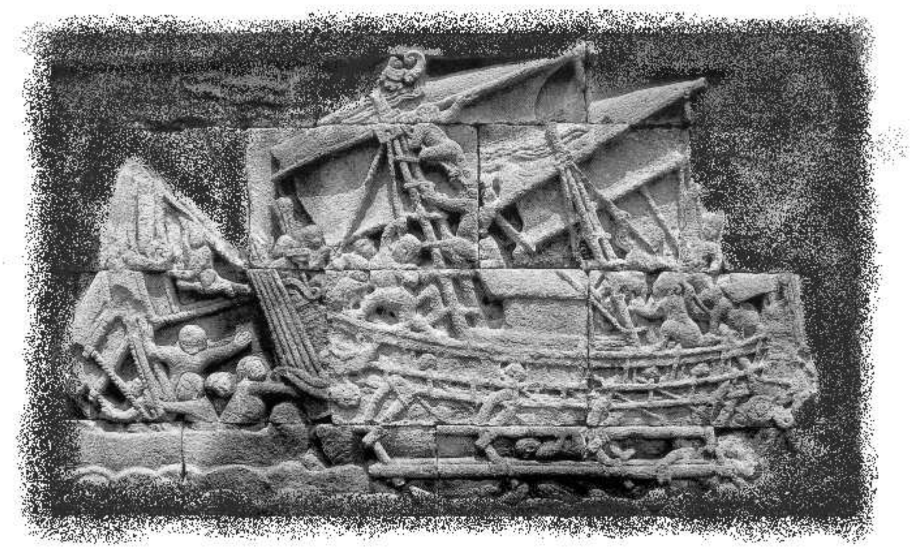
Concept of Compatibility in Shipping

Fuzzy Set Theory and Case-Based Reasoning Approaches



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- Fuzzy Set Theory and Case-Based Reasoning Approaches -

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Dedicated to:

my children,

my wife

and

my parents

Summary

This thesis aims at contributing a new perspective on the way living problems in shipping practice are addressed.

Shipping is the workhorse of the world economy. It connects nearly all parts of the world. State of the macro economy, weather and political events affect the sector very much. The magnitude of their influence is unclear and is difficult to justify objectively. Those aspects are taken into account when determining of freight rates or charter hire. Therefore shipping can be viewed as a complex system.

The existing tools including market forecasts and shipping indexes are less useful for conducting daily shipping practice. Information is available in abundance, but the useful one is still scarce and expensive.

In spite of the complexity of the living problems in shipping, an experienced shipping practitioner can solve problems quickly and -frequently- satisfactorily. An experienced ship broker, for example, can assess the value of ships better and faster than any value assessment method. This merit leads to the idea, that it would be useful to have a better insight on this phenomenon that experience and intuition play an important role in practice and that similar problems tend to have similar solutions. Therefore the capability to recognize similar problems will be helpful to find the desired solution.

Compatibility, a concept proposed as an attempt to explain and to embrace the way problems-solvings (value assessment and planning tasks) are conducted in daily shipping practice. The concept of compatibility involves an act of grouping of similar attributes of similar objects, for example in the case of a ship replacement. The concept concerns also an act of matching between objects of different roles or functionalities, for example between a ship and route, or between a ship and a charter hire value. It implies that the concept of compatibility means an act of problem-solving.

Fuzzy set theory and case-based reasoning are used, given the capability for addressing the notions of vagueness and learning respectively, which mark the concept of compatibility. Three models have been developed : (a) fuzzy arithmetic-based voyage estimation (b) tailor-made shipping index and (c) case-based stowage planning. The implementation of the concept delivers a new and promising way of addressing the problems which are not addressed satisfactorily at present.

Kurzfassung

Kompatibilität in der Schiffahrt:

Perspektiven der Theorie von Fuzzy-Mengen und des Fallbasierten Schließens

Mit dieser Arbeit wird versucht, eine neue Perspektive für die Lösung von Problemen in der Handelsschifffahrtspraxis zu schaffen.

Schifffahrt ist in der Weltwirtschaft der wichtigste Transporteur, vor allem für Güter. Sie verbindet fast alle Teile der Welt miteinander. Die Weltwirtschaft, die Politik einzelner Länder, Einzeleinflüsse wie Ölpreis, Klima oder Wetterbedingungen beeinflussen den Wirtschaftssektor Schifffahrt in großem Maße. Die Größenordnungen der Einflüsse sind veränderlich und schwierig objektiv fassbar. Sie sind der Hintergrund auch für den Wert eines Schiffes sowie für Fracht- und Charterraten. Schifffahrt ist daher ein hoch komplexes System.

Existierende Hilfsmittel, wie Schifffahrts-Indexe, Bewertungsmodelle und Marktprognosen, sind keine hilfreichen Werkzeuge im täglichen Schifffahrtsgeschäft. Viele Informationen sind verfügbar, aber die wirklich nützlichen sind knapp und teuer.

Trotz der Komplexität der realen Problematik können erfahrene Schifffahrtspraktiker ihre Probleme oft schnell und zufriedenstellend lösen. Zum Beispiel können Schiffsmakler den Wert von Schiffen besser und schneller abschätzen als veröffentlichte Bewertungsmodelle. Diese Fähigkeit führt zu der These, dass es nützlich wäre, eine verbesserte Einsicht in das Phänomen zu gewinnen, dass Intuition und Erfahrung viel zum täglichen Problemlösen beitragen und ähnliche Probleme dazu neigen, zu ähnlichen Lösungen zu führen. Das Erkennen ähnlicher Situationen kann daher zu wichtigen Hinweisen für die Lösung eines Problems führen. Der Begriff Kompatibilität wird benutzt, um die Art und Weise zu erklären, in der Problemlösungen in der Praxis (z.B. Wertermittlung und Beschäftigungsplanung) erfolgen.

Der Begriff Kompatibilität enthält einen Akt von Gruppierung ähnlicher Attribute oder ähnlicher Objekte, z.B. im Zusammenhang mit dem Ersatz eines Schiffes durch ein anderes. Kompatibilität bedeutet ferner auch ein Zusammenpassen von Objekten unterschiedlicher Funktionalitäten oder Aufgaben, z.B. zwischen Schiff und Hafen oder zwischen Schiff und Charterrate. Es zeigt sich, dass die Feststellung von Kompatibilität einen Akt der Problemlösung darstellt.

Die Theorie der unscharfen Mengen und das Fall-basierte Schließen werden ausgewählt aufgrund ihrer Lernfähigkeit und ihrer Fähigkeit zur Verarbeitung unscharfer Phänomene. Drei Modelle sind entwickelt worden: (a) Fuzzy-arithmetische Reiseberechnungen, (b) individuell formulierte Schifffahrts-Indexe und (c), als Exkurs, die fallbasierte Stauplanung für Containerschiffe. Die vorgeschlagene Implementierung liefert somit ein neues und vielversprechendes Konzept zur Lösung von Problemen in der Schifffahrt, insbesondere im Chartergeschäft.

Preface and Acknowledgement

Human experts are not systems of rules, they are libraries of experiences

Riesbeck and Schank [1]

This dissertation can perhaps be viewed as a journey. It is a journey to few places and situations. It is a journey through viewpoints and experiences. Without supports of many, the end of the journey would have not been visible.

Firstly, I would like to thank Prof. Horst Linde (Department of Marine Transport, TU Berlin) who has given me the liberty to explore new areas, called AI. I am also very grateful for having been given the opportunity to join a research project COMSTAU (Computer Aided Stowage Planning for Container Ships) with TU Hamburg-Harburg and Müller+Blanck software firm.

Views on AI have affected my views on looking at my shipping domain very much. For this, I owe many thanks to Prof. Erhard Konrad (Department of Knowledge-Based Systems, TU Berlin).

I will miss colleagues and friends, with whom I could share ideas and problems. Imad Khemlichi, Frauke Baumgärtel, Felix Fliege, Hanurani Prajanto, Aceng Hidayat, Wayan Karyasa, Peter Horstkorte, Heike Vogeley, Frank Laue, Jens Heyer, Csaba Piller are among a few.

Last but not least, I would like to thank my wife, Herlin, and our children, Dipto and Saraswati, for their understanding when I frequently came late at home. Without them this dissertation would not have been possible. For them too, this dissertation is written.

[1] [66]

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Part I

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Chapter 1

Introduction

1.1 Motivation

1.1.1 Few scenes from shipping practice

Chartering is the heart of bulk shipping. Ships are chartered-in and chartered-out everyday. Bulk shipping plays an important role in the world economy, as bulk carriers transport most of cargoes world wide. It is a very economical transport mode.

Intensive exchange of information marks the activity of chartering and operations departments everyday. A ship practitioner, either in chartering or operations department, communicates endlessly with brokers, cargo owners, agents and partner shipping companies, through phone conversations, faxes, e-mails and postal letters. Messages containing cargo owners seeking suitable tonnage or ship owners seeking for employment for their vessels is received and transmitted daily. In many cases such messages are sent by brokers.

Besides, information from newspaper or television concerning the oil

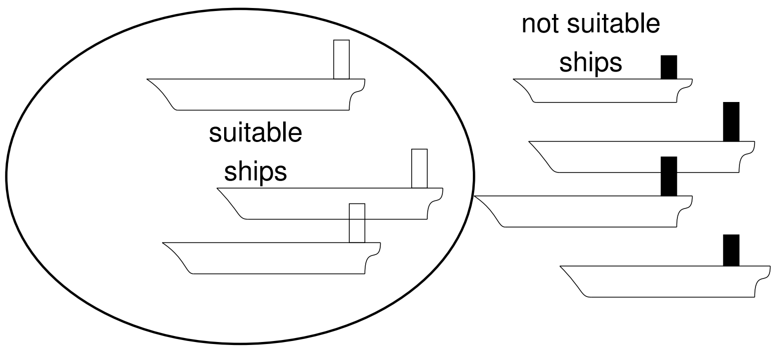

Figure 1.1: Suitable and not suitable ships

MV KALKAYAN	MV HANDY ISLANDER
TUR FLAG/ 1977	LGR MAN 1985
27306 MTONS ON 10.594 MTRS	26584 DWT ON 9.54 M
GRT/NRT 16050/8665	G 33917 CBM
LOA/BEAM 177.3/22.84	5 HH, 4 X 30 CR
GR 1116276/BALE 1060742	12.5 / 19 + 1.5 MDO
4X15T	ALL ABT
LR 100A1 - PANDI MUTUAL	OPEN HAMBURG
11.5 KNOTS ON 24MTONS IFO 180CST	
+ 2MTONS AT PORT	
OPEN GLASGOW	

Table 1.1: Vessels available for employment

price, world economy, events, usually political ones, which may affect the world trade, fuel price is followed closely. Most of messages received do not contain something useful. One needs to filter out useless messages from unreliable sources or messages containing irrelevant topics. The most useful and compact information is still scarce and expensive.

This section portrays three scenes describing the tasks in ship chartering and operations. Firstly, consider the following conversation in a chartering department:

> *We see an opportunity to obtain cargo from Rotterdam to Mumbai. Can you find us a suitable 40.000 dwt bulker*[1]*?*

From the pile of faxes and e-mails received, a chartering staff will find numerous ships available for charter. The message is usually brief containing a summary of the particulars of the ship and its position when available, as shown in Table 1.1.

From the ships offered to him, he will make a selection. Few can be viewed as suitable ships and the remaining are not suitable ones, as shown in Figure 1.1. What has he been doing actually? Can one categorize those ships simply into suitable and not suitable ships? Can one do that objectively? On which considerations does he base his selection? How well can current methods address the above situation?

In the following steps, as the negotiation has been started, he has exchanged some information with the broker. More details become available for both parties, i.e. charterers' and owners' wishes, expectations or preferences[2]. The size of information available to both parties grows. It becomes

[1] a synonym to bulk carrier, a ship carrying dry bulk/ unpacked cargoes

[2] The plural forms of 'owner' and 'charterer' are often used in communications, i.e. owners/ ship owners and charterers, though those usually denote a single organisation (one ship owner or one charterer)

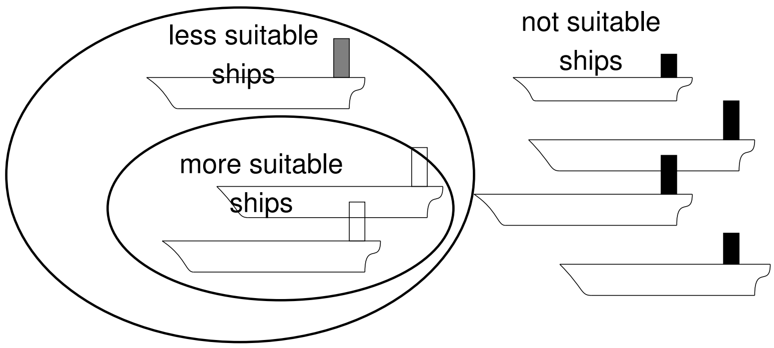

Figure 1.2: More suitable, less suitable and not suitable ships

evident that he needs to narrow his selections. Among the suitable ships, one can divide into two finer groups, more suitable or less suitable ships, see Figure 1.2. The process goes on until he finds the most suitable one.

The above tasks teach us the idea of grouping as a part of decision making task. It is a task of grouping of ships into suitable and not suitable ships, or in a finer fashion. The concept 'suitable' reflects the degree of preference of the chartering practitioner. The immediate striking question lies before us. The concept 'compatible' will be used to embrace concepts such as 'suitable' [3].

Consider now the second situation. A ship practitioner is seeking a ship. His ship broker offers him a ship available for employment, with following brief particulars:

MV FOREST CHAMPION
LGR, PAN, 1993
26472 DWT ON 9.54 M
G 33917 CBM
14/22 + 2 MDO
ALL ABT
OPEN GLASGOW

Few brokers and shipping consultants publish recent charter fixtures regularly and distribute them to their clients. Such a report contains brief information on ship, her delivery and redelivery ports and reported charter hire, as shown in Table 1.2.

He wants to have an idea on the prevailing charter rate of MV FOREST CHAMPION. As, an experienced practitioner can guess the charter hire of MV FOREST CHAMPION well and quickly. He does not need any mathematical equations. He simply knows it. He would say, for example, a charter

[3] Compatibility means the capability of existing or performing in harmonious or congenial combination [3]; more on this, see Chapter 4 and Glossary.

MV IRA	MV ARISTOTELES	MV ERMIONI
1979, 26697 TDW	1985, 23286 TDW	1977, 66157 TDW
DEL SPORE	DEL NORTH CHINA	DEL US GULF
REDEL KOSICHANG	REDEL TAIWAN	REDEL SKAW/
VIA PADANG	13 K, 18 T	CAPE PASSERO
14 K, 24 T	PROMPT	14 K, 38 T
PROMPT	US$ 6500/DAY	PROMPT
TRIP OUT		TRIP OUT + 175500 BONUS
US$ 5500 / DAY		US$ 9000 / DAY

Table 1.2: Past fixtures

hire of about $ 6,000 / day would be appropriate for that ship. In other words, a charter hire of approximately $ 6,000 is compatible to such a ship.

The third situation. It may appear that a ship, say MV FOREST CHAMPION, serving a route regularly has to be docked soon. Another vessel must replace her. The task is to find the most suitable vessel to replace her. Ships having similar characteristics to her are strong candidates. But this criterion is far from adequate. The most compatible ship must comply with an array of criteria such as having a reasonable charter hire and her current location must be in the vicinity of MV FOREST CHAMPION'S current sailing area.

1.1.2 State of the art of shipping research

The above illustrations can be summarized as follows:

Situation 1. Determination of a ship suitable for a certain route or trade. Its solution can be expressed, for example, as follows: "MV KALKAYAN is *suitable* to this trip Rotterdam-Mumbai".

Situation 2. Determination of a ship's value (charter rate). Its solution can be expressed, for example, as follows: "Current charter hire of MV FOREST CHAMPION is approximately $ 6,000/day", in other words "I suppose assuming the charter hire of MV FOREST CHAMPION US$ 6,000/day is appropriate".

