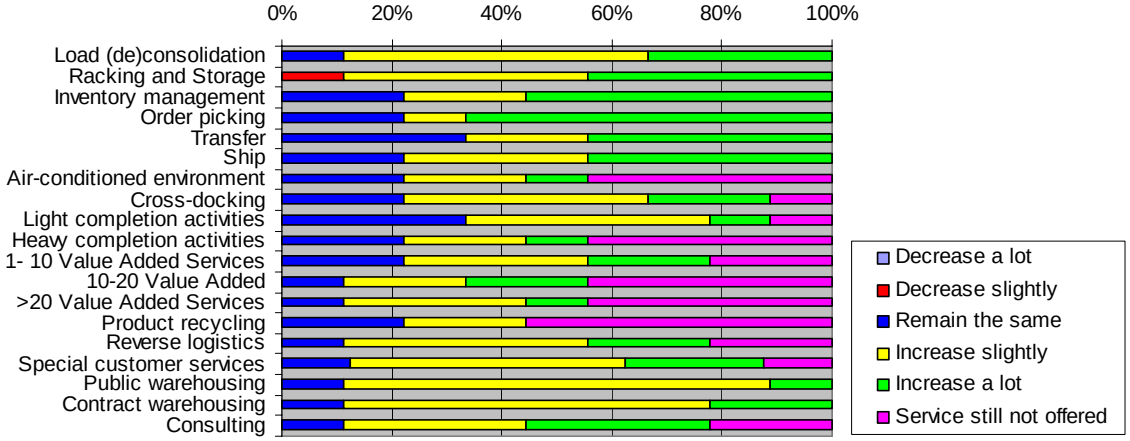

Figure 5-7 Expected change in level of sophistication next 10 years in CEE

Consolidation, cross docking, logistics service center and break bulk warehouses are mostly used in CEE (see figure 5-8, the horizontal axis represents the number of responses).

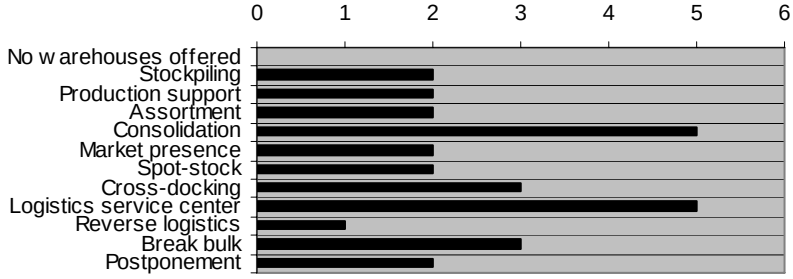

Figure 5-8 Types of warehouses offered in CEE

When asked about the implications of the change in level of sophistication on the required site competence, the respondents indicated a higher need for technical expertise or advanced technology at first place. Secondly, external or more specialized Human Resource Management was considered important. See figure 5-9 below, in which the horizontal axis represents the number of responses.

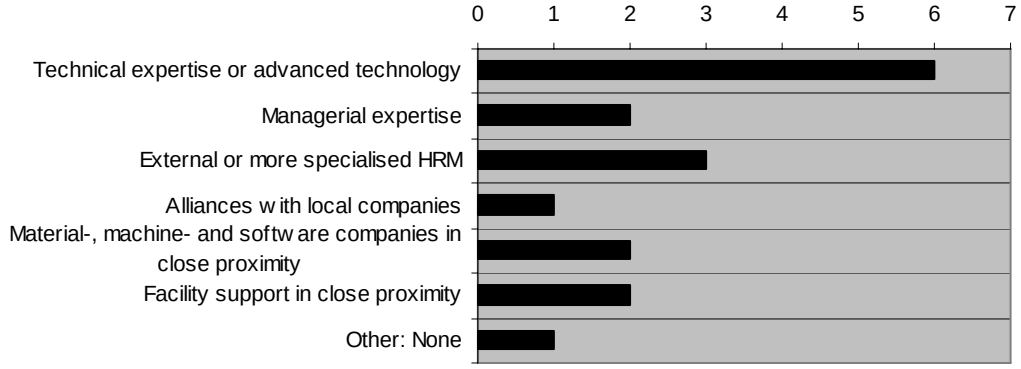

Figure 5-9 Implications of level of sophistication on required site competence

The respondents were asked to indicate the expected change in a list of warehouse design areas (see figure 5-10, the horizontal axis represents the number of responses). It turns out that most change is expected in handling systems and HVAC-systems. Also floor design, support systems and parking and circulation areas are expected to change. Motivations for these areas vary (question 11): a lot of Western products and materials will come towards Eastern Europe; increased VAS will require more strict security control and definitely more optimized floor/mezzanine utilization; due to expansion a change is expected in fire protection & detection systems and also the use of scanners to optimize product handling; technical issues become old-dated and need update; with every year there is a raise in demand of the clients, regarding the characteristics of the warehouses. For example, sprinkler installations, software etc.

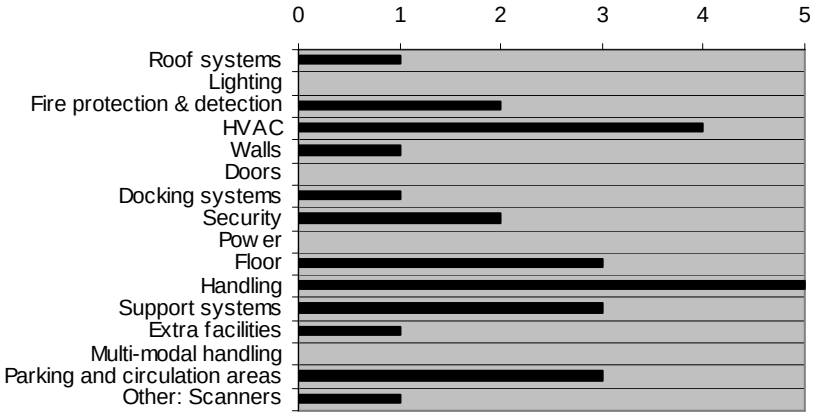

Figure 5-10 Expected change in requirements in certain Warehouse Design Areas

5.2.2 Part 2 3PL in Ukraine

Proximity to the market is considered the primary location driver for establishing warehouses in Ukraine (see figure 5-11). The other drivers, access to low-cost input factors and skills and know-how increased in importance over time. In future they seem to suppress the importance of proximity to the market.

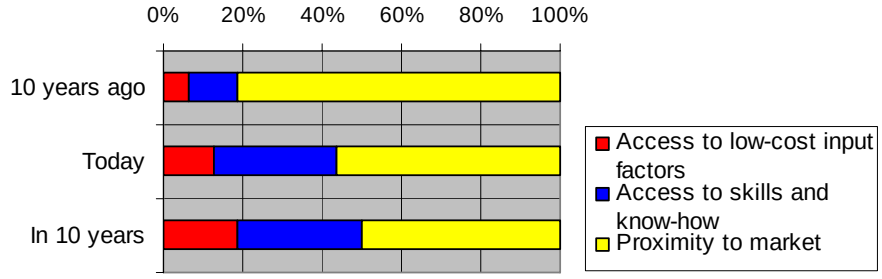

Figure 5-11 Primary location driver for Ukraine

In general, the level of sophistication of the offered services in Ukraine is at normal level, with a few exceptions (see figure 5-12, next page). In comparison to Western Europe, more activities still have a low level of sophistication. Also, several activities are offered on a limited scale.

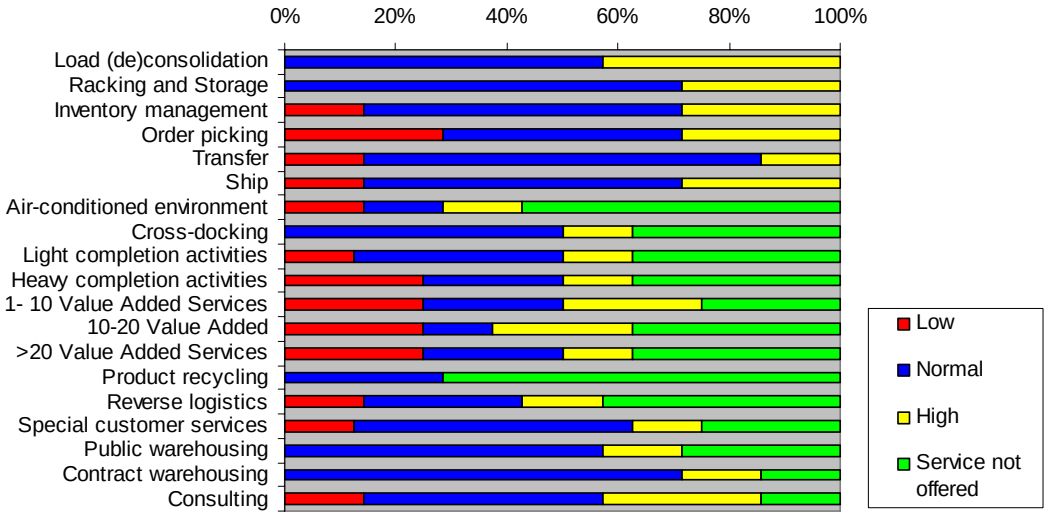

Figure 5-12 Level of sophistication of services offered in Ukraine

The level of sophistication is expected to change considerably in the next 10 years (see figure 5-13). The number of services not offered today are expected to decrease in future.

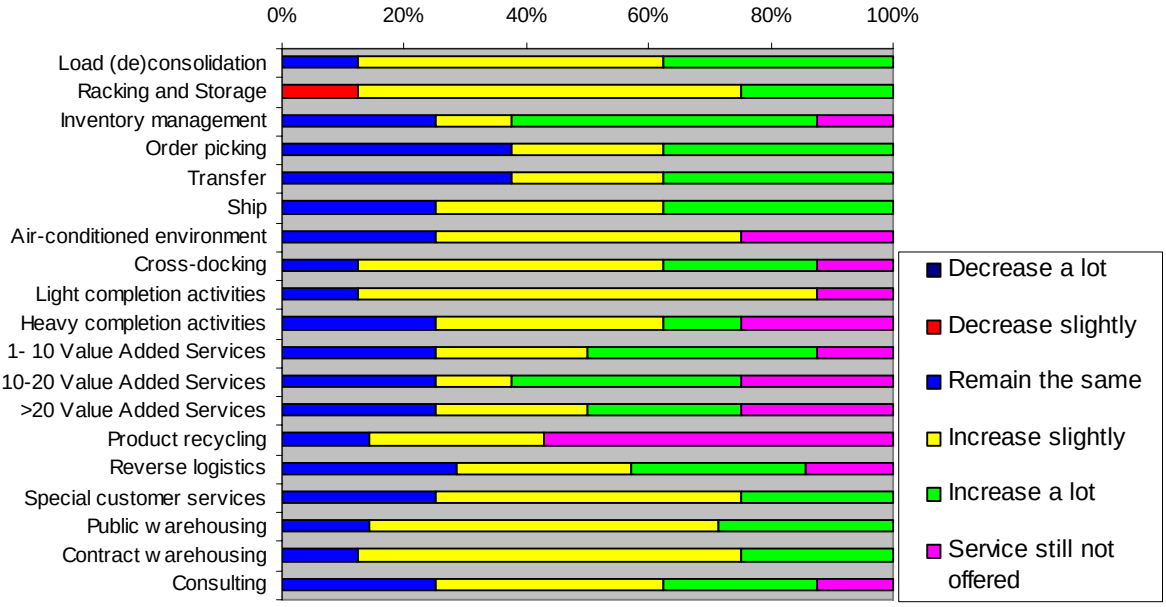

Figure 5-13 Expected change in level of sophistication next 10 years in Ukraine

The types of warehouses most offered in Ukraine are logistics service centers. All respondents indicated that the number of warehouses they offered will increase in future. Logistic service center and break bulk warehouses can expect the biggest increase. The most preferable region (question 17) is north-Ukraine. See figure 5-14 for the results, the horizontal axes represent the number of responses.