Situation 3. Determination of a replacement ship. Its line of reasoning can be expressed, for example, as follows: "MV X' & MV Y's design characteristics are similar to those of MV FOREST CHAMPION. The location of the MV X's delivery port is closer than that of MV Y to MV FOREST CHAMPION'S redelivery port. So MV X is more suitable one to replace her"

Shipping research is apparently interested in the second situation, namely the value assessment task; the remaining situations do not seem to attract attention. Newbuilding and second hand prices, time and voyage charter rates are affected very much by numerous factors, from supply and demand of ships, exchange rates, fuel price till macro economy [46]. This is an initial sign that shipping is a complex system. Efforts have been undertaken to address valuation problems in shipping. A valuation task focusing on the future is called forecasting. Beenstock, Vergottis, Wergeland and Tang, to name a few, developed forecasting models, which might help us to predict the future charter rate movements of a *market segment* [8, 23, 75]. This market segment means a set of ships of a range of sizes, operating in few standard main routes. Those forecasts are of use for macro-economic analysis purposes, but as we will find later in Chapter 2, those forecasts are of a little use in shipping practice.

Resources such as shipping indexes are published regularly. Indexing is in fact an attempt to describe the whole shipping market using few main shipping trades. Those may give an adequate overview of the whole shipping market, but a chartering staff cannot rely very much on those indexes. Most of routes or trades are very specific, whilst those indexes are too general to be practicable. Therefore the shipping indexes are not much of use in conducting daily chartering negotiations.

Intuition plays an important role in shipping practice. Various tasks concerning the value assessment and decision making in operations, chartering and sales and purchase involve intuitive judgments. Datz adds [16]:

> *In examining the decision-making processes associated with merchant fleet operations one is struck by its great reliance on* intuitive *type judgment. Management appears to be more of an art than a science. Traditionally it has been conceived as an esoteric process occurring within the mind of skilled manager*.

The role of intuition and experience has been widely acknowledged [46, 63]. But efforts to understand and to make use of it seem to be non existent. Shipping research seems to have been marked with its preference for quantitative methods, statistics and operation research [23, 79, 75]. Adland and Pace's efforts to address the valuation tasks in shipping illustrate this view very clearly [60, 5]. Terms such as intuition and experience are vague and subjective. Those seem to be less *accessible* to many. Many researchers do not consider those aspects seriously.

Decision making is a process of determining an action. In real world, the situations are far less than ideal. There are many things which are unknown or partially known. The probabilities of certain events are not always available. Therefore, Simon argues in his Theory of Bounded Rationality, that it is hardly possible to make decisions rationally [72, 71]. Goncalves' argument that shipowners do not make decisions rationally confirms Simon's view [27]. In spite of his advocation for using mathematical approaches, Adland admits that the results can not yet challenge the existing intuitive valuation method in shipping [5].

Shipping practitioners are exposed to situations, in which no tools are available which support them to conduct their job. Nevertheless, in spite of the complexity of shipping system, they can do many tasks well and quickly, based on experience and intuition, ranging from assessing port and cargo handling performance, charter rate estimation, voyage performance till stowage planning.

The above illustrates that today's shipping research has not been addressing problems living in daily shipping practice adequately. This research aims at contributing to address daily shipping problems, through building a sound foundation, before making the next step to make a solution tool.

The choice of method follows after elaborating the state of problems. Apparently this 'journey' has produced a way of looking at shipping problems, which differs from the main stream of shipping research undertakings today.

1.2 Hypothesis and problem formulation

1.2.1 Hypothesis

The above three situations share one thing in common, namely the concept of compatibility. The concept of compatibility involves the notion of uncertainty, which is not a probability concept [36]. It is *not* a probability of an event that a ship is compatible to a particular route or not. The concept of compatibility involves a concept of imprecision, inexactness or vagueness. Analogously, the meaning of *a suitable* ship or *an appropriate price* or *a low charter hire* or *about $ 6,000/day* is imprecise or vague. As we will find in Chapter 2, an experienced ship practitioner knows instantly, if a ship is suitable for a certain route or not. Those concepts are often to be interpreted contextually. A fresh graduate of a shipping school does not know if a charter hire of $ 6,000/day is low, moderate or high. Therefore knowing the context involves knowledge. This leads to the first hypothesis:

> *Concept of compatibility is related to or contains information or knowledge on shipping.*

It makes difference whether someone is an experienced shipping practitioner or not. Being experienced can be viewed as having done and memorized many problem-solving situations. Experience is a form of knowledge accumulation. And knowledge is useful to solve problems. If the first hypothesis is correct then, the second hypothesis:

> *Applying the concept of compatibility opens a new perspective to address shipping problems.*

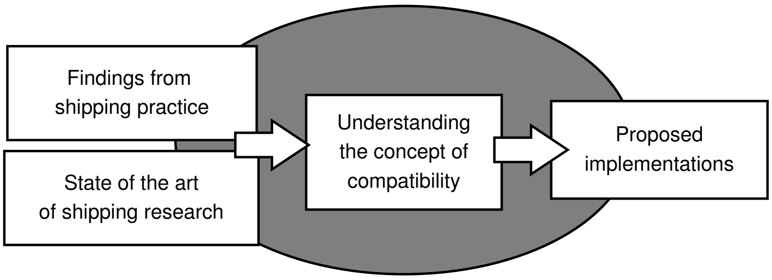

Figure 1.3: Research focus

1.2.2 Problem formulation

The above hypothesis can be summarized as follows: Firstly, *"what do we understand under compatibility?"* Secondly, *"what can we do about it"*? The following array of questions describe the steps conducted:

How are shipping tasks conducted? What are the tasks in shipping? Which tools and resources are used today? How well do they serve the needs?

Research: state of the art and views. What is the contribution of shipping research to address tasks in shipping. How well are their methods used in practice? How is the view of the research community concerning the way to address the problem?

Survey of methods. Which direction should we look at? From whom or from where can we obtain ideas? What can we learn from successes and failures from the past research or applications, when necessary of domains other than shipping? Does experience really matter? What is experience? What is intuition? What is imprecision?

Building the concept. What is the concept of compatibility? Why does this concept offer a promising perspective towards addressing the problem?

Demonstrating its usage. Few preliminary implementations are introduced.

1.3 Scope and structure

1.3.1 Scope of work

The daily running of shipping business stands on the foreground of this research. This involves all activities related to daily decision making, in particular (but not merely) in the operational management level in the fields of chartering and operations.

A five-month field research was conducted in 2000 at Egon Oldendorff shipping company in Lübeck. Egon Oldendorff owns and operates some 200 ships of 10,000 dwt and above of various types, mainly bulk carriers trading worldwide. They own also other types of vessels from multipurpose ships till ferries, which are chartered out. Furthermore, few scenes are recalled from the author's previous job at the chartering and operations desk at Meratus shipping company in Surabaya, Indonesia, in 1994-1997. Meratus owns and operates multipurpose and container ships in South East Asian waters. It is soon evident that there is no strict distinction between a plain bulk carrier and a multi-purpose tween-deck ship, from the chartering viewpoints. Therefore the topics elaborated in the research, to some extent, are applicable to other types of ships.

The study presents empirical findings on the way few shipping tasks are conducted, on how much the shipping research has contributed to address shipping practice's problems. Furthermore it outlines the needs for considering more natural and human aspects in developing of tools or methods addressing shipping problems, and it appeals for having an eye on the Artificial Intelligence (AI), in order to raise our insight on the concept of compatibility.

The emphasis is put on enhancing our understanding on the concept of compatibility supported by empirical findings from shipping practice and by existing theories and methodologies, see Figure 1.3.

1.3.2 Report structure

This thesis consists of six chapters, structured as follows:

Chapter 2 starts with an overview of the bulk shipping sector, size of supply and demand. It portrays few scenes showing the tasks to run the shipping business. This involves tasks which support decision-making. A special attention is paid to the chartering and operations matters.

Chapter 3 elaborates the efforts for understanding shipping tasks. A reconstruction of chartering negotiations is made to show aspects and considerations which play a role in negotiations. A striking question now is how do the shipping research papers view those? What do they propose to solve the problems of valuation and decision making?

Chapter 4 raises a question concerning the choice of directions and, in turn, the choice of methods. Learning from the 'failure' of previous efforts, it becomes evident that the complexity of the shipping problems has not been adequately addressed. This complexity deals a.o. with imprecision, knowledge intensity. Attention is paid to understanding the tasks, the environment in which those tasks are conducted. This leads to a survey into the world of AI methods, which is then followed with a few implementations from our 'neighbors'.

Chapter 5 presents the concept of compatibility and its implementations. It elaborates the 'anatomy' of the concept of compatibility and how it is used and interpreted. The implementation is enabled using established methods, in particular, Fuzzy Set Theory and Case-Based Reasoning. Tasks in shipping are addressed implementing the idea of this concept: shipping index coverage measurement, voyage estimation, tailor-made shipping index and stowage planning.

Chapter 2

Nature of Dry Bulk Shipping

2.1 Dry bulk shipping

2.1.1 Definition

From the size of shipment, the carriage of cargoes can be divided into two main categories, partial or full shipments. In partial shipments, a ship carries a number of cargo units, or cargoes belong to more than one shippers. Such a cargo is called general cargo or break bulk cargo. In the second category, cargoes are shipped as a homogeneous mass, usually without packing and in large quantities or bulk. Its shipment is also known as a “one ship, one cargo” shipment. This cargo is called bulk cargo. This cargo can either be liquid, such as crude oil, product oil, liquefied gas or dry, such as coal and iron ore. An additional class of cargoes, called neo-bulk, are a combination of both definitions mentioned earlier. Neo bulk cargoes are physically break bulk cargoes usually packaged; but those are shipped in large quantities, such as coils or bundled wood products[1]. Unless stated otherwise, the term ’bulk’ in this thesis refers to the dry bulk.

The physical manifestation of the cargo determines the type of ship used to carry it. Tanker and bulk carrier are ships used to carry liquid and dry bulk cargoes respectively. A multipurpose dry cargo vessel is used to transport break bulk cargoes. Other types of ships denoting the combination of types, such as Ore Bulk Oil (OBO) carrier, or emphasizing specific feature of the ship, such as self-unloader (for a bulk carrier having own discharging gear on board) are also used widely in practice. MPTW stands for a multipurpose tween deck ship, OHBS stands for open hatch bulk ship). Unfortunately the categorization of cargoes and types of ships used in statistics and in practice involves some inconsistency [47].

[1]For a more details, see [47, 73, 80].

COMMODITY	MILLION TONNES	%	BILLION TONNES-MILES	%
Iron ore	475	8.6%	2700	11.6%
Coal	575	10.4%	2570	11.1%
Grain	220	4.0%	1250	5.4%
Crude oil	1565	28.2%	7860	33.8%
Oil products	422	7.6%	2090	9.0%
Other cargoes	2292	41.3%	6781	29.2%
Total	5549	100	23251	100

Table 2.1: Seaborne trade 2002 [83]

MAJOR BULKS	MINOR BULKS
iron ore	bauxite/alumina
coal	phosphate rock
grain	agribulk
	fertilizer
	iron and steel
	forest products
	other ores and minerals

Table 2.2: Major and minor bulk cargoes [80]

2.1.2 Seaborne trade

Approximately 60% and 70 % of all cargoes, in tonnes and tonnes-miles respectively, carried across the oceans in 2002 were dry and wet bulk cargoes, as shown in Table 2.1. The transport of three major dry bulk cargoes, iron ore, coal and grain, contribute some 22.9% and 28.0% of the total transported cargoes in tonnes and tonnes-miles respectively. Seaborne bulk commodities are divided into two groups, major and minor bulk cargoes [80], see Table 2.2.

The nature of bulk shipping is to transport large shipments of cargoes from and to almost any ports in the world. It has no fixed schedule, as known in liner shipping. A bulk shipping company usually has a lean shore organization. The handling of shipowners' matters at those remote ports are handled by owners-appointed agent.

Table 2.3 shows major export and import areas of dry bulk commodities. Some 16 major export areas and 8 import areas dominate the dry bulk cargo carriage world wide.

MAJOR EXPORT AREAS	mill dwt	%
IRON ORE		
Brazil	151.1	13.0
West Australia	119.6	10.3
India	94.5	8.2
South Africa	23.0	2.0
Venezuela	5.7	0.5
COAL		
East Australia	179.9	15.5
South Africa	78.7	6.8
Indonesia	59.3	5.1
Columbia	35.0	3.0
Poland	22.1	1.9
Hampton Roads	8.1	0.7
GRAIN		
US Gulf	130.3	11.2
River Plate	46.6	4.0
Australia	22.6	1.9
PHOSPHATE		
Morocco	24.3	2.1
OTHER BULK		
Canada	116.0	10.0
Australia (rest)	42.3	3.6
Total	1159.1	100.0

MAJOR IMPORT AREAS	mill dwt	%
Western Europe	531.4	34.6
Japan	373.7	24.4
China	211.1	13.8
South Korea	131.2	8.6
Black Sea	90.6	5.9
Taiwan	75.4	4.9
Hong Kong	70.2	4.6
Baltic/ Former USSR	48.8	3.2
Total	1532.4	100.0

Table 2.3: Major export and import areas of dry bulk commodities [83]

FIELDS
Week ending
Port of delivery
Port of redelivery
Name of vessel
Year of built
Deadweight
Speed
Fuel consumption
Date of laycan
Terms
Charter rate
Charterer

Table 2.4: Database fields of Time Charter Fixtures 1997-1999 [50, 51, 52]

Database of charter fixtures

The transportation of cargoes are arranged by conducting chartering negotiations, see later in Section 2.2. The result of a negotiation, a charter fixture, is officially documented in Charter Parties. Many, not all, charter fixtures are published by ship brokers and some research institutions, daily, weekly, monthly or annually.

This Chapter presents analysis based upon the annual time charter fixtures of Maritime Research Inc 1997-1999. 8181 time charter fixtures are contained in this database. The aim is to obtain an insight on the dry bulk shipping, in particular the time charter sector. The original table structure containing ten columns is cumbersome. The fourth and sixth columns contain different data types, vessel name & years of built and main engine's & auxiliary engine's fuel consumptions respectively. Each of both columns is then split into two columns. After renaming them, the table now consists of twelve columns or fields, as shown in Table 2.4[2][3].

2.1.3 World Fleet

Table 2.5 shows the fleet composition of ships of over 500 dwt size. In terms of number General Cargo ships dominate the world fleet. But in terms of the capacity, expressed in deadweight, tankers and bulk carriers compose about 80% of the total world fleet.

[2] Not all fixtures contain a complete data set. All data are input manually.

[3] Laycan: laytime canceling

Figure 2.1: MV Luise Oldendorff

SHIP TYPES	NUMBER	%	1000 DWT	%
Bulk carriers	5,970	15.15	284,066	34.80
OBO carriers	183	0.46	12,789	1.57
Oil tankers	7,937	18.77	305,248	37.39
Chemical tankers	1,290	3.27	8,334	1.02
Liquid gas tankers	1,120	2.84	19,594	2.40
Container ships	2,905	7.37	83,744	10.26
General cargo ships	16,668	42.29	96,754	11.85
Passenger ships	3,882	9.85	5,856	0.72
Total	39,415	100.00	816385	100.00

Table 2.5: World fleet 2002 [83]

Figure 2.2: MV CAROLINE OLDENDORFF

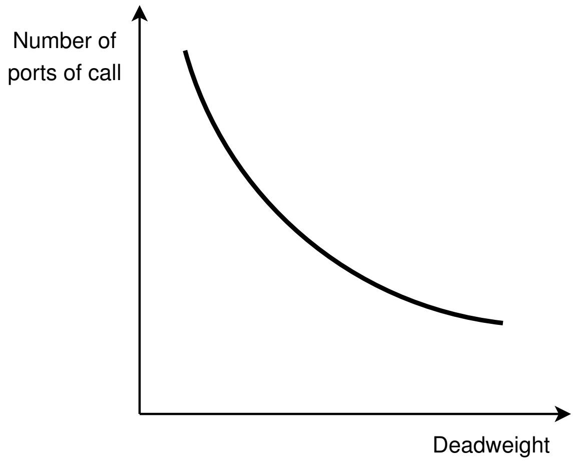

Figure 2.3: Number of ports of call versus size of ship

Bulk carrier is a ship used to carry dry bulk cargoes. Figure 2.1 shows MV LUISE OLDENDORFF, a Panamax class bulk carrier. She was built at Samsung Heavy Industries, South Korea, delivered in 1994. She is gearless, has a deadweight of 72,873 tdw and seven cargo holds with average volume of about 11,500 cbm. The vessel's construction is strengthened and capable to carry heavy cargoes. Her overall length is 224.95 m, breadth 32.24 m.

MV CAROLINE OLDENDORFF, a handy size bulk carrier of 22,159 is a tdw, see Figure 2.2. She is log-fitted, built in 1993 at Onomichi Shipyard, Japan. She is equipped with four cranes of each 30 t lifting capacity. Further principal dimensions: overall length is 157.50 m, breadth 25.00 m.

A ship has basically three main functionalities namely: (a) holding cargoes (b) moving cargoes from port to port (c) transferring from ship to shore and vice versa (optional). Deriving from the above, the following design aspects of utmost important: (a) size of cargo spaces (b) power of main engine, speed of ship and its fuel consumptions (c) cargo gear, such as a crane or self-unloading belt conveyor.

Speeds of Handymax bulk carriers vary between 10 and 19 knots. The speed of Handymax bulk carriers vary between 10 to 19 knots. Few operators prefer to have speedier ships in return for more potential carrying capacity (in ton miles annually).

According to its size, bulk carrier sector can be divided into three classes: Handy size, Panamax and Cape size. Handy size bulk carriers have a size of 10,000-50,000 dwt. Panamax bulk carriers have the maximum size for passing the Panama Canal, which is restricted to a width of 32.25 m. Their typical deadweight is approximately 60-80,000 dwt. Cape size is the largest

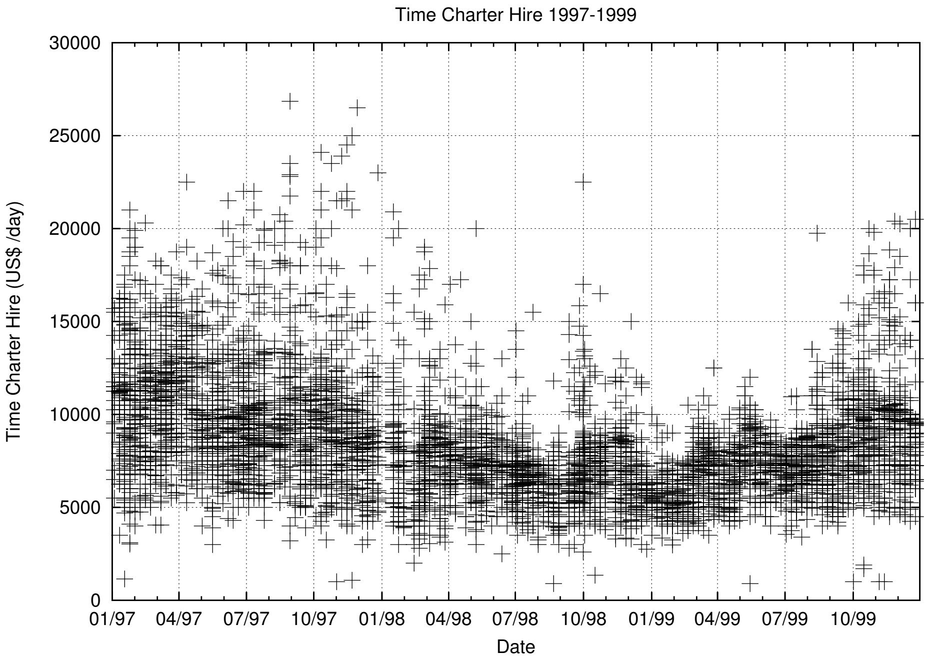

Figure 2.4: Development of T/C rates (1997-1999) [50, 51, 52]

ship's class. All ships beyond the Panamax class are categorized into this class, their deadweight is usually over 100,000 dwt.

2.2 Chartering and Sale & Purchase

Figure 2.4 shows the development of time charter fixtures 1997-1999. This section highlights the time charter fixtures for all bulk shipping segments, Handy size, Panamax and Cape size. From the chartering and operations viewpoints, the way the chartering negotiations, the operations are managed, there is basically no difference between all the above-mentioned segments. A separate detailed analysis for each segment is less relevant and goes beyond the scope of the research. Figures 2.5 and 2.6 show the sizes (deadweight) and speeds of vessels deployed in charter market.

Ships are employed until approximately they reach the age of 27 years, see Figure 2.7. Figure 2.8 shows the relation between the age of the vessels and their charter hire. Whilst the relations between the fuel consumptions of the main engine and time charter rate and ship's deadweight are shown in Figures 2.9 and 2.10.

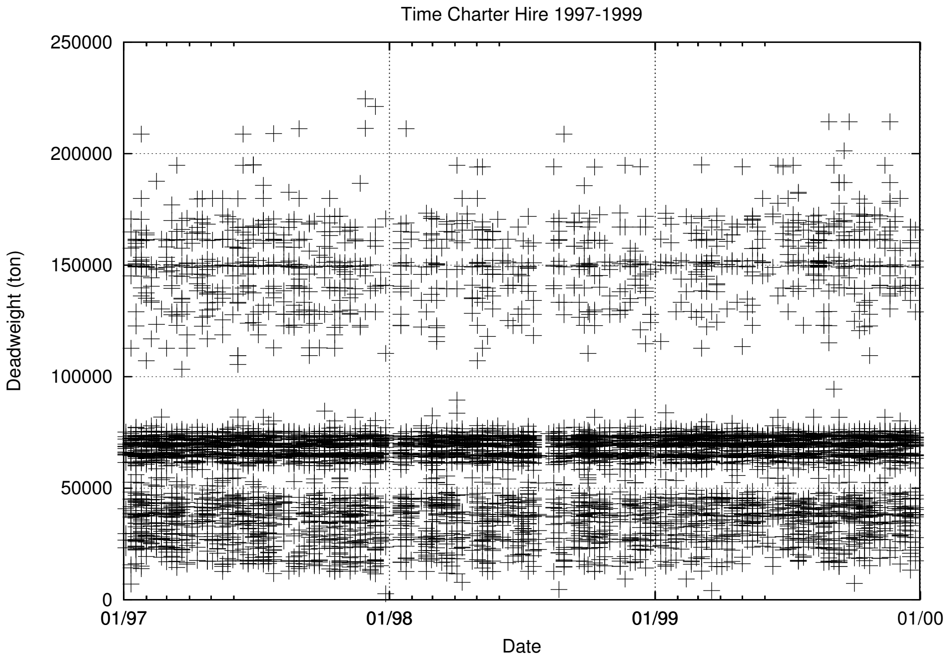

Figure 2.5: Deployed deadweight (1997-1999) [50, 51, 52]

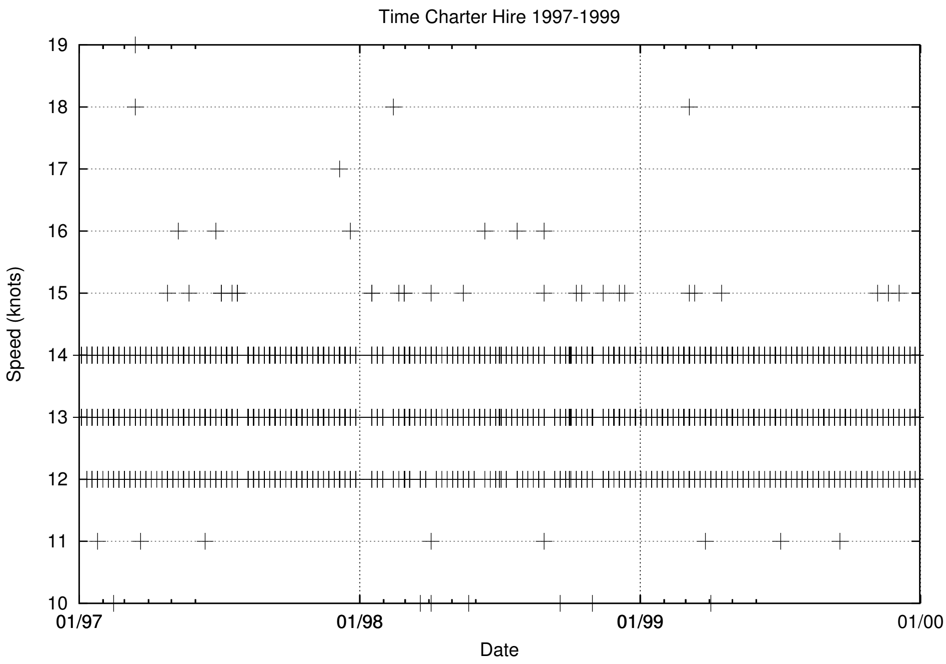

Figure 2.6: Deployed speed (1997-1999) [50, 51, 52]

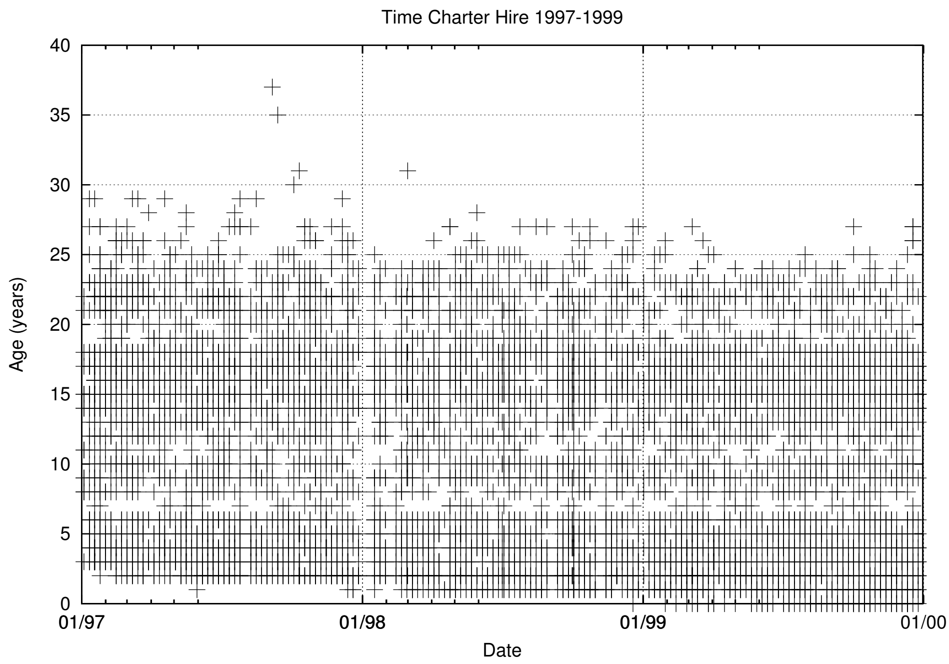

Figure 2.7: Age of ships deployed (1997-1999) [50, 51, 52]

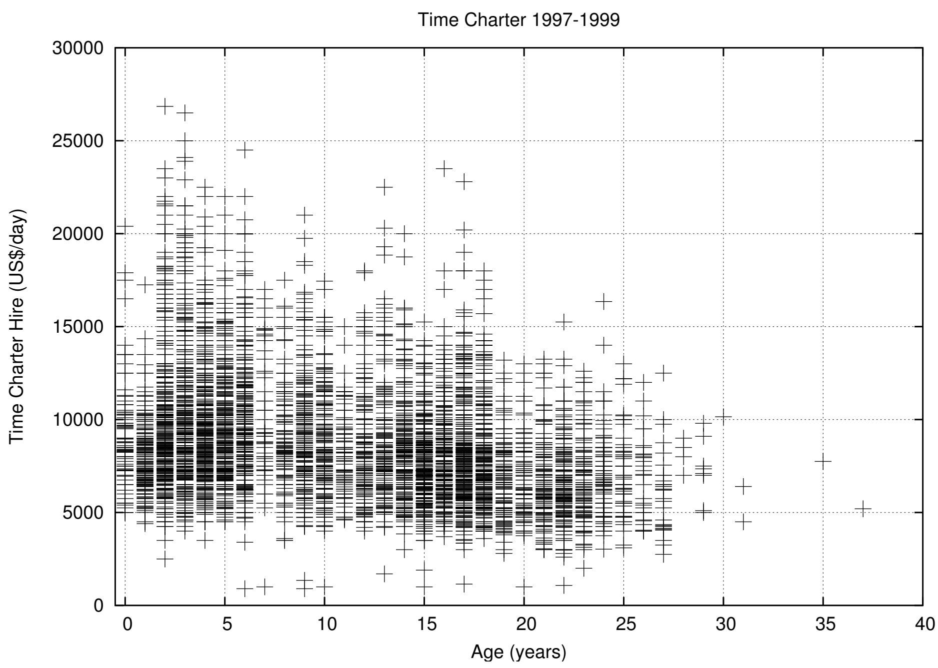

Figure 2.8: Age versus Time Charter rate [50, 51, 52]

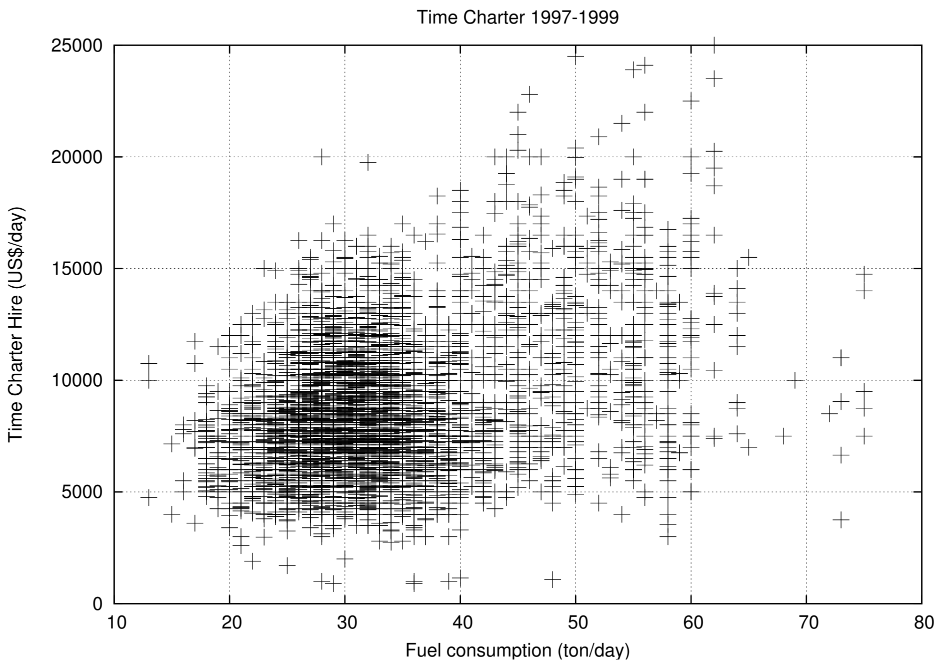

Figure 2.9: Main engine fuel consumption versus T/C rate [50, 51, 52]

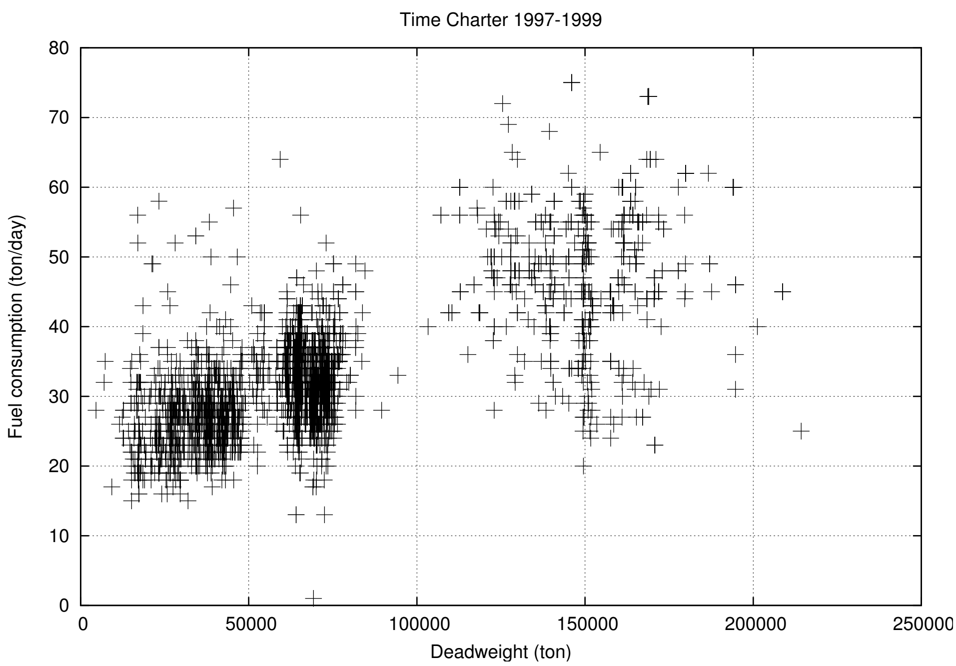

Figure 2.10: Deadweight versus ME fuel consumption [50, 51, 52]