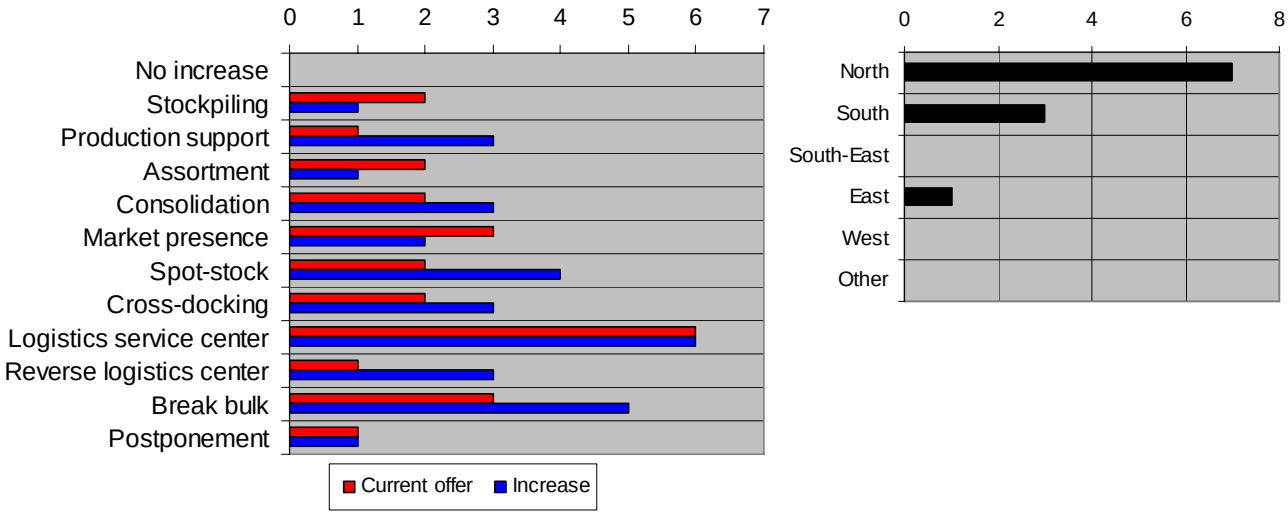

Figure 5-14 Types of warehouses offered and most preferable region in Ukraine

When asked about the top 3 possible threats for the growth of 3PL services in Ukraine, the respondents indicated the complex and 'old fashioned' regulation, norm and tax system as the biggest threat (see figure 5-15). Economic and political instability and lack of trust and awareness among Ukrainian firms and state institutions are the next most important threats.

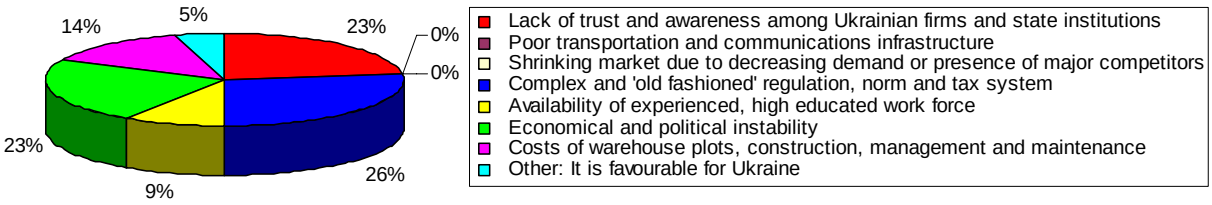

Figure 5-15 Possible threats for 3PL-growth in Ukraine

The biggest opportunity for growth of the 3PL services in Ukraine is the increasing awareness towards logistics outsourcing (see figure 5-16). Economical and political stability and an increase in transparency and clearance in regulation, norm and tax system are the second most important opportunities.

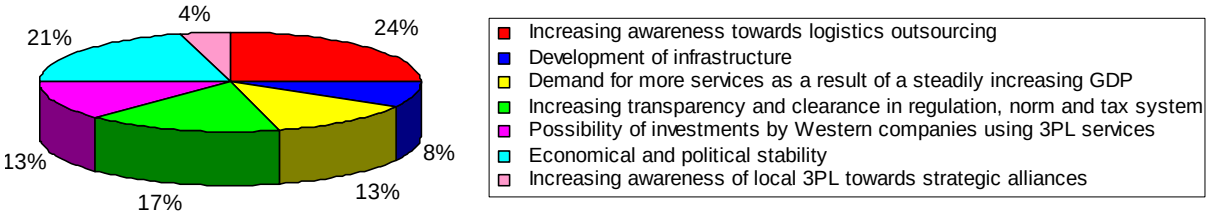

Figure 5-16 Possible opportunities for 3PL-growth in Ukraine

5.2.3 Part 3 General information and finalization

The last question intended to get insight in the presence of the respondent in other countries in Europe and whether he himself established warehouses or through alliances (see figure 5-17 on the next page). Most respondents offer business in the different CEE

countries, with Belarus as an exception. Also, most respondents established services themselves, and to smaller extend through alliances.

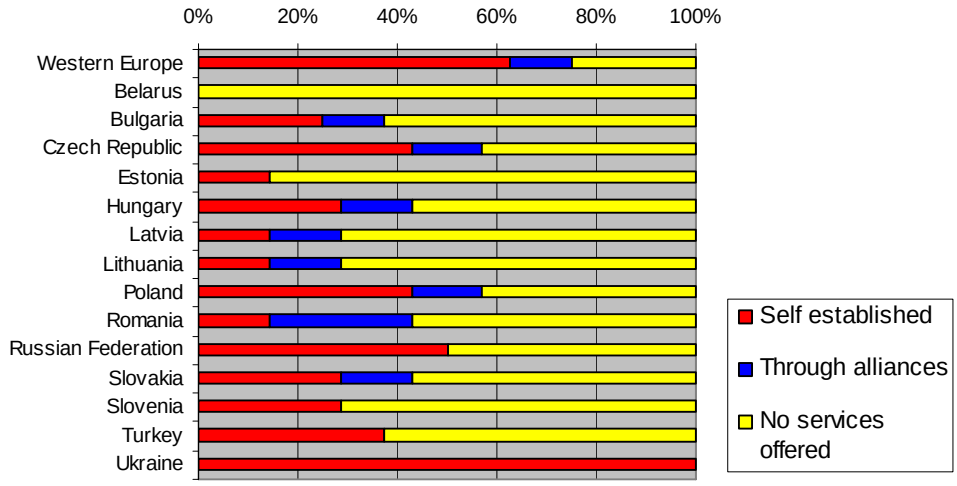

Figure 5-17 Countries in which 3PL services are offered

5.3 Interview results

Because the respondents have different functions or positions in the field of logistics, and all experience with the Ukrainian logistics market, a varied view resulted from the open interviews. The results will be discussed together, based on the initial questions as viewed in appendix H. When a certain statement was made explicitly by one of the respondents, it will be indicated by showing the name in brackets.

Two waves of growth of the LSP-market can be distinguished [Klimenko 2006]. The first wave is assigned to the transport industry. At a certain point, transport companies started to offer more logistics services than transporting. The second wave is caused by the retailers. Retailers have experience in supermarket distribution, work often directly with manufacturers and have experience with and means to support big transportation loads. These companies are considered to be more flexible and faster than LSPs, and besides that, they have more knowledge about technology (in cold storage for example) than LSPs. In Ukraine the number of LSPs offering a very wide range of services is relatively low and some of the local originated LSPs are taken over by international LSPs. Because the international LSPs widely use technologies in their services, they can offer a higher customer service level than local LSPs. New chances for local LSPs can only be utilized by alliances because such cooperation offers sufficient competition towards the big international LSPs [Klimenko 2006]. However, alliances are not considered to be preferable, because local LSPs often do not think in 'network'-view [Derks 2006].

The real estate sector is developing, but there remains a considerable shortage of (leasable) suitable land plots and warehouses. The plots that come available are expensive and are bought at fast rate. Existing warehouses are often renovated in a poor way or even have multiple floors and use elevators. It causes LSPs to develop their own warehouses and they

search for land plots outside Kyiv (within a range of 30 kilometers). As far as other logistic related sectors concerns, there is a lack of specific 'cold storage'-technology. Cold storage is a specific sector within logistics and, despite the high need, only is gradually developing at this moment.

In Ukraine, besides the considerable lack of high quality warehouses there is a major shortage in machinery to support the activities. In addition, the lay-out of the warehouses should be based on market demand [Korte 2006]. The main services offered are consolidation and so-called route-transporting in Ukraine: trucks follow fixed routes through Ukraine, but only full truck-loads. There is no necessity yet for LSPs to offer less-than-full truck loads [Grimberg 2006], although it is already offered on limited scale [Klimenko 2006]. When someone wants to send a single pallet, in many cases a full truck load is invoiced. There is a need for expedition services, because transport companies do not have experience in arranging everything for transport, like transporting multiple single pallet shipments.

In principle, Western investors are reluctant because the lack of sufficient transport organizations in Ukraine. Problems occur between Western companies and local companies (on cultural level), but also between a Western LSP and its local branch (on communication level). The cultural problems together with the inevitable network thinking is for Mr. Derks a reason to install Dutch management in Kyiv. By offering a reliable and stable management, international manufacturers are less reluctant to do business. Another example is the lack of reliability of rental contracts, which caused Mr. Derks to manage his own office space.