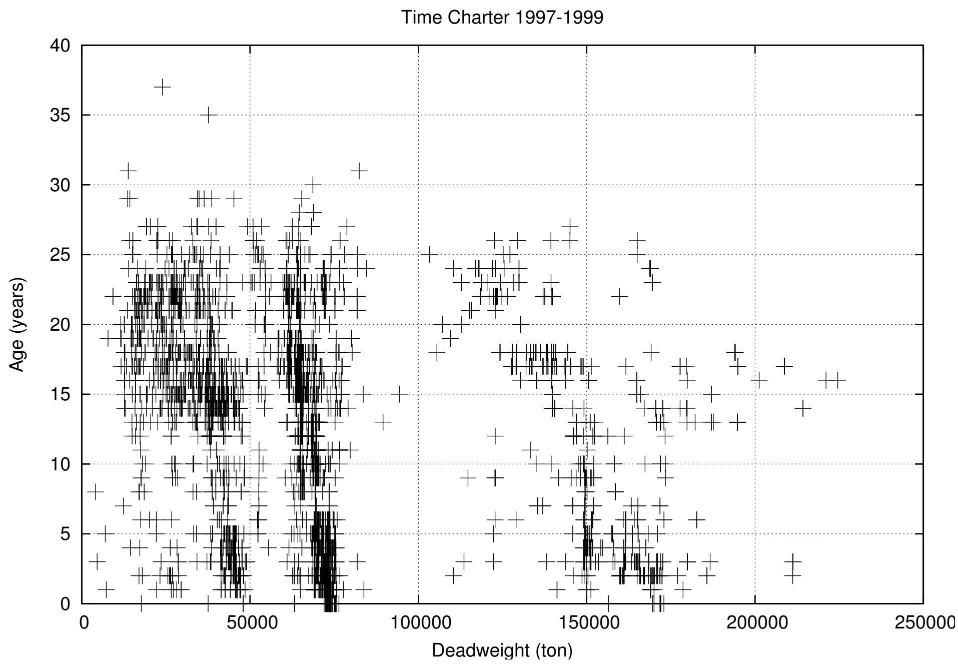

Figure 2.11: Deadweight versus age [50, 51, 52]

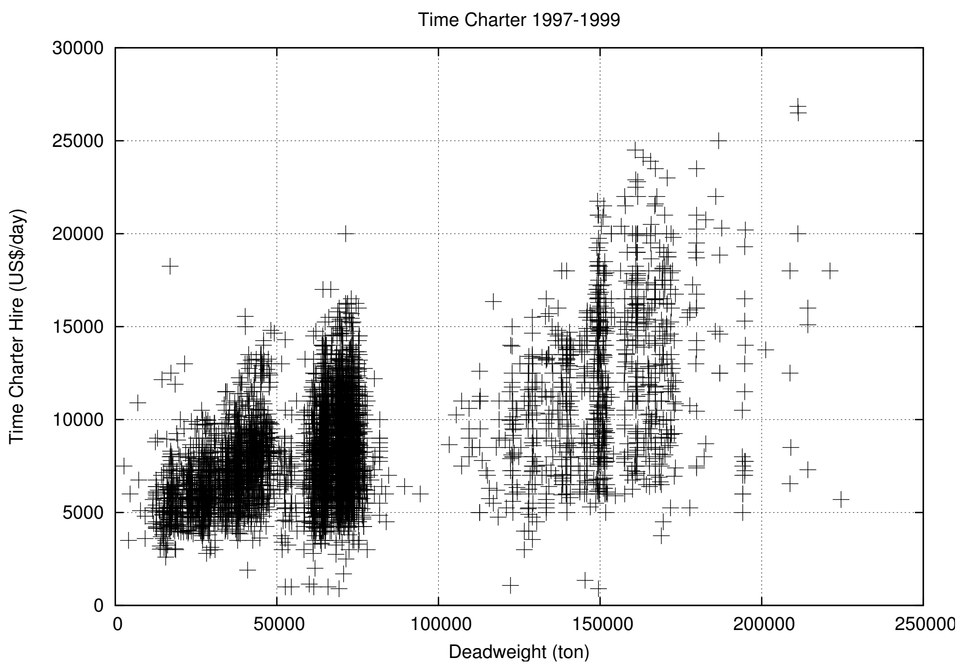

Figure 2.12: Deadweight versus T/C rate [50, 51, 52]

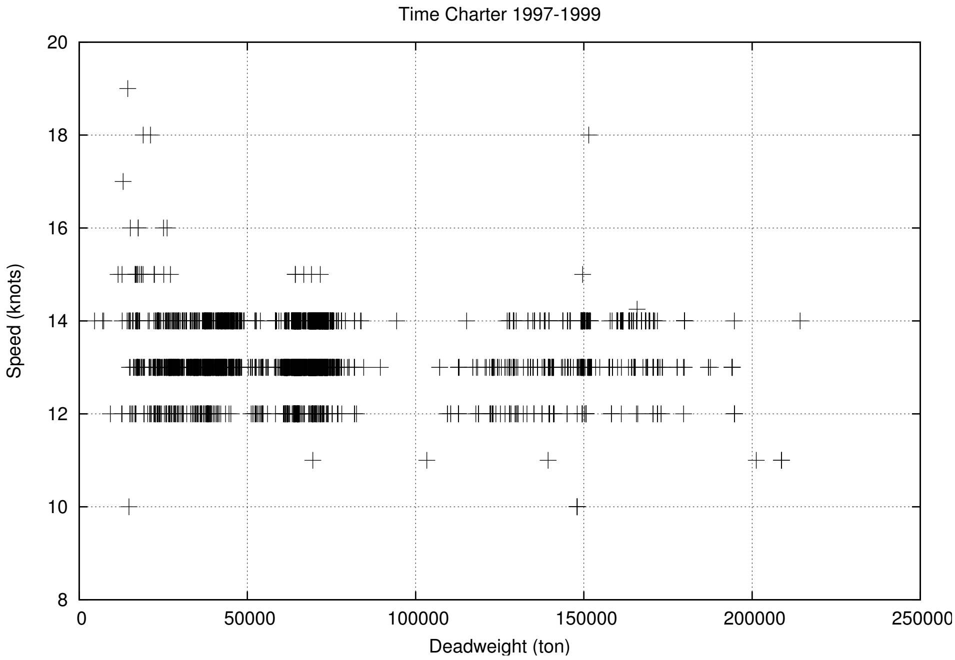

Figure 2.13: Deadweight versus speed [50, 51, 52]

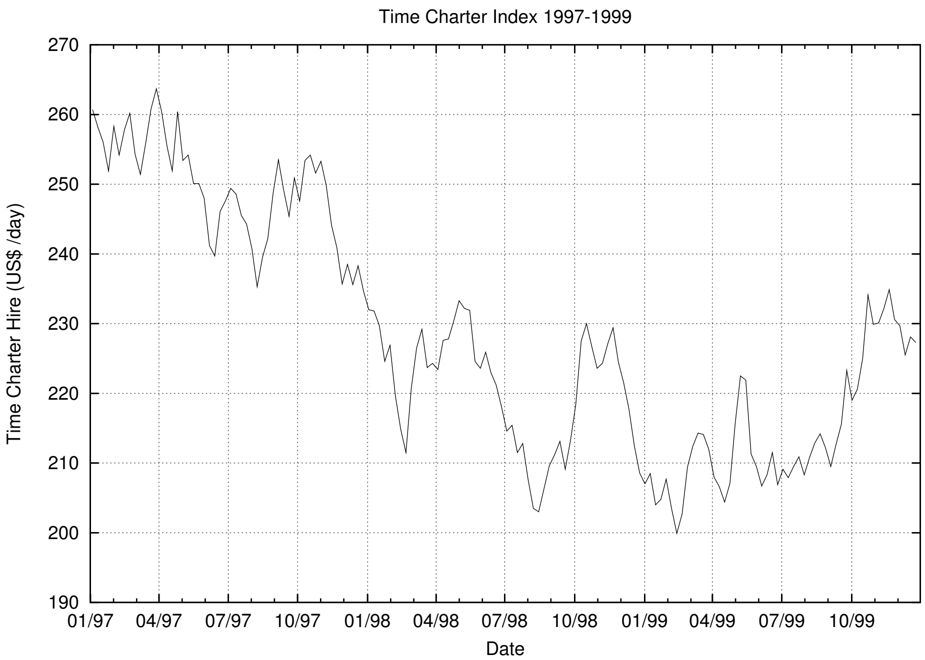

Figure 2.14: Time Charter Index [50, 51, 52]

2.2.1 Chartering

Chartering is a basic form in shipping. A ship is hired from a shipowner to a charterer either directly or through one or more brokers. A charter party is an agreement which states the details of the terms and conditions concerning the operations of the ship.

Two types of Charter Parties dominate the chartering market[4]: (a) Time Charter consisting of Trip Time and Period Time Charters and (b) Voyage Charter. In a Time Charter Party, a vessel is hired for a specified period of time for payment of a daily, monthly or annual fee. In its first variant, Trip Time Charter Party, the vessel is chartered on the basis of a time charter period of a specified voyage and for the carriage of a specified cargo. The shipowner earns a lump-sum per day for the period determined by the voyage. Whilst in its second variant, Period Time Charter Party, the ship earns a daily hire, paid monthly or semi monthly in advance. The shipowner retains possession and mans and operates the ship under instructions of the charterer who pays voyage costs, including bunkers.

In the Dry Voyage Charter Party, the ship earns freight per ton of cargo transported on terms, set out in the charter party, which specifies the precise nature and volume of cargo, the ports of loading and discharge and the lay-time and demurrage. All costs are paid by owners.

In order to conduct chartering, a party which helps smoothen the negotiation between shipowners and charterers is called a broker. There are three types of broker, (a) owners' broker (b) cargo broker (c) competitive broker [81]. An owners' broker acts in the best interest of the shipowners and is often a part of a shipping company. A cargo broker acts in the direct interest of the owner of the cargo ad is often a part of its organization. A competitive broker has no links with either the owner of the ship nor the owner of the cargo. He acts as a pure intermediary with the only objective of concluding a deal, a fixture and earns his 1.25% commission of the freight revenues.

Shipping costs

There are four cost categories distinguished in the running of ships. These are [73, 81]:

1. Capital costs, which cover interest and capital repayments and are determined by the way in which the ship has been financed.
2. Operating costs, which constitute the expenses involved in the day-to-day running of the ship such as including manning costs, stores and maintenance.

[4] Other types of charter parties, such as Bareboat Charter Party, are not elaborated in this research, as this type of Charter Party does not occur frequently.

No	Bad paying cargoes	Good paying cargoes
1	Petcoke	All forest products
2	Rice	Glass
3	Fertilizer	Rubber
4	Cement & clinkers	Hot briquette iron (RDI)
5	Scrap	

Table 2.6: Shipment values of few cargo examples[5]

3. Voyage costs, which comprise the variable costs associated with the actual sailing of the ship, such as bunker, port charges and canal dues.
4. Cargo handling costs, which are the costs for stowing, loading and discharging of the cargo.

The first two costs, namely capital and operating costs, do not depend on whether a sea voyage is made or not (i.e. voyage independent costs). In contrast to the former, voyage and cargo handling costs are voyage dependent costs, i.e. the costs arise only when a voyage is made.

Handy size bulk carriers contain numerous and non-standardized niches. Market reports give an overview on the tendencies in the charter market. Relevant events, such as oil prices, or some political events somewhere are well considered. When it comes to a real negotiations, the market reports are far from adequate. An aspect which plays an important role in the assessments of shipping players (consultants, brokers and charterers) is that the assessment is heavily affected by qualitative factors.

Shipment values

Cargoes have a range of properties, beside their inherent selling price. Few may require careful handling, other cargoes do less. Cargoes which require a good care (loading, discharging and during transport) and which are transported in small quantities are generally high paying cargoes. Their typical shipment size varies as well, see Table 2.6.

Back-haulage cargoes

When fixing a contract, a vessel can be delivered in any place in the world. It is not unusual that a vessel has to perform a carriage to remote places, meaning far away from cargo centers, i.e. ports or areas from which cargoes are easily to be obtained. Therefore anticipating the period after the redelivery of the vessel is important. At which level, a shipowner will be willing to charter out his ship, depends upon the market situation.

> *Back-haulage cargoes is important in a depressed market. In a rising market, it has to be short higher paying business to justify tieing the ship up but the strategy is to get more back-haul cargoes so we always look at this type of business.*[6]
>
> *Basically you look at your result on a round voyage basis. In a good market, the point is how to avoid areas where you potentially would have difficulties to find cargoes.*[7]

This shows that a ship's geographical position determines its charter hire value, besides the aspect of time. More precisely, the distance to the nearest cargo center could be decisive in determining the charter rate of a vessel.

Conducting value assessment tasks: a survey

Service is difficult to judge. In most markets the role of non-price variables play a more important role. Therefore a task of assessing a situation is not always easy, even for an experienced market researcher, like Lorentzen & Stemoco :

> *The market of modern Handymaxes is getting increasingly difficult - even last week's rate of very low USD 10's for short period unfixed and even with owners' rats down to mid/high USD 9's failed to attract any interest.* [8]

The following survey was conducted to illustrate the difficulty of a value assessment task. A list of ships taken from the inquiries received by the chartering department is distributed to two handy size chartering desks of Egon Oldendorff[9], i.e. the Pacific and Atlantic, see Table 2.7. For survey purposes, the dates and ports of delivery of the ships are altered. All ships are to be delivered in Japan and laycan dates are assumed to be prompt.

Both, Pacific and Atlantic desks, were asked to estimate the charter hire values in two situations, all with a focus or involvement of the Pacific market : (a) Delivery: Japan, redelivery: Madagascar with a voyage length of about 45 days (b) Delivery: Japan, redelivery Singapore with a voyage length of about 25 days. The assessment of the Pacific desk is shown in Table 2.8 [10].

For all ships, the first situation (del/redel Japan/Madagascar) delivers higher charter rates than the second one (del/redel Japan/ Singapore), all

[6] Viveka Mansukhani, E-Mail and interview, 31 May 2000

[7] Patrick Hutchins, interview, 9 May 2000.

[8] Lorentzen & Stemoco - Weekly Market Outlook, 22 June 2000; USD 10's means US$ 10,000

[9] Shipping company located in Lübec, see also seb-section 2.5.

[10] Del: delivery, redel: redelivery

1. MV KALKAYAN	2. MV HANDY ISLANDER	3. MV FOREST CHAMPION
TUR FLAG/ 1977	LGR MAN 1985	LGR PAN 1993
27306 MTONS ON 10.594 MTRS	26587 DWT ON 9.54 M	26584 DWT ON 9.54 M
GRT/NRT 16050/8665	G 33917 CBM	G 33917 CBM
LOA/BEAM 177.3/22.84	5 HH, 4 X 30 CR	5 HH, 4 X 30 CR
GR 1116276/BALE 1060742	12.5 / 19 + 1.5 MDO	14/22+2 MDO
4X15T	ALL ABT	ALL ABT
LR 100A1 - PANDI MUTUAL	OPEN JAPAN	OPEN JAPAN
11.5 KNOTS ON 24MTONS IFO 180CST		
+ 2MTONS AT PORT		
OPEN JAPAN; PREF DIR MED/CONT		
4. MV SEA BAISEN	5. MV ZI YUN SHAN	6. MV HUA NAN
LGR PAN 1998	PRC FLAG 1978 BLT	PRC FLG BLT 1977
26637 DWT ON 9.51 M	DWT 33633 MT ON 10.94 M SSW	DWT 40542 ON 12.07 M SSW
G 36782	G/B 41524/39142 CBM	LOA/BEAM 183.7M/27.6M
5 HH - 4X 30 CR	5X15T SWL	5HX5H 16T/5 DRK
14/23+2	5HX5H	GRAIN 47717 CBM
ALL ABT	OPEN JAPAN, AA	OPEN JAPAN, AA
OPEN JAPAN		

7. MV FU AN CHENG
PAN FLG MPP 94 BLT
22765 MT ON 10 M SSW
LOA/BEAM 173.6/25.6M
GRAIN 33433 CNM
4HX7H 2X25T+2X20T CRN
SPEED ABT 15 KN ON
30 MT IFO+ 3MT MDO
OPEN JAPAN, AA

Table 2.7: List of ships: value assessment survey

Ship	Del/redel Japan/ Madagascar	Del/redel Japan/ Singapore
1. MV KALKAVAN	6200	6000
2. MV HANDY ISLANDER	6400	6200
3. MV FOREST CHAMPION	6900	6700
4. MV SEA BAISEN	6900	6700
5. MV ZI YUN SHAN	6800	7000
6. MV HUA NAN	7500	7500
7. MV FUA AN CHENG	5900	5500

Table 2.8: Estimation survey by Pacific desk

are without ballast bonus. In Madagascar area, they believe, they would face difficulty to find back-haulage cargoes. Therefore they would charge a higher rate for redelivery in such an area. Though MV ZI YUA SHAN is larger than MV SEA BAISEN, the time charter rate of MV ZI YUN SHAN is lower than the later due to its age. Qualitative aspects such as their perception on flags and reputation of the shipowners are not considered.

The Atlantic desk was represented by Sebastian Dohrendorff who has been working at EO for six months at the time when the survey was conducted. Two situations are considered: (a) Delivery: Hamburg, redelivery: Le Havre via: Norfolk with a voyage length of about 45 days (b) Delivery: Hamburg, redelivery Norfolk with a voyage length of about 25 days. A general remark he made is that redelivery of the previous voyage in Japan would make an unrealistically high charter hire or ballast bonus if the vessel is to be put in service in Atlantic. Assumption is made that those ships are to be redelivered in the vicinity of Hamburg in the previous voyage. His assessment is shown in Table 2.9.

Dohrendorff suggests that the ones of the Concept Carriers (CC)[11] must know better the estimated values of all unanswered spaces. All have filled out the questionnaire quickly, they do not need to use any calculator. It shows that the capability of estimating charter values involves reoccurrence. The above valuation assessment task does not involve intensive calculation processes. The one who has never been in touch with a similar case, would have a difficulty to assess the charter value. Recognizing similar situations apparently have contributed very much to conduct an assessment task intuitively and quickly.

Figures 2.15, 2.16 and 2.17 show the charter transactions of the Concept Carriers (CC) in 2000. The vessels are time chartered-in vessels by the Concept Carriers and chartered out, in this case, as period time charter

[11] a subsidiary of Egon Oldendorff, see 2.5.

Ship	Del/redel	Del/redel
	Japan/ Madagascar	Japan/ Singapore
1. MV KALKAVAN	n/a	5250
2. MV HANDY ISLANDER	7000	6500
3. MV FOREST CHAMPION	7500	7000
4. MV SEA BAISEN	7500	7000
5. MV ZI YUN SHAN	n/a	6000
6. MV HUA NAN	n/a	n/a
7. MV FUA AN CHENG	6000	6000

Table 2.9: Estimation survey by Pacific desk

	dwt	yrblt	period	rate	rate/dwt
dwt	1.00				
yrblt	0.54	1.00			
period	-0.26	-0.24	1.00		
rate	-0.11	-0.33	0.61	1.00	
rate/dwt	-0.85	-0.60	0.45	0.53	1.00

Table 2.10: Correlation of time charter fixtures of Concept Carriers

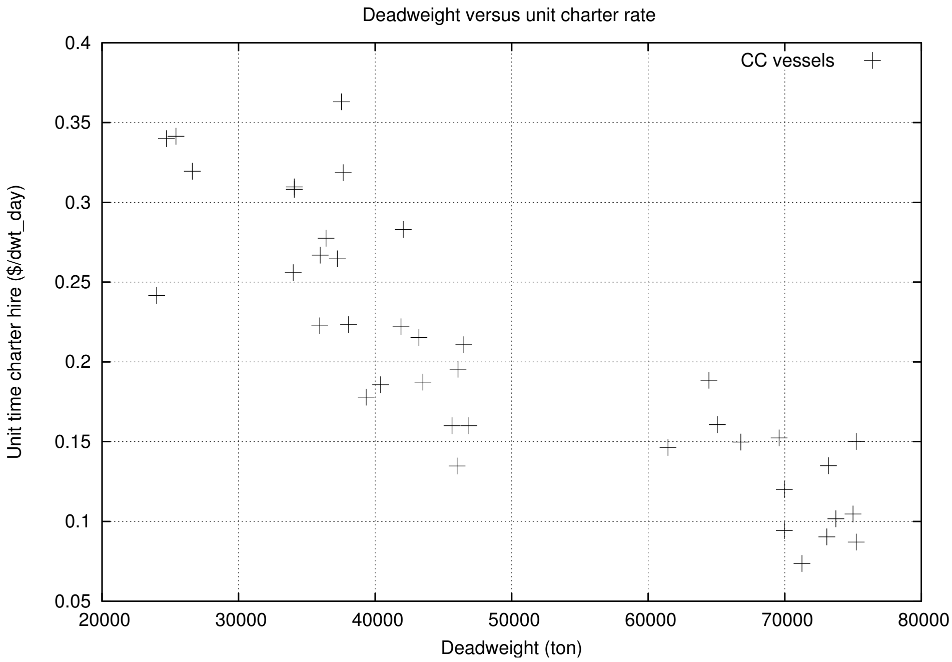

Figure 2.15: CC's fixtures: dwt vs unit T/C rate

parties too. There is a tendency, as expected that a smaller ship tends to have a higher unit charter hire. A glimpse at the correlation is shown by the Table 2.10. A regression function showing the relation between deadweight and its unit charter hire, y = -0.2017 ln (x) + 2.3804, will produce a very rough charter hire determination. In remaining paragraphs, only the graphical relations will be presented.

Figure 2.16 shows that there is no relationship between the period of charter and it charter hire value. As mentioned elsewhere in this chapter, the choice of charter party, either time or voyage charter, may be affected by the fuel price.

Figure 2.17 shows a slight relation between age of ship and it time charter (T/C) rate meaning that age does not play a dominating role in determining the charter hire.

2.2.2 Sale & Purchase

The market values of the ship are estimated to decrease $ 500,000,- till $ 1,100,000 annually, see Figure 2.21. Some still believe that the Greeks are well-known for their outstanding knowledge on the movements of ships' prices. The shipping community keeps watching closely when the Greeks