Awareness towards logistics outsourcing is still developing, but there are a few reasons why it does not seem to appear in practice. First, economical and political instability can cause money flows to halt. In that case, there are no financial means available to realize the plans. Secondly, there is a considerable lack of skills, experience and knowledge of logistics and logistic systems. Although some LSPs claim to offer cross-docking services, in general the concept is not used as it should be. Storage is still the leading concept, transportation trucks are too small and are not used for the purpose they are made for. By allocating people with experience in and knowledge of modern supply chain management and giving trainings, the growing level of awareness can be supported. It was also a reason that a project of building an EDC in Poland did not succeed [Korte 2006]. In the Netherlands, for example, lift truck drivers need to be certified. In Ukraine, there is a very low awareness that skilled employees are needed to work efficiently. In addition, the more experienced 3PLs are developing themselves towards 4PL causing a need for additional technical and managerial expertise and advanced technology. A major contribution to efficiency can be made by taking care of a 'closed' administration of goods flows throughout the warehouse. A barcode registration system could be used, getting insight in the goods flow through the warehouse. Thirdly, clients are not yet willing to pay for such services. In Ukraine, a lot of manufacturers still have their own transport, sometimes they have a huge fleet. When they supply a client on a far distance, they often

do not have return freight. As a consequence 'air' is transported in return, causing a major in-efficiency. These are reasons to develop awareness of 'smooth'-logistics (logistics focused on supply chain efficiency). In addition, in order to do their work properly, 4PL-providers need to work in close cooperation with their clients and the lack of transparency of many Ukrainian companies is a serious barrier. Fourthly, there are simply not enough LSPs to carry out the outsourced activities. For example, outsourcing cold storage activities is not possible, because there are no specialists available in the market.

The future promises a very fast development of the logistics market, but the government should guide these developments with suitable regulation [Grimberg 2006]. It is quite possible that the lack of awareness exists on political level. The government should become more aware of the circumstances in which logistics take place. The old fashioned regulation, norm and tax system need to be improved. Ukrainian LSPs are used to do business under these heavy conditions [Klimenko 2006]. Western companies experience problems with the lack of transparency of local companies and authorities. Should Ukraine enter the World Trade Organization, then transparency in law and regulation systems would be the biggest and most needed consequence.

One of the biggest barriers for international trade is the customs of Ukraine. The absence of a Chamber of Commerce (like in the Netherlands) causes problems with custom clearance, goods crossing the border legally need to be certified. The amount of money and time it takes to get a certain good certified, outweighs the costs of the product itself. Custom procedures like these cause a lot of problems, for example between a Western located LSP and its local branch, problems occur when exchanging goods. For that reason the number of importers that cover Ukraine via a warehouse and distribution network is limited.

Providing high quality logistic services is still a major opportunity in Ukraine, with a major focus on 'fresh'-goods and cold storage.

6 FINDINGS AND DISCUSSION

In this chapter, the results are interpreted and confronted with the theory and context. The focus is on the theoretical implications of the model and the practical implications as a consequence of market developments.

6.1 Theoretical implications

In the literature about site selection decisions, no such model as used in this research was found. Only Jayaraman [1998] comes close to the initial purpose of the model by recognizing the relationship between the management of inventory and the location of facilities, but does not pinpoint locations based on the activities carried out. The developed model has its consequences for the different theoretical frameworks used. It could impose a change in the process of site selection decisions by considering warehouses in strategic roles. Meijboom & Voordijk [2003 p. 464] point out that *the notion of strategic role is appropriate for analyzing the configuration of the (…) network of internationally operating companies. It contributes to the understanding of internal motives underlying international location decisions. These decisions (…) are (…) strongly influenced by external factors, representing the firm's environment*. Among others, these external factors are formed by the business environment (technology of the product, logistics considerations) and the general environment, formed by the macroeconomic context, political circumstances and national culture.

It is believed that market developments in these environments will influence the level of sophistication of the activities of 3PLs. Furthermore, the primary location driver for establishing a warehouse is one of the internal motives underlying international location decisions. The theoretical model suggested a division of warehouse types to primary location driver. With the model, the influence of the activities within the warehouse on the preferred site competence can be revealed. Thus, the model suggests a relation between the warehouse activities and the site competence. To see whether or not there is a fit between the model and the real world, the prediction that there is indeed a relation is (dis)confirmed with the collected data (i.e. the survey and the expert interviews and in addition the context). Each of the elements in the model, primary location driver; market developments; and site competence, will be discussed.

6.1.1 Primary location driver

According to the model, warehouses in their pure form are either established for low-cost input factors or proximity to the market. Low labor costs is an example of a low-cost input factor. The labor costs in CEE are in general lower than in Western Europe. The Eastern Europe countries outside the EU (like Ukraine) show even lower labor costs than CEE-countries part of the EU, what could be attractive for specific warehousing activities. As stated earlier, low labor costs seems to be a short term advantage [Graham & Sahling 2004, Frost & Sullivan 2004] and also do not necessarily lower production costs because labor

productivity may be low [Toubal 2004]. As a consequence, supported by several studies [Pournarakis & Varsakelis 2002, Konings 2003, Narula 2005], production relocation towards the CEE does not necessarily take place based on this advantage. Rather, the emphasis shifts towards labor skills due to the sophistication of production techniques and new technologies [Pournarakis & Varsakelis 2002], also used by LSPs in their warehouse activities. This seems to be supported by the respondents from the survey, in future both in CEE and in Ukraine, access to skills and know-how becomes more important. It means that skilled labor should be available to make sure the activities can be carried out. When the level of sophistication of activities is relatively high in comparison to a low qualified workforce (both in management and in technological expertise), it could result in a low efficiency. Therefore, availability of skilled labor is an important matter to be considered when doing business in Eastern European countries.

Survey results show that market proximity is the primary reason why warehouses are established throughout Europe. This is not surprising as in the past, many LSPs followed their clients (manufacturers) to the new markets. It is likely that proximity to the market will keep that status for Western Europe in future, but for CEE it seems that access to skills and know-how is becoming more important. This could be explained by the rise in level of sophistication of activities, causing a need for a higher educated workforce to carry out the activities. In Western Europe, high educated workforce is in general better available. In addition, two waves of developments in logistic services can be discovered. The first one consists of LSPs entering new markets with 3PL services. The second wave consists of 3PLs engaging in 4PL activities. Because of growing awareness to the importance of skilled employees and efficient supply chain management the more developed 3PLs need skilled labor. Once established close to a market, they extend their activities and number of locations using the advantages of the already established warehouses like local presence and experience with, for example, customs clearance.

Conclusion

Market proximity remains the most important location driver. However, available skills and know-how is growing in importance due to the increasing use of technology in warehouse activities. This technology needs to be adopted by the work force to make sure that the advantages are well utilized. In CEE there is a higher need for highly educated work force compared to Western Europe. New technologies are just recently brought in in warehouses and are yet developing.

6.1.2 Developments in the warehousing market in Ukraine

General developments on country level

The post communistic developments of the country in the macroeconomic context, political circumstances, national culture, level-of-education and technological climate ask for a tailor made approach. The lack of trust and awareness among Ukrainian firms and state institutions and the economical and political instability are seen as serious threats for the 3PL industry. The 3PLs experience the outdated institutional regulation, norm and tax

system as the biggest threat to growth. In future, trade relations between the EU and Ukraine will be intensified and there is a possibility for Ukraine to join the World Trade Organization. Bilateral market access negotiations are still ongoing [WTO 2006]. The reduction of trade barriers, an increase in transparency and an update of the institutional framework will contribute to a better trade and investment climate. Together with an increase in awareness towards logistics outsourcing and economical and political stability these are the most important possibilities for growth of 3PL. These are inter-related, because economical and political instability can cause money flows to halt so there are no financial means available to invest in new facilities or services.

The influence of market developments

It is clear that the role of the warehousing concept is changing, following developments on macro, meso and micro level [Hesse 2002a, 2002b] in both the European and Ukrainian market. At macro level, the expansion of the EU influenced the current national and global supply chains as new Pan-European supply chains emerge. Meanwhile, these Pan-European supply chains also reach Ukraine. Furthermore, there is a considerable lack of awareness towards smooth-logistics (as practiced in Western Europe). This causes sub-optimization of the supply chain, with inefficiency as a consequence. For example, the concept of cross-docking is often not used as it is intended. Warehousing in Ukraine shows turbulence as the country is developing, the demand for high quality warehouses still exceeds the supply and there is a lack of suitable land plots. The high quality warehouses are needed for (international) LSPs in order to practice their activities in a suitable environment. Infrastructure, lay-out, security and other location and design criteria need to make sure that the warehouse itself can support all the activities.

On meso level, logistics related, high-tech and knowledge based sectors contribute to warehousing with new methods and means. But most companies, especially local LSPs in Ukraine, do not have the financial means to invest in new systems to increase product flow and supply chain visibility (i.e. information flow). The 3PL providers planning to get involved in 4PL activities, covering a broader area of the supply chain, experience problems. The lack of transparency (which is a requisite for good overall supply chain management) in Ukraine keeps them reluctant to offer 4PL services. Companies, especially manufacturers, are not yet willing to pay for these kind of services or do not want to get intimately related to a LSP. Besides that, local partners may have a complete absence of any real experience with standards of business conduct or knowledge of only the socialist ethical standards [Fuxman 1997]. They also need to become familiar with the network view of most Western LSPs, which is a requisite for a good alliance. The success of alliances between Western and local companies also depends on the individual company, its strategic business plans and its goals in establishing a presence in Ukraine. This could be an explanation why most companies indicated that, when they offered services in one of the CEE-countries, their services are self-established. Only a small percentage offers services in countries through alliances. Consultancy companies can meet the needs of international companies, for they often offer partner search activities and

they have knowledge of the Ukrainian standards and laws. Strategic alliances can offer advantages in combining international know-how with local experience.

On micro level the developments in VAS are important, for they influence the physical dimensions and characteristics of warehouses (see section 6.2). In Western Europe a high demand of customer service asks for activities that go beyond simply storing goods. Most of these activities exist of VAS and are brought together in the ELCs. The survey revealed that a change can be expected in future in both European and Ukrainian market; in general the level of sophistication of the offered services will increase. In the Ukrainian market, mostly basic activities are offered (at normal level) and the number of 3PL offering modern services is considerably less. One of them is cold storage (air-conditioned environment), for which there is a high need in the Ukrainian market. It seems that retailers are increasingly getting involved in this sector because they have experience with the, rather specific, cold storage technology. Due to the transition status of the country the services and related activities are on a normal level and not yet that many activities have been shifted towards the warehouse. In general, warehouse activities of local LSPs can be characterized by a high degree of inefficiency. This inefficiency is believed to be caused by a misbalance between the level of sophistication of activities and skills, experience and knowledge of modern supply chain management to support them. These market developments impose a moderating effect on the functioning of a particular warehouse role. It is believed that these have a direct and indirect influence on the functioning of the strategic role of a warehouse. Nevertheless, the Ukrainian market is developing and more LSPs consider to enter Ukraine or extend their services portfolio.

Conclusion

The act of warehousing in Ukraine is still developing and there is a difference between international and locally originated LSPs in Ukraine. The international LSPs are aware of the importance of supply chain visibility and have the technology to achieve it. Most local LSPs do not have the financial means to invest in the necessary technology. Furthermore, international LSPs have the knowledge, the experience and the means to offer 4PL activities. In Ukraine, the number of 3PLs offering modern services is considerably less than in Western Europe or CEE. However, both in the European and Ukrainian markets the level of sophistication of activities and services is expected to rise.

6.1.3 Site competence

As stated earlier, the required site competence of a warehouse refers to the extent to which specific technical activities that go beyond simply receiving, storing and/or shipping products are required at the site. Site competence plays an important role in the model, which suggests a relationship between the level of sophistication of the activities and the required support from its environment (i.e. site competence). To work efficiently in their considered role, the model suggests that warehouses must be established with regard to the required site competence. This means that the general and business environment of the warehouse to be established needs to be favourable for either carrying

out the activities, for distributing the type of goods or for extending the portfolio, warehouse or the number of employees.

In general, the level of sophistication of warehouse activities throughout Europe and Ukraine is at normal level and is likely to increase in future. The survey respondents indicated a need for technical expertise or advanced technology as the most important implication on site competence following an increase in level of sophistication (which is exactly what the model indicates). This need is originated in the use of modern technologies in more and more services. The technical expertise can be found via consultancy companies or external or more specialized Human Resource Management. Furthermore, to support the increase in complexity of services offered, managerial expertise in modern supply chain management should be available. An extension or change in certain warehouse design areas, in order to provide in a suitable environment for warehouse activities, is easier to realise with facility support in close proximity. More and more logistics services rely on specific machinery, use specific materials and are supported by tailor-made software systems. When companies who provide in such support are available in close proximity, the reliability and continuity of such supply chain elements increases. Other examples of site competence in practice are support in the area of process engineering and improvement, product customization, commercial services, decision-making on procurement and distribution and product development.

6.1.4 Conclusion

The model is useful to support location decisions, especially because it involves the warehouse activities offered in the process. For the literature, it means that more attention should be paid to the type of activities a LSPs offers. It is true that Chen [2001] involves human resources as one of his selection criteria, but he does not explicitly relate it to their technical expertise of supply chain management. According to the model, warehouses requiring a low level of site competence are not established because of the available skills and know-how. In theory, this is rather logical, because from origin a warehouse does not have the task to tap into specific sources of knowledge. It is possible that logistic service centers and reverse logistic centers will get involved in such activities (tapping into knowledge sources) because of ongoing product or service improvement as they represent the manufacturer. It is also possible that the initial division of warehouse types in the model, will change when the level of sophistication in warehouses increases in such way that a very high site competence is required.

It appears that when the activities are so complex or varied, the warehouse does not function well in an environment with too low support. The confirmation of this statement can be found in the failure in functioning of an EDC in Poland (due to lack of skills and know-how) and the lack of efficient management in many Ukrainian warehouses. The latter is also caused because the supply chain is not seen as a connected and interrelated whole, which is necessary in modern supply chain management (see Pfohl [1997]). In such case, the role of warehousing can not grow to its potential. At the moment, there is

no experience or knowledge about modern supply chain management publicly available to provide insight. Training or counselling in modern (Western) supply chain management could precede higher efficiency levels, provided that the steps towards overall supply chain management need to be taken gradually. Especially the awareness and implementation of smooth (highly efficient) logistics must grow step by step and through training. Significant changes in the operating environment of a warehouse, like in Ukraine, also have their influence on the complexity of the decision process. It is believed that the location decisions for Ukraine will increase in complexity over time.

More and more, LSPs search for warehouse locations in suburban areas, because of the availability of land plots and the relatively lower prices. Excellent infrastructure, together with the lowest costs possible will always be the most important factors in location decisions. In case several options remain after taking these selection criteria in account, the model can simplify decisions about the possibilities left. It can serve to make a distinction of the available land plots at sublevel. That distinction is based on the site competence of the available land plots. In practise, this means that some kind of Multi Criteria Analysis is applied on the different sublevel site factors (like industries and companies in close proximity). In essence, site competence should be approached in such a way that location decisions are justified according to the required site competence for warehouses to operate effectively in their considered role.

6.2 Practical implications

6.2.1

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7 CONCLUSION AND RECOMMENDATIONS

In this chapter, the overall conclusions of the research are discussed and reflected based on the problem statement and the objective. It closes with recommendations for future research.

7.1 Conclusions

In this thesis, the focus lays on developments in warehousing in Europe and Ukraine and the effects of logistic activities on warehouse site preferences. Europe and Ukraine form the context in which the developments in warehousing take place. Along with the developments, the concept of warehousing is changing. It has its effects on the warehouse location preferences by companies involved in logistics. The objective of this thesis is (1) to develop a model to support warehouse site selection decisions based on logistic services and (2) to provide insight in the theoretical and practical implications of the model by analyzing the European and Ukrainian market of warehousing. To structure it, this objective was converted into a problem statement. In chapter 1.3 the problem statement is put down in two central questions. Each question will be answered.

What are the developments in the European and Ukrainian market of warehousing?
When considering the European and Ukrainian market of warehousing, the development that stands out is the alteration of European supply chains. The need to restructure the distribution network originates in the upcoming of new customer markets in Eastern Europe and in meeting customer service requirements. A Pan-European supply chain emerged, reaching also into Ukraine. On the one hand, there is a tendency to centralize the management of the supply chain in order to be able to control the total supply chain. On the other hand, local presence is needed to provide optimal customer service, which can be met by market proximity. Proximity to the market is the most important motivation to establish warehouses in Western Europe. In Central and Eastern Europe (CEE), access to skills and know-how is seen as important as well. The alteration of supply chains gave cause for a wide range of developments in the warehousing concept. Out of these, two main developments can be discovered.

First, there is a shift in activities towards the warehouse, pushed by manufacturers, distributors and retailers. The demand for a high customer service takes the activities within the warehouse beyond simply storing goods. As a result, not only a wider range of activities is offered, like Value Added Services, but the level of sophistication of each activity rises by the use of new technologies. The survey respondents indicated that the level of sophistication will rise in future, both in Western Europe and in CEE. The growth in importance of customer service is emphasized by the use of logistic service centers through Western Europe and CEE, as indicated by the majority of the respondents. Secondly, the power shift in market relations from a supplier-dominated to a buyer-oriented market caused the upcoming of logistic related sectors. Examples are the real

estate industry (important for the development[10] or availability of warehouses at suitable locations), logistic service providers like third-party logistics (3PL) and fourth-party logistics (4PL) and engineering, consultancy and software companies (to provide an efficient layout or insight in product and information flows through Warehouse Management Systems). Another development is a change in certain warehouse design areas. Most change can be expected in product handling systems (for a more efficient product flow) and Heating, Ventilation and Air Condition-systems (providing a better work and product environment).

In Ukraine specifically, warehousing is developing since the last decade. Economic development, the growing industrial and retail sector, the tendency to outsource logistics towards 3PL-providers and the increasing scale of operations of logistic operators will drive demand up for modern warehouses. A demand that cannot be met for the fifth year in a row, because the existing supply of warehouse premises consists for the major part of reconstructed and old facilities. They have characteristics far from the requirements Western companies demand. New warehouses are hardly built due to a major shortage of land and complex acquisition and permit procedures. The survey respondents indicated the old-fashioned regulation system, inherited from former Soviet Union, as the biggest threat for the growth of 3PL services in Ukraine. Ukraine is still in transition, which makes the rise of service economies less stringent than in other European countries. However, related sectors to logistics are rising with the development of the country and the growing need for additional services. Logistic service providers (LSPs) are extending their services, but they still show relatively basic activities. Nevertheless, survey respondents expect a growth in level of sophistication of activities.

What is the effect of logistic activities on warehouse site selection decisions?

Based on the model used in this research, the effect of logistic activities on warehouse site selection decisions will be described. For this, the general approach towards site selection decisions as commonly used in literature will be respected. In literature, interest goes to the selection of site criteria or to the site selection process itself, taking into account certain criteria as deciding factors.

As far as the selection of criteria concerns, the model introduces a new site selection criterion, namely the site competence of the considered plot. As stated before, site competence should be approached in such a way that location decisions are justified according to the required site competence for warehouses to operate effectively in their considered role. This means that, for example, when the handling system inside the warehouse is fully automated and using tailor-made technology and software, then the environment of the warehouse should be able to support the process. This support can be seen as technical expertise or a software company. The importance of such support in close proximity is that the reliability and, even more important, the continuity of the process is ensured. The availability of the necessary support in the environment is referred

[10] As in project development.

to as site competence and should be taken into account during location decisions. This can be done by using the criterion 'site competence' to make a distinction between the available land plots. The most preferable plot is the one that has the best fit between the (future) warehouse activities and the available environmental support (like industries and companies in close proximity). A Multi Criteria Analysis can structure this process. Therefore, site competence plays an important role in distinguishing different available sites from each other. Considering the site competence of a plot also means that the logistic activities of the LSP should be considered. After all, the types and level of sophistication of these activities determine the required site competence (labeling a product by hand does not require a lot of support like technical expertise thus a low site competence is sufficient). From this point of view, the type of activity as well as its level of sophistication can be seen as sub criteria, which support site competence as the main criterion. Yet, the status of required site competence as a main criterion is still subordinate to main financial and infrastructural criteria, as they will always determine the very first choices in a wide range of available land plots.

When considering the site selection process, the developments in the market of warehousing are expected to affect the complexity of the site selection process, causing it to increase. Country specific characteristics ask for a tailor made approach during the site selection process. In most literature, strategies or frameworks are used to determine in which area criteria are to be selected. The model can be used as one of these frameworks, shedding a new light on the selection of the area in which criteria will be selected. The model is not suitable for determining the first choice out of the available land plots, because it does not directly consider financial or infrastructural aspects. These can only be taken into account on a more detailed level of the model (at the moment that the required site competence is determined). In case several options remain after taking the main financial and infrastructural criteria into account, the model can simplify decisions about the alternatives left. It can serve to make a distinction of the available land plots at sublevel. That distinction is based on the site competence of the available land plots. From this point of view, the consideration of site competence could ask for expertise that is more specialized (for example, in knowledge about the development of warehousing activities in the considered country) sometime during the process. The use of an integrated approach is therefore appropriate.

7.2 Reflections

Results versus objective

The model in this research is developed after consulting literature about site selection decisions. Because it considers aspects that are rarely used in literature, it shows potential towards future site selection decisions. Testing the model in practice by analyzing the European and Ukrainian warehousing market led to important insights. Yet, these insights remain rather limited because in the used survey, only the LSPs active in Ukraine were approached. There is a difference in services offered in comparison to LSPs from Western Europe. Ukrainian LSPs are not yet that experienced with the changes in supply chain

management for meeting high customer demands. This also explains the relatively low level of sophistication of services offered in Western Europe by the Ukrainian LSPs. Furthermore, the Ukrainian market of warehousing is approached as a sector, but a theoretically embedded sector analysis is not used. Nevertheless, the developed model and the outcome of its embedment in practice meet the objective of this study. When considering the practical implications of the model, companies like Tebodin Ukraine could use the model as suggested in the previous chapter. The 'new' approach in site selection decisions makes it easier for Tebodin to outline the client's needs with possible solutions. In addition, this also applies to warehouse design and layout.