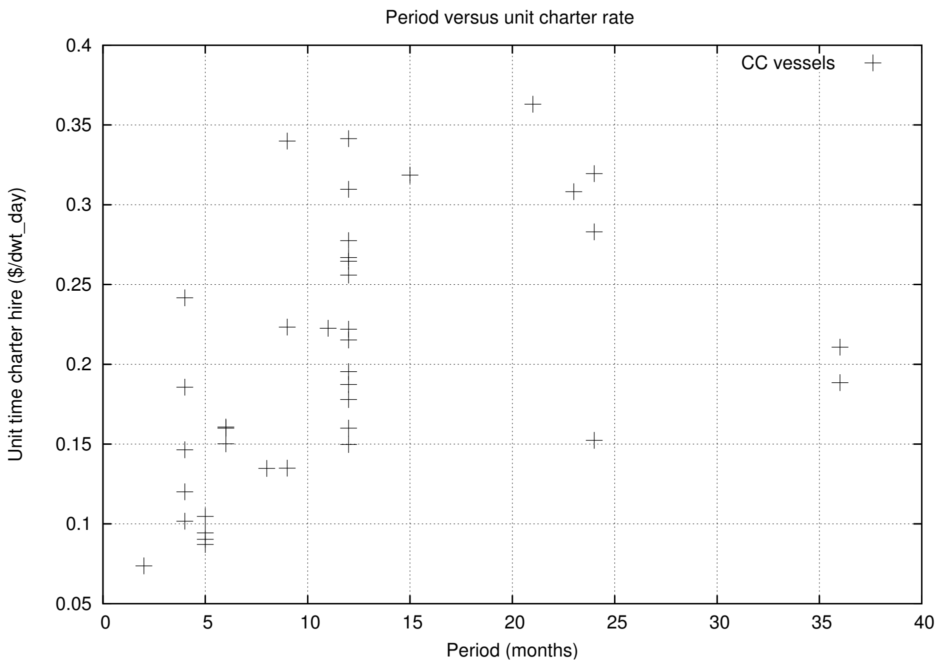

Figure 2.16: CC's fixtures: period vs unit T/C rate

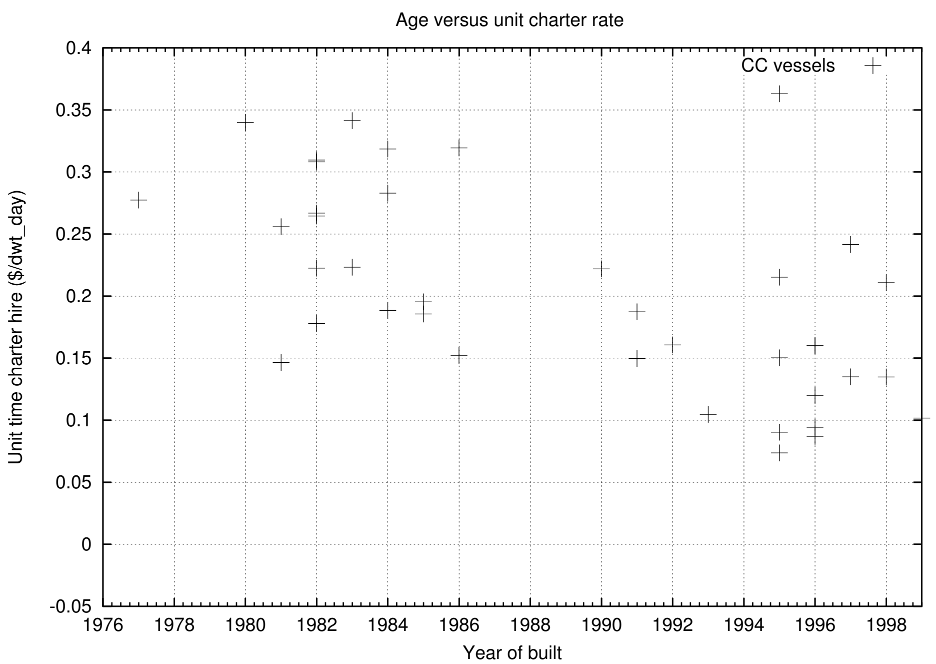

Figure 2.17: CC's fixtures: age vs unit T/C rate

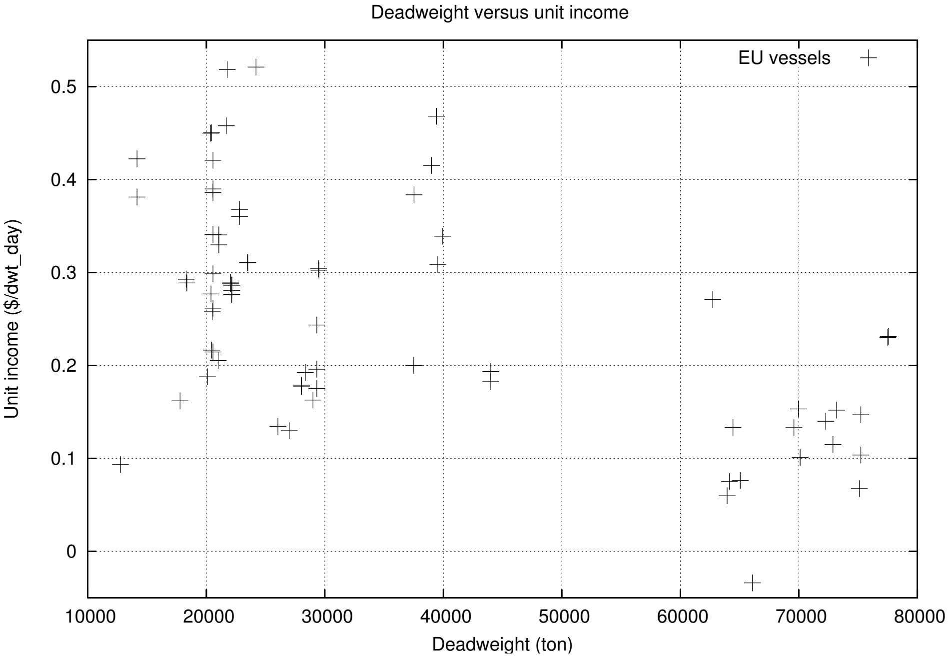

Figure 2.18: EO's fixtures: deadweight vs unit income

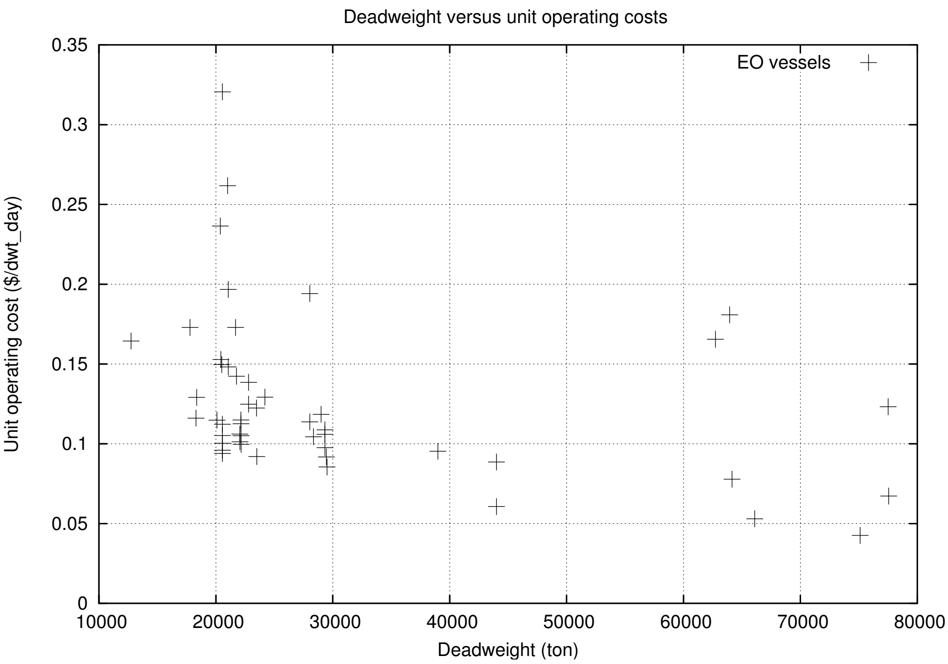

Figure 2.19: EO's fixtures: deadweight vs unit operating costs

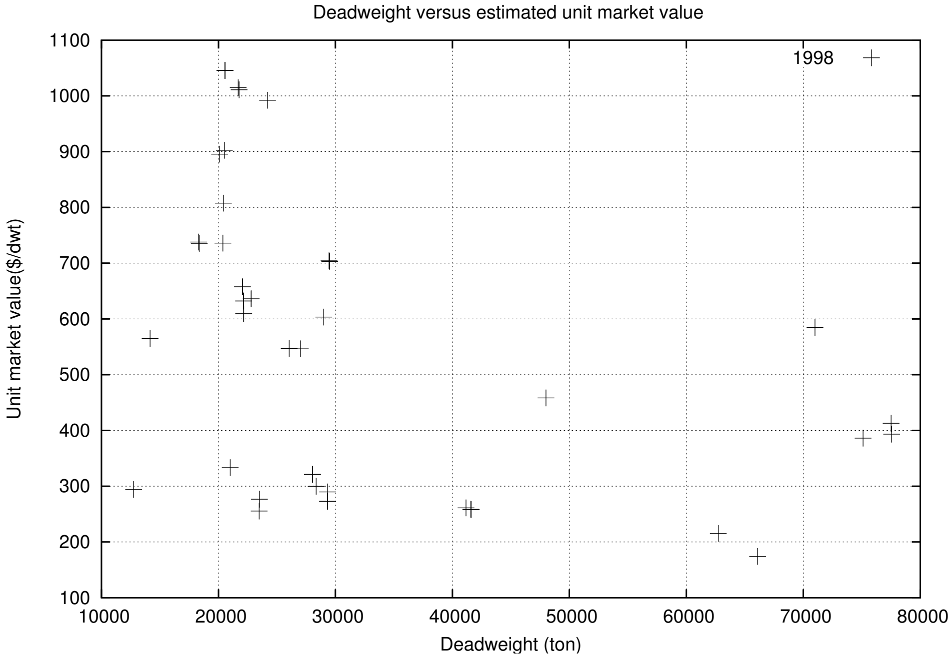

Figure 2.20: EO's fixtures: deadweight vs unit market values

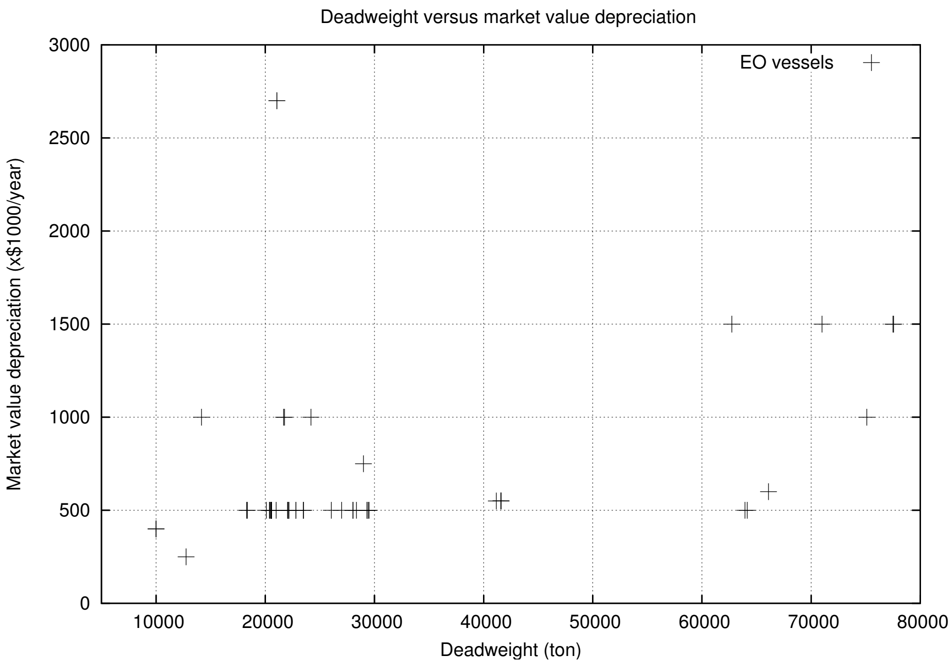

Figure 2.21: EO's fixtures: deadweight vs market value depreciation

start selling or buying tonnage in a huge scale [12]. There is some rule of thumb for estimating a ship's price, e.g.:

> *The value of a Panamax bulk carrier drops about US$ 750,000 annually, meanwhile a Handy size Bulker US$ 500,000. And a 15 year old vessel is valued about $\frac{1}{3}$ of current new-building price.*

It is difficult to assess a ship's value well. An experienced practitioner may still need an independent opinion, e.g. from a ship broker. Valuation services are provided by several shipping research companies, such as Clarckson. An internet-based valuation services are also available today[13]. Important features as input are the type, age and size of vessel. For conducting such a valuation task, they ask a fee of approximately $ 750. An assessment for an identical sister ship needs a lower fee (negotiable).

An assessment is usually based on the main particulars of the vessel and few other information such as age and the ship management. An assessment sheet may start with the following wordings:

> *We have neither inspected the vessels nor their records - however under the assumption that the ships are reasonably kept and there is a willing seller and willing buyer ...*[14] [15]

It implies that more details are needed to obtain more accurate assessment[16].

Trade-off in freight rate might take place. For example in grain seasons in South America, EO is willing to discount freight rate to South America, for the sake of positioning the vessel in that region[17].

There are a lot of market niches in the handy bulk shipping. There are many ships with specific properties. It covers properties such as the suitability for log carriage or for container carriage, gear type and capacity. It is difficult to estimate or assess charter rates reasonably. [18]

Pistorius believes that Panamax on the other hand shows a cyclical pattern. It has never reached a $12,000 level[19]. An important main question concerning running those vessels is how to route this type of vessel. Two

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[12] Peer Gröpper, interview, 22 May 2003

[13] For example: www.bnp-paris.com and http://www.shipvalue.net/default.asp, downloaded 29 September 2003

[14] Fax from Allship to EO, 2 June 2000

[15] This implies, that if a site inspection were made, the values stated in the sheet might differ.

[16] From methodological point of view, see also Chapter 4, sub-section 4.4.1 and Table 4.5

[17] Patrick Hutchins, interview

[18] Mark Pistorius, interview on 4 July 2000

[19] Compare with Wijnolst's findings in [79]

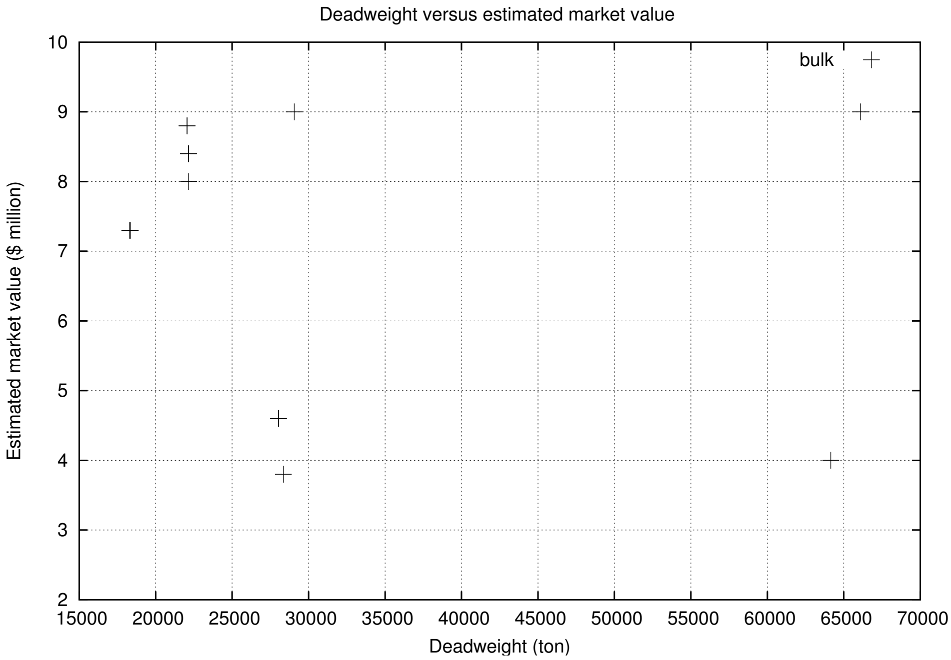

Figure 2.22: Allship's estimation: deadweight vs price

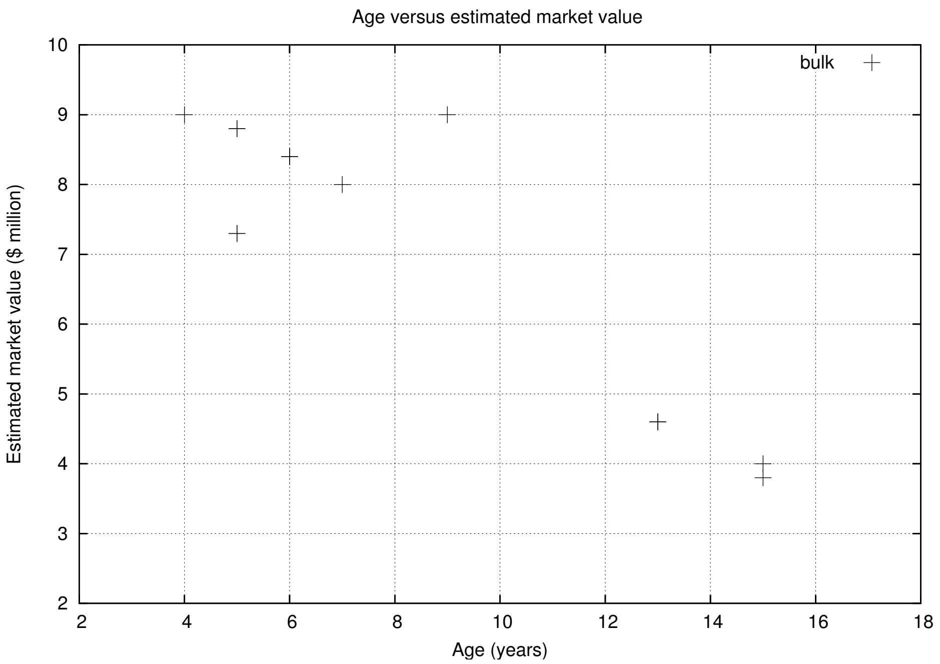

Figure 2.23: Allship's estimation: age vs price

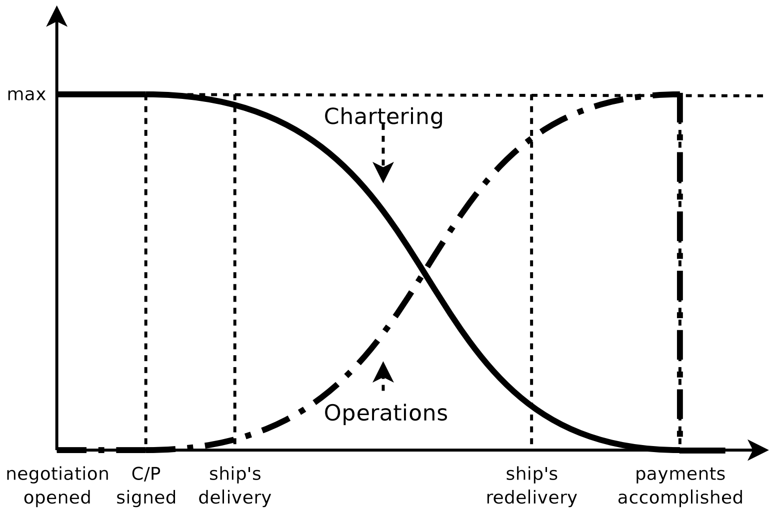

Figure 2.24: Role of chartering and operations departments

alternatives are available either to stay at a port waiting for the right time for fixing cargo at a reasonable rate or to position to more promising areas [20].

Two VLCC[21] tankers "MV BERGER FOREST" and "MV BERGER FISTER" were purchased in 1991 for US$ 35 million each. In May 2000 the vessel was sold for US$ 8 million each to Egon Oldendorff. Within 9 years its value dropped by US$ 27 million. The estimated scrapped value of the vessels are US$ 6 million each. These ships have actually been tied since March, subject to inspection. Since then the charter rate of VLCC rose from US$ 25,000 to US$ 35,000. End of May the rate has risen even further up to US$ 65,000 per day. EO gained a lot of profit from this deal by chartering out the vessel immediately. And Clarckson praised it, and concluded the article with "... shipping is all about timing"[13] .

2.3 Operations

2.3.1 Running

The chartering department represents the commercial face of the company. The initiative and the main role in negotiation for ship's employment are performed by this department, see Figure 2.24. The duo between chartering and operations department seems indispensable in running the shipping

[20] Mark Pistorius, interview, 4 July 2000

[21] Very Large Crude Carrier

business. As a chartering negotiation is opened, the role of chartering department is very dominating. After signing the Charter Party, as an agreement of the employment of the ship, its role begins to decrease, and the role of the operations department comes into the foreground.

Port disbursements and claims of a particular voyage or charter party may take months even years to complete. Before all these payments are settled, the operations department takes over 'the command'.

Handy size bulk carriers spend 25-30% of their time in ballast voyages, Panamax 35-45%. It is difficult to mention a sailing condition ballast voyage or not, since a vessel is very often only partially filled.[22]

Bunker prices of neighboring areas tend to be within a close range, see Table 2.11. Bunker price is closely related to the preference for type of Charter Party. If the bunker prices increase, the shipowners tend to let their ship fixed in a Time Charter Party, releasing the exposure to the volatility of bunker price, see Table 2.12.

> *Prices continue to escalate and any large increase will reflect Owners' concerns as to how to approach voyage business in the days ahead. Of course Time Charterers will also have a say in the matter and reflect the 'status quo in their rates.* [25]

2.3.2 Ship's performance

General performance

What determines the economic performance of a ship? The following report illustrates the situation:

> *Handysize - Pacific. This sector continues to move sideways, however, there has been a slight dip in rates for the* smaller *vessels, but modern handymaxes continue to attract good rates. The market is currently fairly stable but a summer lull seems quite likely.*[26]

It raises a suspect, if a ship's design characteristics determine very much the commercial success of a ship. The design characteristics do not prove to be the decisive factors for a ship's commercial success [79].

Age of vessel does not reflect automatically her performance. It matters a lot whether the vessel is owned or chartered-in. Chartered-in vessels

[22] Mark Pistorius, interview, 4 July 2000. Patrick Hutchins estimates, on the other hand, that Handy size bulk carriers spend 5-10% of their operational time in ballast. Meanwhile Panamax vessels approximately 50%

[25] Robert Matthews, J.E. Hyde London Freight Market Comment dated Friday 1 June 2000

[26] Lorentzen & Stemoco, Weekly Market Outlook , 03/08/00

North Europe	**IFO380**	**IFO 180**	**MDO**
Rotterdam	143	148	217
Antwerp	142	148	218
Hamburg	155	165	227
Le Havre	148	158	255
Gr. Belt	149	155	230
St. Petersburg	137	143	231
South Europe	**IFO380**	**IFO 180**	**MDO**
Gibraltar	162	168	259
Genoa	160	167	253
Piraeus	155	164	240
Istanbul	164	169	249
North America	**IFO380**	**IFO 180**	**MDO**
New York	145	151	274
Philadelphia	146	152	275
New Orleans	141	144	240
Houston	140	144	239
Los Angeles	159	165	253
Vancouver	199	204	285
South/Center America	**IFO380**	**IFO 180**	**MDO**
Panama	164	175	282
St. Eustatius	166	171	298
Venezuela	144	149	272
Buenos Aires	NA	185	268
Santos	158	162	292
Mid /East Africa	**IFO380**	**IFO 180**	**MDO**
Suez	160	164	280
Jeddah	NA	156	255
Fujairah	160	164	248
Kuwait	159	165	247
Durban	NA	167	254
Las Palmas	166	172	253
East Asia	**IFO380**	**IFO 180**	**MDO**
Singapore	165	169	232
Hong Kong	182	184	236
Tokyo	192	196	274
Korea	178	183	264
Melbourne	200	206	283

Table 2.11: Bunker price, 22-28 June 2000[23]

Rotterdam	IFO380	IFO 180	MDO	MGO
24 May 2000	132	136	208	220
31 May 2000	142	149	213	225

Table 2.12: Actual bunker price in Rotterdam[24]

breakdown more frequently than owned vessels. Based on each vessel's performance, she is usually dedicated for a particular trade. The history of vessel play also an important role in terms of their past cargoes and records. [27]

MV IRENE OLDENDORFF is a bulk carrier built in 1991 at DMS Shipyard, 66785 dwt, gearless. She is an old Panamax vessel (9 years old in 2000) and a bad-maintained ship. Her value is low, therefore this vessel is dedicated to carry low value cargoes, such as cement, clinkers or coal. Nevertheless good paying cargoes, such as grain, will always be another target, when available. To carry this type of cargo, the holds must be cleanly swept, prior to loading[28].

Bad performing chartered vessels cause delays and in turn losses and eventually claims. A current claim filed to a shipowner in London, amounting $120,000.- is held by our company. This is a difficult area and gray area in terms of interpretations, which needs energy and time to get it paid by the owners.