Process

The organization of the total research process plays a big role in gaining the right results. To test the model in practice or to get practical information on theoretical matters, surveys and interviews are proven methods. However, when the respondents are not quite willing to cooperate, it could cause some problems in getting the right information. During this research, a major part of the potential respondents for the survey was reluctant to cooperate. It took a lot of time to get replies, translate the necessary information and convince the considered respondent to take part in the research. When using a survey, one should start in time and use all the means possible for obtaining enough response on the right time. For interviews, it is very important to select the right people. Financial means or network contacts could provide in the needed support.

7.3 Recommendations

This research focused on the development of a model in which site selections of warehouses are made with consideration of the LSP's activities. It is one of the first approaches in the literature so it has not been applied to a wide range of such decisions in practice. Site selections made in practice are not taken into account to support the validity of the model. Therefore, and also to explore the model in more detail, it is recommended to extend the scope of this research. It is difficult to measure to what extent the direct environment, apart from infrastructure and financial considerations, plays a role in present location decisions. For each company, different tangible and intangible reasons play a role. Investigating the cause of wrong location decisions in practice and relating it to the required site competence according to the model, could result in important insights. Also it is useful to analyze why certain types of warehouses do not function well in their environment. It can lead to additional insights in the relation between the business environment of a warehouse and the influence on logistics activities. This part could also focus on the services in a warehouse's business environment that are called upon by warehouse managers. All of the above should be researched or surveyed among a larger group of respondents. Furthermore, the respondent group should be represented by LSPs, 3PLs and 4PLs in Western Europe and CEE.

A theoretically embedded sector analysis would bring more structure in the analysis of a country's logistic sector, of which warehousing is an element. An example of such analysis

is the sector approach from Porter, with which two different countries can be compared on sector level. More insight in the cultural differences between countries is especially useful for international companies who want to get involved in an alliance with a local company. Hofstede uses the concept of cultural dimensions, with which it is possible to compare different countries on a cultural level. In this way, by using the suggested approaches, the sector to be researched in the considered country can be made more understandable for the business society of the home country. It makes it easier for a company to identify itself with the prevailing business climate of the researched country.

The use of a classification system does not contribute to the importance of the model, at least not in the existing classification system. The design of a classification system mainly for the purpose of site location decisions based on the warehouse activities could be a useful step, since there is a relation between the business environment of a warehouse and the functioning of that warehouse. The classification system needs to be adapted so that it optimally supports location decisions processes. This will be an iterative process and applies to both real estate and engineering and consultancy companies. After all, these parties offer existing warehouses or support during site selection decisions.

GLOSSARY

3PL	Third-Party Logistics
4PL	Fourth-Party Logistics
AC-10	Accession Countries (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia)
AHP	Analytic Hierarchy Process
CSCMP	Council of Supply Chain Management Professionals
CEE	Central and Eastern Europe
CIS	Commonwealth of Independent States (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, Uzbekistan)
DC	Distribution Center
EDC	European Distribution Center
ELC	European Logistics service Center
ESFR	Early Suppression Fast Response
EU	European Union
EU-15	European Union before May 1st 2004 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, Sweden, United Kingdom)
FDI	Foreign Direct Investment
HVAC	Heating, Ventilation and Air-Condition
LM	Logistics Management
LLP	Lead Logistics Provider
LSP	Logistic Service Provider
VAS	Value Added Services
WMS	Warehouse Management System

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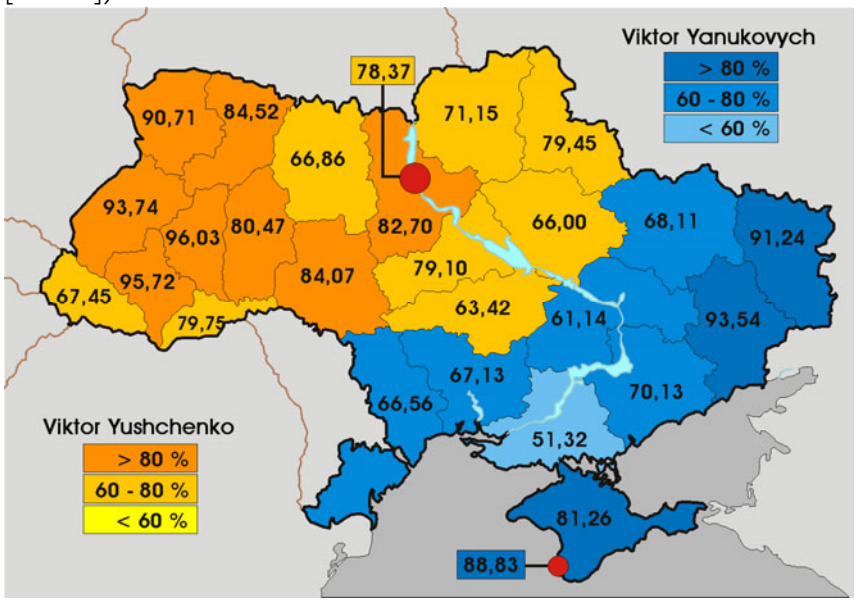
APPENDIX A USE OF TERMS

In literature, different usage of the terms 'warehouse' and 'distribution center' occur. It is important to have clarity on this matter, for the term says something about the purpose of the facility. In some literature, distinctions are made between warehouse and distribution center [Lambert et al. 1998 p. 266], while in other literature they are often seen as a synonym. Lambert et al. stress that warehouse is the more generic term (i.e. for receiving, storing, shipping and picking all products), whilst a DC, among other differences, only receives and ships products based on holding minimum inventories.

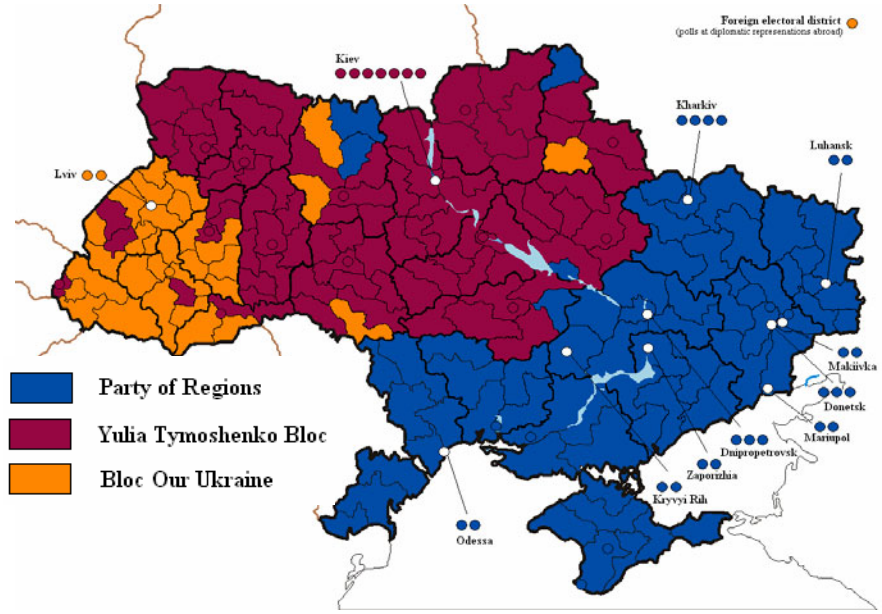
It seems that this distinction is hardly supported by other authors: (among others) Van Goor et al. [1996, 2003] only mention DCs; Bowersox et al. do not use the term DC and define a warehouse as *a place to store inventory* [Bowersox et al. 1996 p. 389]; Lefebvre et al. use the terms distribution center and distribution warehouse as a synonym [Lefebvre et al. 2006 p. 2]; and in his article, Ackerman uses distribution center synonymous to warehouse [Ackerman 1999 p. 3]. As a result, for this thesis the terms DC, warehouse or even distribution warehouse are seen as synonyms. Furthermore, with regard to the different definitions used in the literature and the wide range of activities practiced in warehouses today, the number of activities can be low, for example receive and ship (also known as cross-docking), or high, for example: receive, store, pick, VAS and ship, depending on the role of the warehouse. Preferably, the term warehouse is used as it fits better in the warehousing concept to which it belongs.

APPENDIX B POLITICAL PREFERENCES IN UKRAINE

Despite Yushchenko's victory in the second round of voting on December 26th 2004, the regional voting patterns were largely unchanged from the first one, with many southern and eastern provinces going largely for Yanukovych, with the western and central regions again favouring Yushchenko, see figure below (text and figure derived from Wikipedia [2006a]).

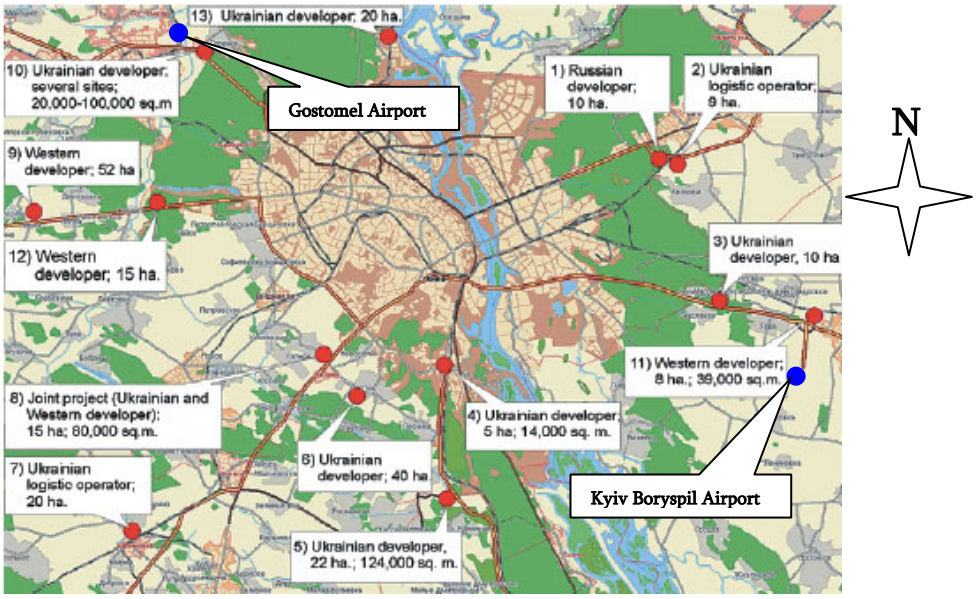


As a result of the March 26th 2006 elections, an 'Orange' coalition between (1) Party of Regions, (2) bloc of Yulia Tymoshenko and (3) bloc "Our Ukraine" will form the government in Ukraine's Parliament after long drawn out negotiations between the parties. The 'new' President is Viktor Yuschenko (Party of Regions), prime minister is Yulia Timoshenko. See also figure below (text and figure derived from Wikipedia [2006b]).