> *There are only two types of vessels: badly and well-maintained vessels. Every single ship has her own market niche. Second hand vessels or older vessels perform better in economic terms due to her lower fixed costs.*[29]

Performance at port

In handy size sector, charterers play a very important role for achieving a reasonable ship performance at ports of call. An owner's protecting agent is usually appointed to deal with charterer's agent in order to achieve the above goal. Saving is not that much at port and agency expenses, but more on time-related costs, namely fixed costs (capital costs, fixed operating costs) [30].

Time is an important factor which determines the profitability of a ship operation. It is not easy to estimate port time. Port congestion, cargo han-

[27]Mark Pistorius, interview, 4 July 2000; Gunnar Eisenecker & Jan-Henning Asmussen, interview

[28]Mark Pistorius, interview, 4 July 2000.

[29]Mark Pistorius, interview, 4 July 2000.

[30]Mark Pistorius, interview, 4 July 2000

dling rate, weather, labor, to name a few, play an important role. Published information can be helpful but it is far from adequate. Shipowners rely very much on information provided by their local agent, since they have local knowledge of the conditions [31].

Tariffs at few ports are much more expensive. At these ports the ship operators watch and guide the operations of their ship very carefully, since they will pay in cash for any delay. Meanwhile at other cheaper ports, operation staffs are 'allowed' to be less careful. Most costs are actually caused by the time-related fixed costs. Saving on unnecessary extra due at expensive ports can be substantial:

> *"Japanese ports are very strict and very expensive. Laycan is a very important cost factor. Wharfage costs for a Panamax are about \$ 10,000 per day. For the whole fleet, 240 voyages are made annually. Our operational policy: if we have to pay additionally \$ 2000 for every voyage due to unpunctual laycan, it means 240 x \$2,000.- is approximately \$ 0.5 million. It is a scale effect, that everyone of us must realize",* [32]

Every country and every port has its own typicality. A shipment to a particular port may experience things which make ship operators, shippers and consignees care more about their operations in future.

> *Due to some recent cases we would like to remind Members of the exacting standards of the Australian Quarantine and Inspection Service (AQIS). Members should remind their crews that "Grain Clean" now takes on a different meaning when trading to Australia.*
>
> *The Club is presently involved in a case where* just 13 grain seeds *were found in 19,000 mt of fertilizer and can confirm the strong stance being taken by AQIS as it is likely this cargo will be totally rejected.*
>
> *As a consequence of this the cleaning standards for ships loading Australia-bound fertilizers must now be* extreme *and meticulous and require the use of mechanical lifts, "cherry pickers" and water blasters. Each frame, beam and stiffener including those at the upper extremities of the holds* MUST *be cleaned at close quarters to ensure that not one grain of organic material remains.* [33]

[31] Mark Pistorius, e-mail, 14 August 2000.

[32] Mark Pistorius, interview, 4 July 2000.

[33] Loss Prevention Bulletin - no. 147, 07/00 - New Standards of Hold Cleanliness + Receivers and Shippers Checklist - Australia

There was an issue in the year 2000, concerning the Asian gypsy moth. Gypsy moth caterpillars decimate forests. The caterpillars feed on the leaves of trees and shrubs. Masters/ owners of vessels which have called at Russian far-east ports, China (north of latitude 30 degrees) Korea and Japan (Hokkaido) between September and October should arrange for a thorough inspection of their vessel to ensure that there are no egg masses of larvae [34]. In relation to an on-going chartering negotiation a confirmation of applying the above the so-called Gypsy Moth Clause can be necessary, as illustrated by the following:

> OWNS CONFIRM VSL HAS NOT CALLED CIS PACIFIC PORT(S)
>
> BETWEEN 40 AND 60 DEGREES NORTH
>
> BETWEEN JULY AND SEPTEMBER IN LAST TWO YEARS
>
> GYPSY MOTH CLSE APPLY
>
> 35

Weather is an important factor which determines the operational performance of a ship. At port cargo handling which depends heavily on shore gangs will depend very much on weather situations. Those are an important source of delay and cargo damage. In Vancouver, it rains 200 days annually. A cautious planning for cargoes such as pulp or paper or even timber, is of utmost important.[36]

For self-unloading bulk carriers equipped with discharging gears on board, the consequences of harsh weather situations can be reduced. Those vessels discharge cargo using scrapper or belt conveyor or pneumatic discharging equipments; they can discharge cargoes such iron ore or grain well, in almost any weather situations without shore gangs employed.

In spite of the company's high dependence on its agent, it is not always wise to rely too much upon it. By calling a particular port, a ship operator must be aware of fraudulent practices, which appear in the bills showing expenses for few services, for example:

> *In one case a Member received an invoice for garbage removal in the Port Said. The invoice had apparently been signed by the ship's master and stamped with the ship's stamp. On further investigation the document was found to be fraudulent. The master's signature and the ship's stamp had been scanned from an official document.*
>
> *Two weeks later the same Member received another fraudulent invoice for a different ship.*

[34] An internal company circular, Section 6 "Asian Gypsy Moth", page 33-34.

[35] A draft Charter Party clause of MV BALTIC MERMAID; Markus Eller, e-mail 24 March 2000.

[36] Mark Pistorius, interview on 4 July 2000

> *In an earlier case a more substantial sum was demanded from a tanker operator for clean up costs following an oil spill which had not occurred*[37]

Operation evaluation

A brief evaluation of 22 voyages, the estimated values when fixing the charter parties and the actual values after the operations are entirely completed are compared. The focus is paid to the predictability in terms of time (port and sailing time) or money (income and result). Those are the main concerns for all parties (chartering, operations and technical departments) involved in a charter party agreed.

Port days are in general not easy to predict, in contrast to it, sailing days are in general more predictable. Figure 2.25. Panamax vessels tend to have longer voyages than the smaller Handy size bulk carriers. The smaller vessels have more ports of choice to call, see Figure 2.26. Handy size bulk carriers call more various types and sizes of ports. Their performances concerning cargo handling speed, claims, waiting time and tariff vary considerably. The types of cargoes are less uniform, involvement of 'new' ports agents appears to be more frequent than in the case of Panamax vessels. It mounts in the form of low predictability of port time. Handy size vessels' port expenses are therefore less predictable than those of the Panamax vessels, see Figure 2.27.

The difficulty to estimate the length of voyage is evident. Years of built of vessels do not affect very much on the sailing time predictability very much, see Figure 2.28. But the Handy size vessels' sailing time predictability is better than that of Panamax vessels, Figure 2.29. There is no guarantee that younger vessels produce a higher result (gross profit per voyage), Figure 2.31. Voyage lengths of Panamax vessels are frequently longer than estimated. The higher contribution of ballast voyages plays an important role here, since the duration of ballast voyage is difficult to predict, see Figure 2.34.

Figures 2.32 and 2.33 show that the actual result is less predictable than the time charter equivalent. These confirm the low predictability of the voyage duration and the need for having a capability to better estimate the performance of ship at port, see also sub-section 2.3.3.

[37] Joern Jentzsch, e-mail dated 4 July 2000 and Loss Prevention Bulletin, 146 - 06/00. A member means a shipping company which hold a membership of the association issuing the above-mentioned bulletin.