APPENDIX C WAREHOUSE LOCATIONS AROUND KYIV

Locations close to highways towards the city attract most LSPs, and in particular in the West bank of Kyiv. The figure below, derived from LP [2006 p. 52], shows the latest developments of warehouse premises around the city of Kyiv. Added in blue are the two airports close to the city. Gostomel airport on the North-East and Kyiv Boryspil airport on the West side.



APPENDIX D CLASSIFICATION OF WAREHOUSES

This part is based on National Logistics Company [2005] and Tebodin Ukraine [2006].

Warehouses of class A+

Mostly new-built on existing industrial areas or new appointed areas.

Design specific requirements.

1. Modern one-floor warehouse constructed of light metal ware and sandwich panels, preferably of rectangular shape without columns or with a step of columns not less than 12 meters and with a space between bays of not less than 24 meters.
2. Maximum building coverage is 40-45% of the land site.
3. Even concrete floor with covering against dust, with the loading of not less than 5 tones per square meter, at the level of 1,20 meters from the ground.
4. High ceilings of not less than 13 meters allowing an installation of multilevel rack equipment (6-7 tiers).
5. Operated temperature regime.
6. Availability of the fire alarm system and automatic fire-distinguishing system.
7. Availability of the ventilation system.
8. The system of security alarm and system of security cameras.
9. Autonomous power supply and furnace.
10. Availability of the sufficient number of the automatic gates (dock shelters) with loading-unloading areas of controllable height (dock levelers) (not less than 1 per 500 square meters).
11. Availability of the areas for depositing of the trucks and for car parking.
12. Availability of the areas for maneuvering the trucks.
13. Availability of the office promises at the warehouse.
14. Availability of the additional facilities at the warehouse (toilets, showers, additional premises, changing rooms for staff).
15. Availability of the monitoring and control system of the employees' access.
16. Fiber-optic telecommunications.
17. Enclosed (fenced), with security on the twenty-four hour basis, well-illuminated, equipped with modern services and utilities territory.
18. Professional system of control and management.
19. New greenfield building with all materials, utilities and equipment meeting modern requirements
20. 24 hour operation
21. Transparent registered space lease (for multi-users)

Location specific requirements.

22. Excellent access and proximity to transportation links and main roads
23. Located in the neighborhood of the central office trunk.
24. Availability of customs post (in the area or in the warehouse)
25. Experienced developer.
26. Railway branch line.

Warehouses of class A

Mostly new-built on existing industrial areas or new appointed areas.

Design specific requirements.

1. Modern one-floor warehouse constructed of light metal ware and sandwich panels, preferably of rectangular shape without columns or with a step of columns not less than 9 meters and with a space between bays of at least 24 meters.
2. Maximum building coverage is 40-55% of the land site.
3. Even concrete floor with covering against dust, with the loading of not less than 5 tones per square meter, at the level of 1,20 meters from the ground.
4. High ceilings of not less than 10 meters allowing an installation of multilevel rack equipment.
5. Operated temperature regime.
6. Availability of the ventilation system.
7. Availability of the fire alarm system and automatic fire-distinguishing system (sprinklers).
8. The system of security alarm and system of security cameras.
9. Availability of the sufficient number of the automatic gates (dock shelters) with loading-unloading areas of controllable height (dock levelers) (not less than 1 per 700 square meters).
10. Availability of the areas for depositing of the trucks and for car parking.
11. Availability of the areas for maneuvering the trucks.
12. Availability of the office premises at the warehouse.
13. Availability of the additional facilities at the warehouse (toilets, showers, additional premises, changing rooms for staff).
14. Fiber-optic telecommunications.
15. Enclosed (fenced), with security on the twenty-four hour basis, well-illuminated, equipped with modern services and utilities territory.
16. Professional system of management.
17. Availability of the control system of the employees' access.
18. Autonomous power supply and furnace.
19. New Greenfield building with all materials, utilities and equipment meeting modern requirements
20. 24 hour operation, 24 hour security
21. Transparent registered space lease

Location specific requirements.

22. Convenient access and proximity to transportation links and main roads
23. Located in the neighborhood of the central office trunk.
24. Availability of customs post (in the area or in the warehouse)
25. Experienced developer.
26. Railway branch line.

Warehouses of class B+

Typically, former renovated industrial facilities.

Design specific requirements.

1. One-floor warehouse preferably of rectangular shape newly built or reconstructed.
2. Maximum building coverage is 40-55% of the land site.
3. Even concrete floor with covering against dust, with the loading of not less than 5 tones per square meter, at the level of 1,20 meters from the ground.
4. The height of the ceilings not less than 8 meters.
5. Operated temperature regime.
6. Availability of the fire alarm system and automatic fire-distinguishing system.
7. Availability of the sufficient number of the automatic gates (dock shelters) with loading-unloading areas of controllable height (dock levelers) (not less than 1 per 1000 square meters).
8. The system of security alarm and system of security cameras.
9. Availability of the ventilation system.
10. Ramp for unloading transport (cars, trucks).
11. Availability of the areas for depositing and maneuvering of the trucks.
12. Availability of the office promises at the warehouse.
13. Availability of the additional facilities at the warehouse (toilets, showers, additional premises, changing rooms for staff).
14. Fiber-optic telecommunications.
15. Enclosed (fenced), with security on the twenty-four hour basis, well-illuminated, equipped with modern services and utilities territory.
16. Professional system of management.
17. Availability of the control system of the employees' access.
18. Autonomous power supply and furnace.

Location specific requirements.

19. Convenient access and proximity to transportation links and main roads
20. Located in the neighborhood of the central office trunk.
21. Experienced developer.
22. Railway branch line.

Warehouses of class B

Typically former renovated industrial facilities.

Design specific requirements.

1. One- / two-floor warehouse preferably of rectangular shape newly built or reconstructed.
2. In case of two-floor building – availability of the sufficient number of the freight lifts/elevators with carrying capacity of not less than 3 tones (not less than 1 per 2000 square meters).
3. The height of the ceilings as from 6 meters.
4. Floor – asphalt or concrete without covering.
5. Heating system.
6. Fire alarm system and automatic fire-distinguishing system.
7. Ramp for unloading transport.
8. Availability of the areas for depositing and maneuvering of the trucks.
9. Security along the perimeter of the territory.
10. Telecommunications.
11. System of the security alarm and security cameras.
12. Availability of the additional facilities (premises) at the warehouse.
13. Ventilation system.
14. Office premises at the warehouse.
15. Availability of the control system of the employees' access.
16. Autonomous power supply and furnace.

Location specific requirements.

17. Convenient access and proximity to transportation links and main roads
18. Railway branch line.

Warehouses of class C

Former non-renovated industrial premises, heated hangars.

Design specific requirements.

1. Main production building or heated hangar.
2. The height of the ceilings as from 4 meters.
3. Floor– asphalt or concrete bars, concrete without covering.
4. In case of many-storied building - availability of the freight lifts/elevators.
5. Gates at ground level.
6. Availability of the areas for depositing and maneuvering of the trucks.
7. Ventilation system.
8. Heating system.
9. Fire alarm system and automatic fire-distinguishing system.
10. Offices at the warehouse premises.
11. Ramp for unloading transport.
12. Security along the perimeter of the territory.
13. Telecommunications.
14. Availability of the additional facilities (premises) at the warehouse.

Location specific requirements.

15. Convenient access and proximity to roads
16. Railway branch line.

Warehouses of class D

Former non-renovated industrial premises, underground premises, non-heated production buildings or hangars, open-air sites.

Design specific requirements.

1. Availability of the areas for depositing and maneuvering of the trucks.
2. Fire alarm system and fire-distinguishing system.
3. Heating system.
4. Ventilation system.
5. Office premises at the warehouse.
6. Railway branch line.
7. Telecommunications.
8. Security along the perimeter of the territory.

Location specific requirements.

9. Access and proximity to roads
10. Railway branch line.

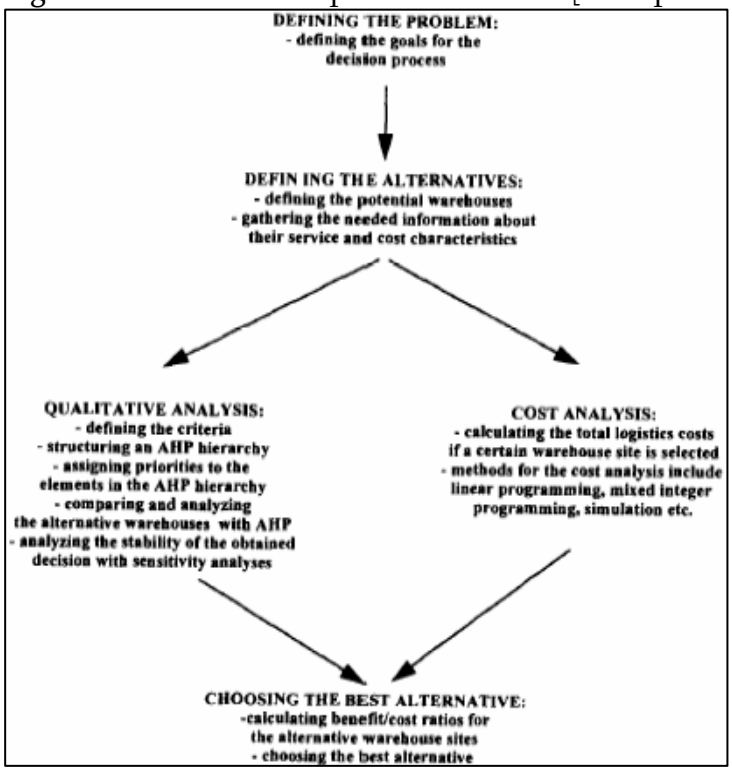
APPENDIX E WEIGHT FACTOR METHOD

CLASSIFIED

CLASSIFIED

APPENDIX F ANALYTIC HIERARCHY PROCESS

Figure derived from Korpela & Tuominen [1996 p. 173].



APPENDIX G POTENTIAL SURVEY RESPONDENTS

#	COMPANY
1	ABX Logistics Ukraine
2	BDP Ukraine
3	EGL Ukraine
4	F Formula
5	FM Logistic
6	Formag Group
7	GeoDis Ukraine
8	Komora-S
9	Koninklijke Frans Maas Ukraine
10	Kuehne + Nagel Ukraine
11	Maersk Logistics Ukraine
12	OST-WEST Express
13	Panalpina World Transport LTD
14	Raben Ukraine Kiev Region
15	REP-Trans LLC
16	Revival Express
17	REWICO International Logistics
18	Schenker Ltd Ukraine
19	SKYNET Worldwide Express (EGL)
20	TNT Logistics
21	Ukraine ICT Internationale Container Tranport GmbH (Dachser)
22	Ukrainian Logistics Systems
23	Ukrainsky Vantazhny Kuriery
24	UPS Ukraine - Zat Delkar
25	Verhoeven / TV-Trans

APPENDIX H QUESTIONS EXPERT INTERVIEWS

Date: _____
Place:_____
Presence:_____
Time:_____

What are the developments in logistics in Ukraine in the field of:

- ☐ Logistic service providers
- ☐ Real estate
- ☐ Logistic related sectors
- ☐ Warehousing
- ☐ Services offered
- ☐ Foreign investments
- ☐ Future outlook
- ☐ Other:_____

What can you say about the following threats to growth of the 3PL market in Ukraine?

- ☐ Lack of trust and awareness among Ukrainian firms and state institutions
- ☐ Poor transportation and communications infrastructure
- ☐ Shrinking market due to decreasing demand or presence of major competitors
- ☐ Complex and 'old fashioned' regulation, norm and tax system
- ☐ Availability of experienced, high-educated work force
- ☐ Economical and political instability
- ☐ Costs of warehouse plots, construction, management and maintenance
- ☐ Other:_____

What can you say about the following opportunities for growth of the 3PL market?

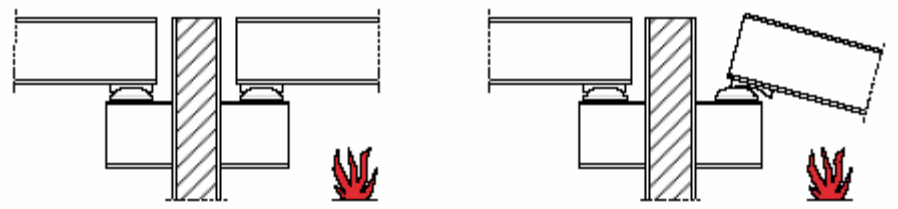
- ☐ Increasing awareness towards logistics outsourcing
- ☐ Development of infrastructure
- ☐ Demand for more (specialized) services as a result of a steadily increasing GDP
- ☐ Increasing transparency and clearance in regulation, norm and tax system and/or adaptation to Western standards
- ☐ Possibility of investments by Western companies using 3PL services
- ☐ Economical and political stability
- ☐ Increasing awareness of local 3PL towards strategic alliances
- ☐ Other:_____

APPENDIX I TRENDS IN WAREHOUSE DESIGN AREAS

Structure

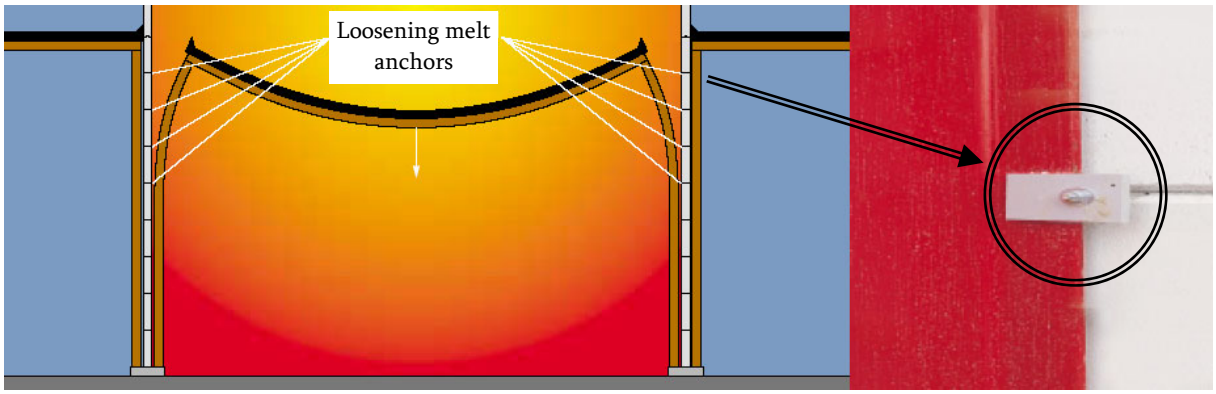
In Ukraine, concrete is still a widely used material to build warehouses and is applied in the floor and columns. This is partly in contrast to Western Europe. For example, almost all DCs in the Netherlands are made of steel. The standard construction of such warehouse consists of steel roof plates, isolation (or spanned sandwich panels), steel beams and steel columns. With steel, bigger spans are possible than with concrete, requiring less support points (columns) thus creating more space. And if columns are applied, they can be protected against mechanical influences (for example from trolleys). The dimensions of such big halls are mostly so large, that it is often cheaper and easier to use steel. Of course, considerations about the use of the materials are related to the present price of steel per kilo[11] or concrete per m^3. In practice, assembly of steel is easier than concrete and can also easily be dismantled and re-used. In situ concrete needs to be stripped from its formwork, a job that is not easy on great heights. The alternative is to use prefab concrete beams or columns, but they are, in comparison to steel, much bigger and heavier to transport. In addition, constructing big warehouses in concrete is too expensive because the total weight has its influence on all other elements and foundation of the construction.

One of the greatest advantages of concrete is that it offers good protection in case of fire. Steel tends to succumb much earlier under influence of extremely high temperatures caused by fire, and can cause the whole warehouse to collapse. There are a few methods to come towards the (legally determined) requirements of fire safety, i.e. the delay in time that a steel structure collapses as a consequence of high temperatures. One of them is to protect the steel columns and beams with plates that either cool or isolate. In a steel frame construction, the steel profiles can be incorporated in the walls and floors. In this way, the partition fulfils a double function (separation plus protection) and is the fireproof lining handled effectively [Bouwen met Staal 2006]. Another method is the use of additional measures in the steel construction, making protection of the steel unnecessary. Depending on specific requirements, a warehouse can be divided in fire compartments, surrounded by fireproof walls. By applying the so-called 'roll-off cam', in case of fire, the beam rolls of the console giving the fire compartment the possibility to collapse without taking along connecting compartments. The principle off the roll-of cam is shown in the figure below, which comes from Bouwen met Staal [2006 p. 6].

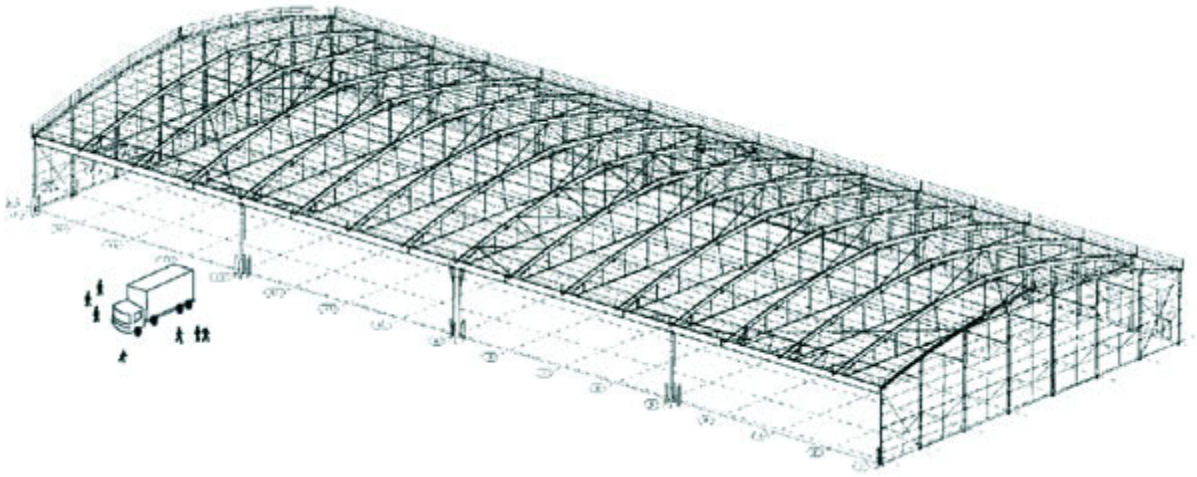


[11] For construction steel: 1,06-1,30 Euro per kg in the Netherlands [Breedveld Staal 2006].

Another method is the use of 'melt anchors' to fixate the steel columns in the walls. In case of fire, these anchors melt and the steel construction of one compartment is loosened from connecting ones. The figure below [Bouwen met Staal 2006 p. 17] shows the principle of such anchors and their reaction in case of high temperatures. At the right an applied anchor is shown.



The average height of warehouses varies between 10 and 12 meter and the column grid varies widely, among others depending on the client's requirements. A column grid of about 12 x 24 [PAIZ 2006, AIG/Lincoln 2006] seems to fit general modern warehouse requirements. To extreme, the so-called 'High Bay' warehouses are very high and wide without columns. The strong and stiff structure can accommodate automatic storage and retrieval systems up to the roof of the structure. Heights of 23.5 meters and spans of up to 200 meters are possible, see also figure below [Reid Steel 2006a].



Lighting

There is a tendency to install high quality artificial illumination in warehouses [Ackerman 1999]. Round the clock operations, the need for a better work environment, the type of activities and racking ask for optimal lightning solutions. First, the illumination must be energy-efficient, like fluorescent high bay lighting, which is also cooler in operation, and re-lights immediately. Second, it must be movable, because if the internal layout changes, lights need to be rearranged as well. The lighting fixtures must accommodate such

changes as well as changes in number of lights. Replacing the fixtures on a later time can be costly, if not a major disturbance in warehouse operations [Paz-Frankel 2006]. It is worthwhile checking subsidies or grands, handed out by local governments, to promote the use of energy-saving systems. Thirdly, the more active the area (such as the loading dock) the higher the light level requirements [Holophane 2005]. This also applies for the type of product, the smaller the product (or label), the more light is required. For example, the average light required for an active area with small product labels ranges between 200 and 500 lux. In addition, systems are available to adjust light level taking activity in the considered warehouse area and incoming sunlight into consideration. From the viewpoint of energy saving, skylights are increasingly popular, because they add a lot of natural light and can replace artificial light during sunny days. Recent developed warehouses have ready installed lighting systems with a light level of 200 lux. It is worthwhile keeping in mind that white walls, light-colored floors, racks and boxes reduce the need for extra lightning as they reflect light more than dark colors.

Fire protection & detection

When considering fire safety, warehouses are unique [Proline 2006a]. The distance between detection device from the smoke/heat source, the constant change in airflows and the change in type, size and manufacture of materials being stored ask for rapid heat source detection and optimal protection support. An example of the first is the use of heat detection cables as fire detection, which are durable against mechanical influences and can cover the total storage area (both in ceilings and in side walls). The most used protection systems are sprinklers. Although sprinklers offer reliable and rapid response in case of a fire, they are costly and need a wide range of support facilities (like pumps and water storage). In addition, they reduce the maximum possible use of height in warehouses, as a certain distance is required between the highest level of products and the sprinkler. Important factors in sprinkler layout design specifically for warehouses are commodity class (referring to the material, form and packaging of the stored product), storage arrangement (size and location of aisles ask for specific sprinkler support) and sprinkler type [Penton Media 2006]. A lot of recently developed warehouses have Early Suppression Fast Response (ESFR)-sprinklers for subsequently suppression of high challenge type fires. These sprinklers have a quicker response and unleash about 4 times more water than normal sprinklers [Rietjens[12] 2006]. The so-called flat-spray sprinklers can be used for higher storage heights.

HVAC (Heating, Ventilation, Air-Conditioning)

The climate inside the warehouse is important for the employees' work conditions. Of course, in a refrigerated warehouse, the cold climate needs to be consisted and maintained at most efficient costs. The systems taking care of the climate inside the warehouse can be divided in three groups: heating, ventilation and air-conditioning. A heating system needs to be cost-effective, energy efficient and safe. The most common used types of heating are gas fired and electric heaters [Arabe 2003]. For larger warehouses with many dock doors

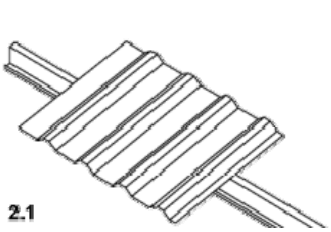
[12] Rietjens is technician at Burgers Ergon BV, a company that is specialized in sprinkler installations.

and greater ventilation requirements, the direct gas-fired air heaters offer most cost and energy efficiency and need the least maintenance of all gas-fired systems. They replenish indoor air with fresh air and distribute warmed air throughout the warehouse. Ventilation systems help to remove the heat, humidity, fumes and noxious smells, providing a supply of clean, fresh air [CoSaf 2006]. They also help in the prevention of airborne infections potentially lowering sick absenteeism and improving production. The purpose of Air-Conditioning systems in warehouses is to cool the air inside the warehouse, creating a more comfortable climate for the workers or the products stored. During the summer, the nights are often cool enough to pre-cool the warehouse for the next day, avoiding the use of air conditioning and saving a significant amount of energy [NRG Systems 2006].

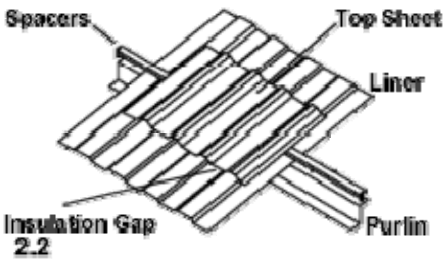
To support energy saving, all HVAC-systems should work together using computer control, providing an optimum work climate against lowest costs. An example is the use of Variable Air Volume, which is a HVAC-strategy through which the volume of air delivered to conditioned spaces is varied as a function of ventilating needs, energy needs or both [EPA 2006]. Of course, all of these systems need to be operated manually as well, in case of a major power or system failure. The system also needs to be flexible, taking changing requirements into consideration.

Walls

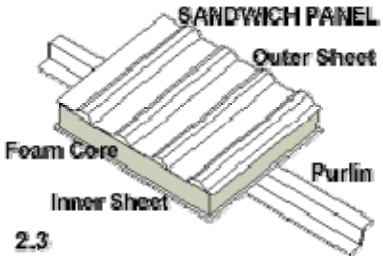
The use of steel sheets as wall and roof clad is most common in warehouse building and can be used in combination with a steel frame structure. The distance between the columns can even be determined by the standard width of steel sheets on the market. The first meter above the ground, however, can exist of concrete or bricks. In this way, the walls are better protected against weather and mechanical influences and have better foundation and isolation. Besides that, most warehouse floors are at a certain height above ground level and, for example, based on a sand bed surrounded by concrete L-profiles. Sheets can be used both for walls and for roofs and can be single skinned, double skinned (if insulation is required) or, in case of windows and door fitting, the so-called sandwich panels [Reid Steel 2006b]. Most important is the flexibility of the walls in case of future expanding or need for additional dock doors. Not only the sheets should be flexible, while designing the warehouse it is wise to take future changes into account.



2.1



2.2



2.3

Doors and docking systems

One of the recent developments in roles of warehouses has a major influence on the doors of warehouses. The cross-docking concept asks for a different lay-out of the warehouse and receiving and shipping doors should be adjacent to each other. The typical balance between the number of docking doors and floor space is 1 docking door per 1.000 m2. It is likely that the balance will increase, due to concepts like cross docking. While designing the dock itself, different aspects need to be kept in mind. The use of trailers with slightly different measures require a dock that can be adjusted to the circumstances. Either hydraulic or pneumatic, the level of the docks should be able to change when this is required for the types of trailers attending the dock.

Security

Security level has increased over the years. In countries with higher security risks, 24hr security is a must, while in other countries camera's and incidental check by security companies is sufficient. In addition, access control at every door and registration of all the 'door movements' within the warehouse (using badges to open doors) is common. Some warehouses even have microphones around the premise and in the warehouse. When intrusion occurs, the systems switches on and a security company can listen what is going on. Security forces can only be called in case of real risk and recorded conversations can serve as evidence.

Power and communication systems

Providing warehouses with autonomous power supply reduces downtime in case of a power failure. Especially when warehouse activities are crucially depended on power or in countries with risky power supply, autonomous power supply by means of generator is necessary. Purchasing and operating costs of such generators outweighs costs as a result of downtime. When activities ask for higher voltage than normal (for example, certain machines), then such facilities need to be supplied. It is wise to take future expansion or change in activities (use of technology) in consideration when determining power connections through the warehouse. This is also the case for communication systems. Fyber glass cables and wireless applications for supporting information flow are applied in modern warehouses. Also connections to access the company's network or WMS are available throughout the modern warehouse. However, there are no developments yet to back up such systems in case of communication failure. Especially for modern warehouses using WMS and other communication systems, down time because of communication system failure should be avoided at all costs.

Floor

All modern warehouses have a dust- and liquid-proof floor and typical floor loading capacity varies between the 5 and 6 ton per sqm. In most cases, the floors are made of reinforced concrete with a coating as finalization. An alternative is steel fiber enforced concrete floors. The advantage is that they are easy and quick to realize. This type of floor is not sensitive to shrink tensions so that cracks in the surface can be avoided. A disadvantage is that the calculation of such floors is complex and often based on

assumptions [Valk[13] 2006]. Furthermore, these floors cannot be used in combination with foundation on piles or when heavy point forces appear.

Handling

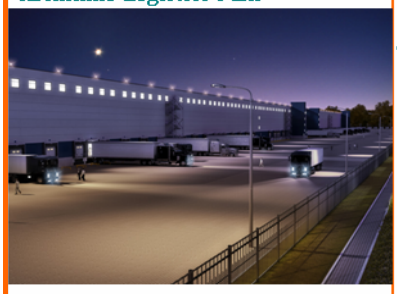
Today, many of the upcoming logistic related sectors offer products to support the goods flow in a warehouse. An example is storage equipment. Although storage equipment should be used as efficient as possible in relation to the usage of space in a warehouse, they also should be designed for flexibility. The need for flexibility originates in product characteristics and process lay-out. Pallet racks, shelving and storage cabinets are adjustable, portable and capable of being moved to another location or even sold. Depending on the product, LSPs can choose for automation of their activities. In case of high volumes, dependable products and process automation can work very well. If operations are highly variable, like changing physical product characteristics, flow, processing or VAS, than there is a need for flexibility. In either way, new facilities should implement technologies gradually, starting small and leaving enough space to extend the level and amount of technology. Important elements influencing decisions about the level of technology are the product, the required customer service level, the order sizes and financial and labor considerations. Typically, the inside is designed, and then the facility is built to fit the requirements.

Multi-modal handling

Although encouraged by the European Union, multi-modal handling does not seem to be a priority requirement when choosing site locations or designing the warehouse facility. Only if really needed, and often indicated by the LSP, then close proximity of railway and facilities for loading/unloading is a key priority.

[13] Valk is constructor at Van Boxsel, a company that provides constructional advice.

APPENDIX J RECENTLY DEVELOPED WAREHOUSES

Krekshino Logistics Park	Location:	Russia, Moscow
	Developer:	Knight Frank LLC
	Type:	Class A warehouse complex
	Parameters:	Size: 25.000 m2 per unit; height: 12.0 m
	Ownership:	All leased
	Floor load:	6 tons/m2
	Column grid:	17.0 x 24.0 m
	Doors:	1 per 1000 m2 (with dockshelter and dockleveler)
	HVAC:	Exhaust ventilation
	Office:	5-6% of total area
	Communication:	Fiber optic telecommunication
Source: Knight Frank [2006]	Comments:	Air curtains above gates, rail spur
ProLogis Distribution Centre Venlo III	Location:	The Netherlands, Venlo
	Developer:	ProLogis
	Type:	Sate of the art warehouse
	Parameters:	Size: 45.700 m2; depth: 100 m; height: 10.8 m
	Ownership:	Unknown
	Floor load:	3 tons/m2
	Column grid:	21.6 x 10.0 m
	Doors:	1 per 1000m2 (with dockshelter and dockleveler)
	HVAC:	Heated to 5 Celcius with outside temp. of -10 Celcius
	Office:	5,5 % of total area
	Communication:	Unknown
Source: ProLogis [2006a]	Comments:	Steel frame, K14 roof-net sprinkler, lightning 200 lux
ProLogis Park Blonie	Location:	Poland, Warsaw
	Developer:	ProLogis
	Type:	Sate of the art warehouse
	Parameters:	Size: 17.500 m2 per unit; depth: 70 m; height: 10.0 m
	Ownership:	Unknown
	Floor load:	5 tons/m2
	Column grid:	12.0 x 24.0 m
	Doors:	Drive-in doors with dock levellers and seals
	HVAC:	Gas fired heating, smoke vents, gravity ventilation
	Office:	Incluided
	Communication:	Telecommunication system
Source: ProLogis [2006b]	Comments:	ESFR sprinkler, lightning 200 lux, 24hr security
Magna Park	Location:	Germany, Berlin
	Developer:	Gazeley
	Type:	Warehouse complex
	Parameters:	Size: 13.000 m2 (example); height: 10.0 m
	Ownership:	Rent
	Floor load:	5 tons/m2
	Column grid:	Unknown
	Doors:	Loading dock doors, level access ramps
	HVAC:	Heated throughout, smoke vents
	Office:	3,1 % of total area
	Communication:	Power & data cabled throughout
Source: Gazeley [2006]	Comments:	ESFR sprinkler, site provides good labour availability
Schenker Grolsheim	Location:	Germany, Grolsheim
	Developer:	Eurinpro
	Type:	Warehouse
	Parameters:	Size: 18.500 m2; height: 12.0 m
	Ownership:	Schenker AG
	Floor load:	5 tons/m2
	Column grid:	Unknown
	Doors:	1 per 1000m2
	HVAC:	Heated throughout, smoke vents
	Office:	2,7 % of total area
	Communication:	Unknown
Source: Eurinpro [2006]	Comments:	Multi-tenant warehouse

APPENDIX K WAREHOUSING SURVEY

On the next pages the survey is shown in the format as sent to the potential respondents.