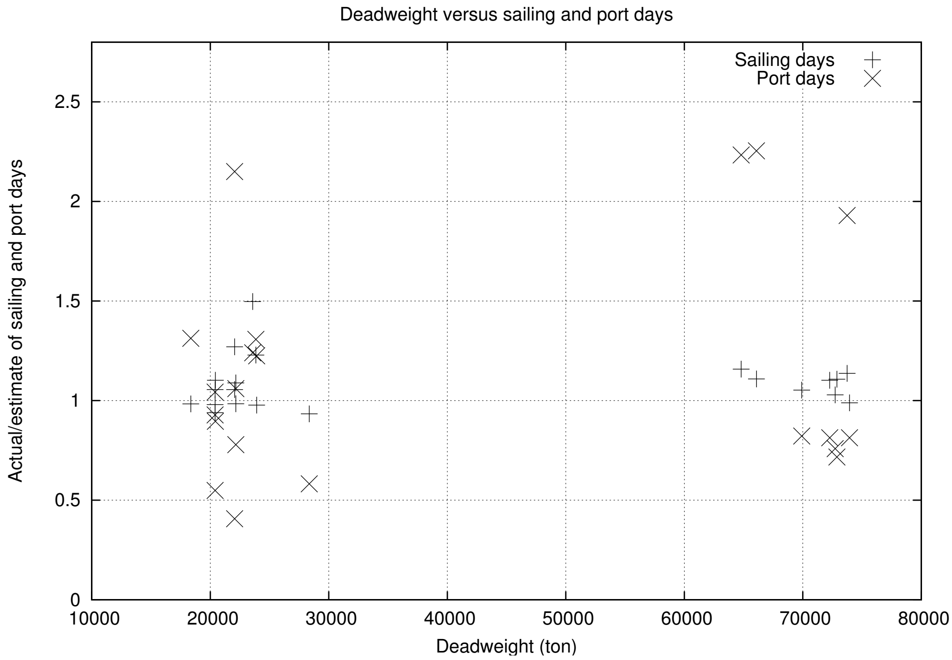

Figure 2.25: Deadweight versus sailing and port days

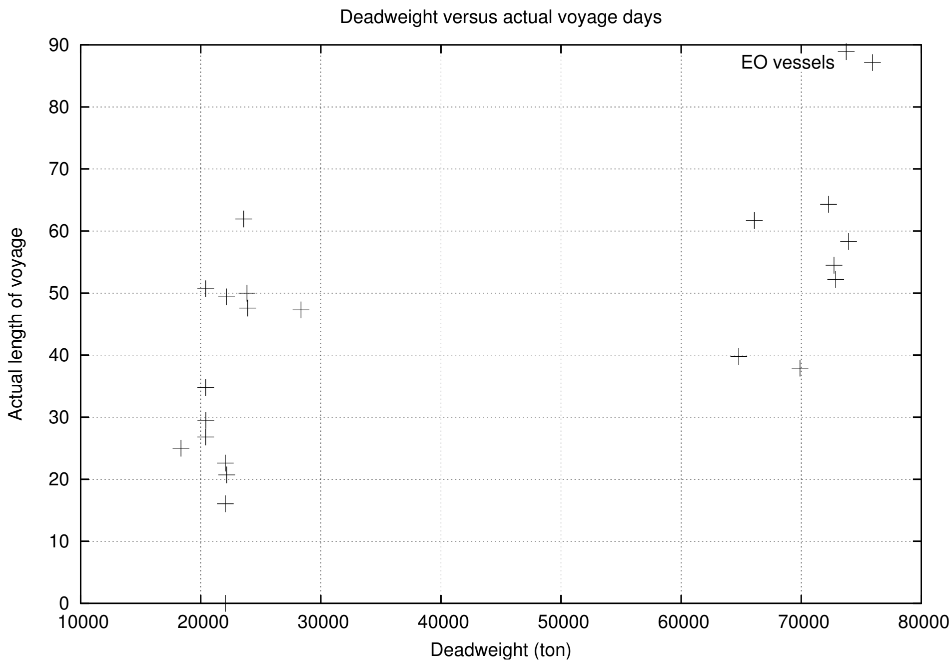

Figure 2.26: Deadweight versus actual length of voyage

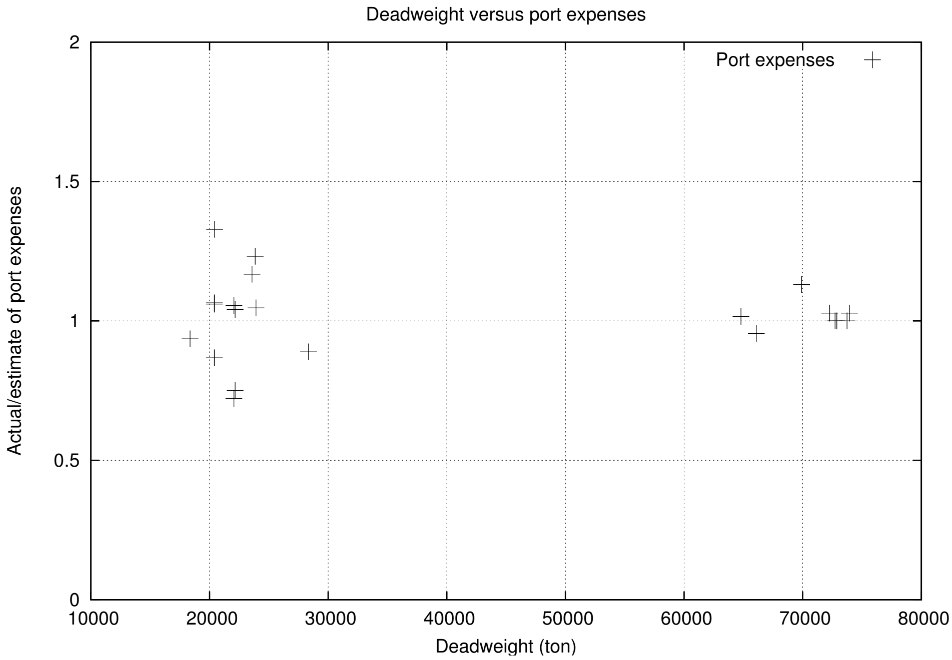

Figure 2.27: Deadweight versus actual/estimate of port expenses

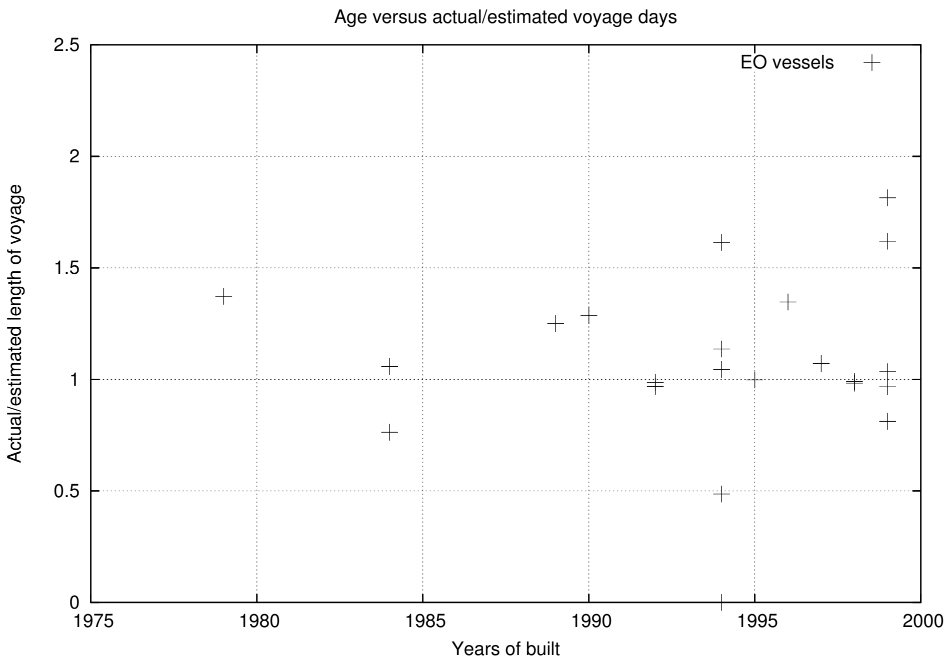

Figure 2.28: Age versus actual/estimate voyage length

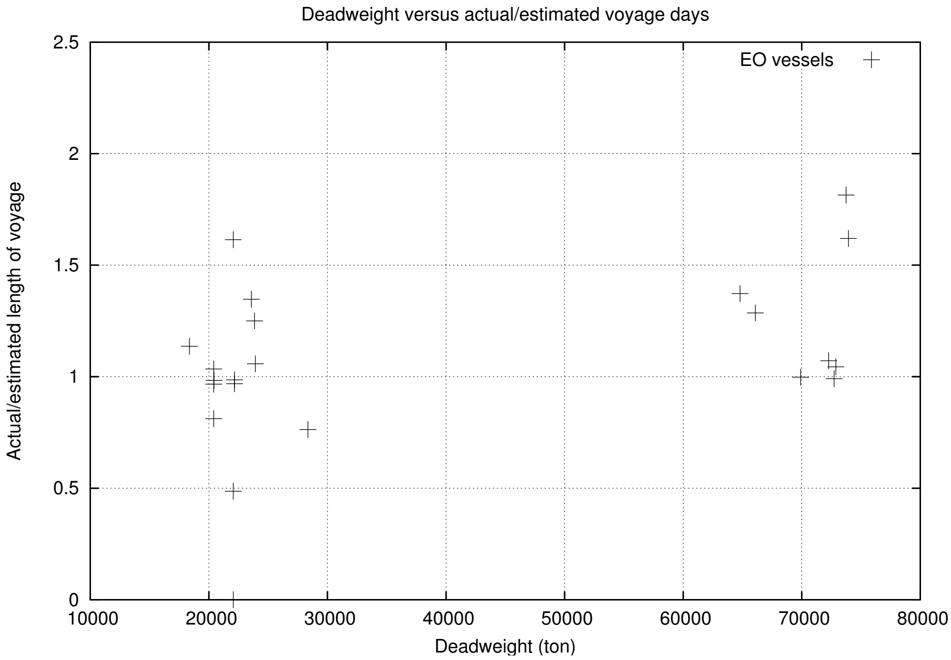

Figure 2.29: Deadweight versus actual/estimate of voyage length

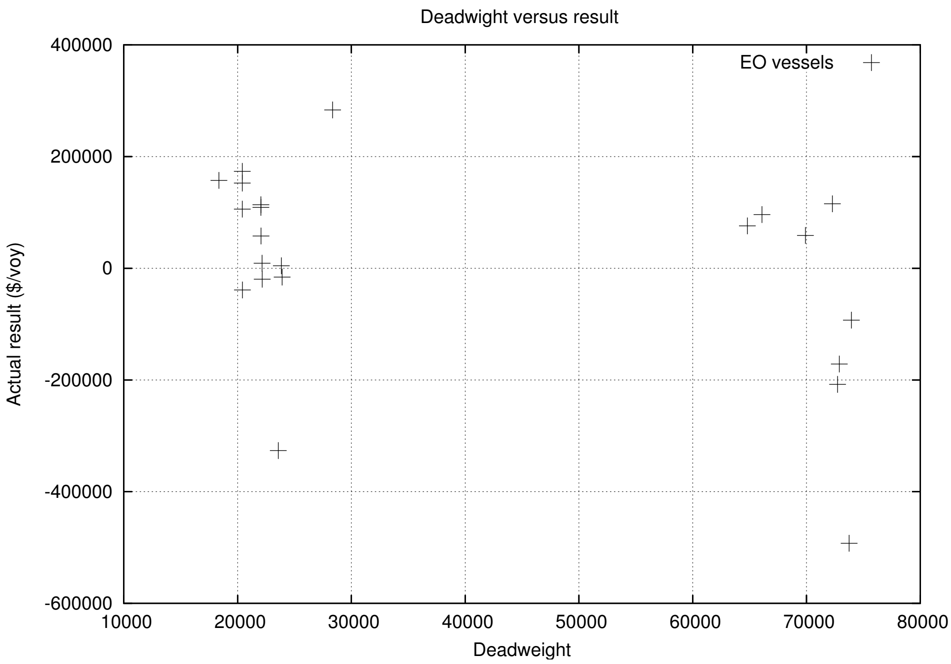

Figure 2.30: Deadweight versus actual results

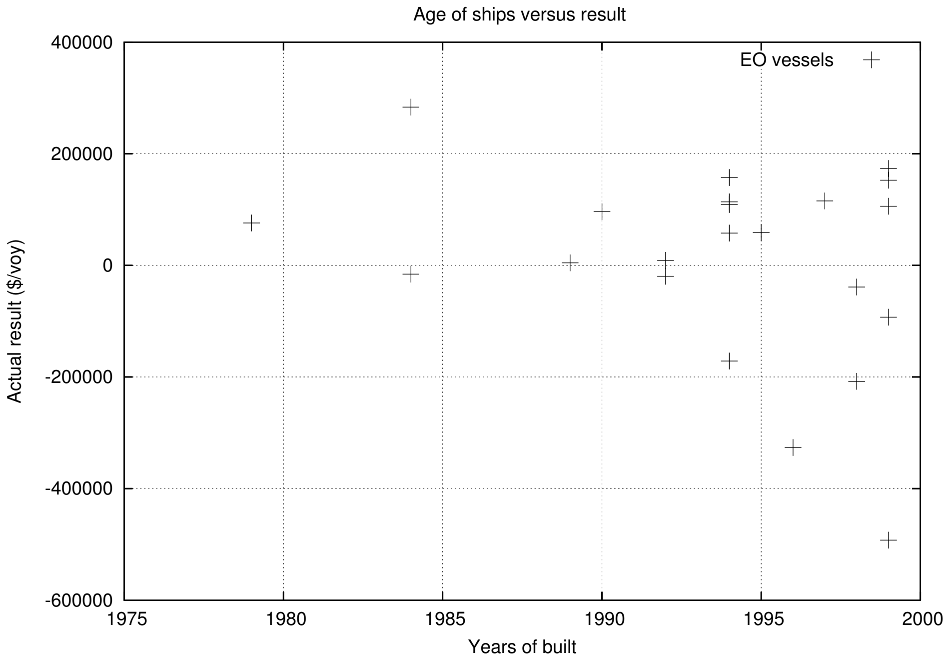

Figure 2.31: Age versus actual results

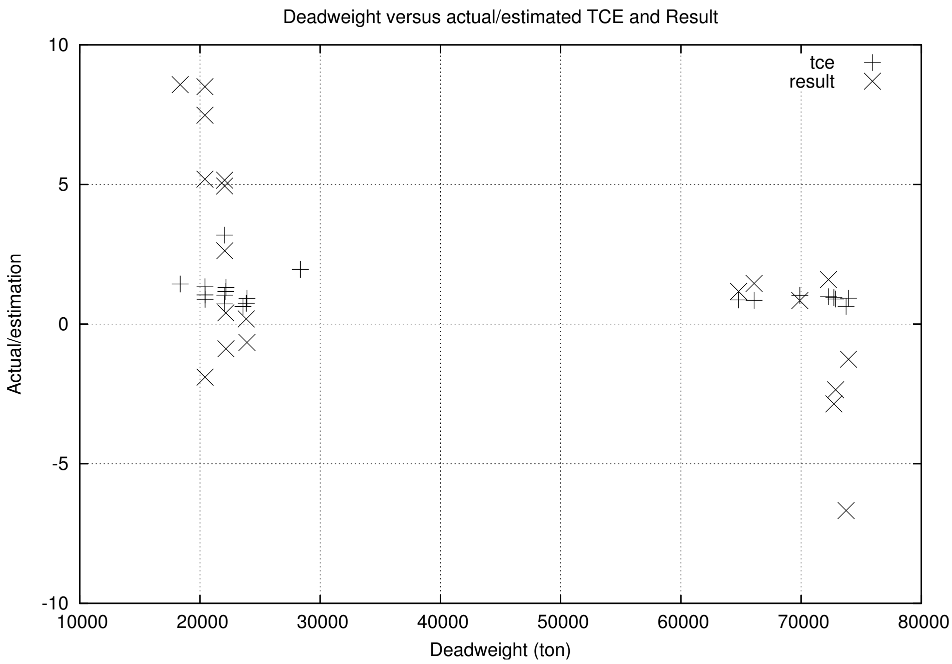

Figure 2.32: Deadweight versus actual/estimate of TCE and result

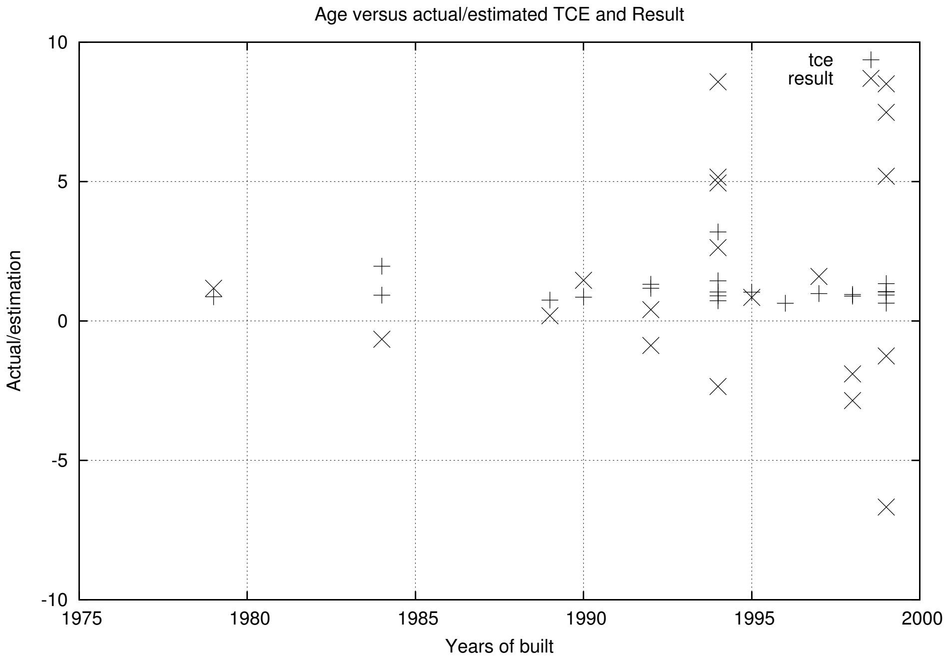

Figure 2.33: Year of built versus actual/estimate of TCE and result

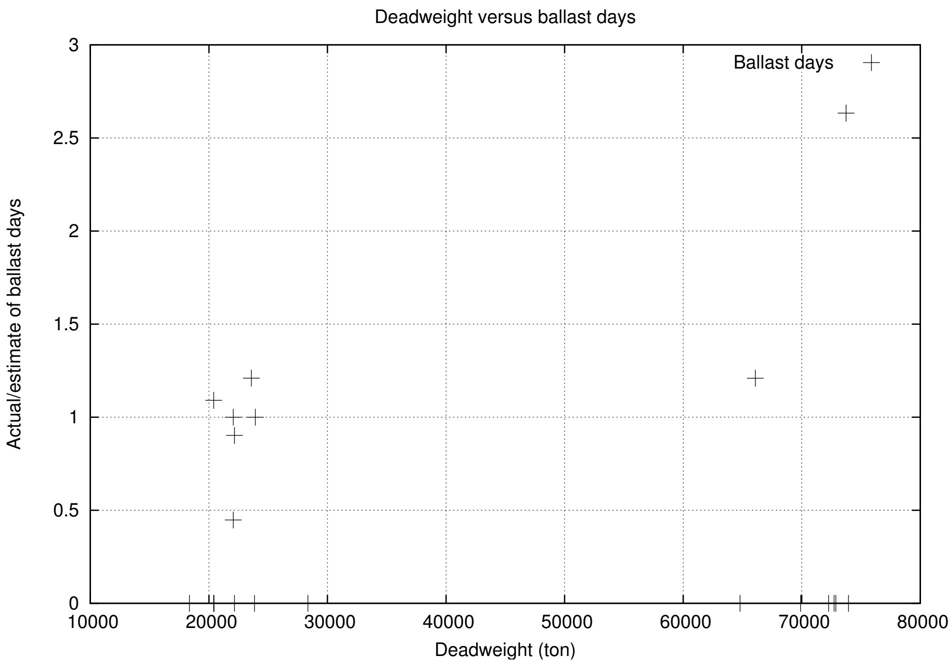

Figure 2.34: Deadweight versus actual/estimate of ballast days

2.3.3 Maintaining knowledge as asset

Usage of programs

The company collects issues from practice concerning chartering, operations, legal and local issues, called 'Cargo Care' and organize them systematically according their subject. The collected information has become a knowledge asset for the company. This is useful in order to minimize the occurrence of similar mistakes.

The usage of computer programs for conducting various tasks, from voyage calculation and stability calculations have helped them very much. But one must use it with a great care, as noted by Ian Barclay, a senior staff of the operations department:

> *Most vessels have approved computer calculations on board now, thank heavens. However is the case of all computers 'rubbish in .. rubbish out'. I have seen during my time some incredible false conclusions reached by these programs. Primarily because of limited information used. So my advice is look it over carefully before submitting it* [38]

Re-education & information directory

To ensure that all parties, at least starting internally, appointed agents and later the broker or partner charterer/shipowner, are performing the agreement accordingly one may need to influence and reeducate others. Since this could be a very important factors. Few terms may differently understood and interpreted, with financial consequences. As an operation director, Mark Pistorius, may need to interfere in very fundamental operational and legal aspects in shipping.

> *We have lost money in the past through this misunderstanding that we are forcing the issue with all charterers in an attempt to re-educate and bring everyone into line.* [39]
>
> *Kindly note Jeanette has ascertained that Mr. Schofield (of Laytime and Demurrage fame) has made an error in explaining the differences between* all laytime saved*,* all working time saved *and* all time *saved.*[40]

The number of vessels handled, the number of parties and persons involved increase the volume of information handled dramatically. In any

[38] Ian Barclay, Posting to 'Cargo Care', 20 June 2000.
[39] E-Mail form Mark Pistorius to Department of Chartering, on 29 June 2000
[40] E-Mail form Mark Pistorius to Department of Chartering, on 16 June 2000

stage of chartering negotiations and ship operations, the accuracy and the completeness of information is an important aspect. Few past information for a particular port can be used safely, but for some other ports are not the case. The need for information on the actual performance of a vessel, cargo handling speed in relation to the cargoes handled, the congestion situation and actual port-related costs is huge. An intensive exchange of information between the chartering and operations departments are inevitable. A documentation on the *past experience* employing a vessel for a particular trade is extremely useful, as illustrated by the following:

> *This will enable those immediate estimates to be made and information given to vessels when time is right. This of course does not relive responsibility to check the latest updated information on the port at the earliest opportunity and advise the master /person involved accordingly of any variations on the initial advices.* [41]

Security

This aspects can be a grey area. How secure is secure? How far is a company willing to let their ship trade in a particular area, which is said to be insecure. Which information sources should we trust?

Usually a very close cross-check actions and close co-operations with the other departments and the company agents are arranged. They do not solely depend on the official report either from local governments or from international organizations. Intensive communications are made, and frequently by phone[42]. From various sources, one may build a better assessment and his conviction on the real situation in the trading area in concern. It is likely that all these information, including hearsay and gossips are as important as the scarce and not timely available official information[43]. Usually the company has a general policy regarding this[44]

[41] E-Mail form Mark Pistorius to Department of Chartering, on 18 May 2000

[42] "We have to be cautious if we enter new areas. We rely fully upon the information of our agents. We put additionally few days for safety reasons. The more insecure there area is, the higher this safety margin would be", Patrick Hutchins, interview, 9 May 2000.

[43] More reports and data, within reason, cannot hurt, but much more important are real-life stories meaningful to the manager. Much of an executive's daily time, according to Henry Mintzberg's careful observations of managerial behavior, is spent seeking just that. Mintzberg observes that businessmen prefer concrete information, even gossip, speculation, and hearsay, to the abstracted summary information contained in routine reports flooding their offices. Page 164 [18]

[44] Security is important but generally the troubled regions are the ones that we do not regularly trade anyway so this does not come up often. Viveka Mansukhani, E-Mail and interview, 31 May 2000

(a) Price-demand relationship

(b) Segmented price-demand relationship

Figure 2.35: Price-demand relationships (source: OECD Working Party 1990, in [34])

2.4 Multifaceted aspects of shipping

2.4.1 The role of quality

In a classical price-demand relationship as shown in Figure 2.35 (a), the quantity of products sold increases as the price decreases. A closer look at it, we find that the companies position themselves at in a certain segment, where the effects of price changes on the sold products differ from one segment to another, see Figure (b).

The players are segmented into three categories [34]:

1. premium supplier, who provides enhanced quality at a high price.
2. standard supplier, who provides guaranteed quality at a moderate price
3. commodity supplier, who provides basic quality at a low price.

A premium supplier provides products at a high price. The number of products sold are not very much affected by the price changes. The clients rely very much on the *perceived* quality they have on the products, which is usually closely associated with the name or reputation of the company. A commodity supplier on the other hand chooses a lower price segment. A slight change of price affects the sale. A standard supplier is the one which sells his product at a moderate price, which lies between both extremes.

The quality is difficult to compare, moreover in a service sector, like shipping. In a service sector the relationship between client and seller is

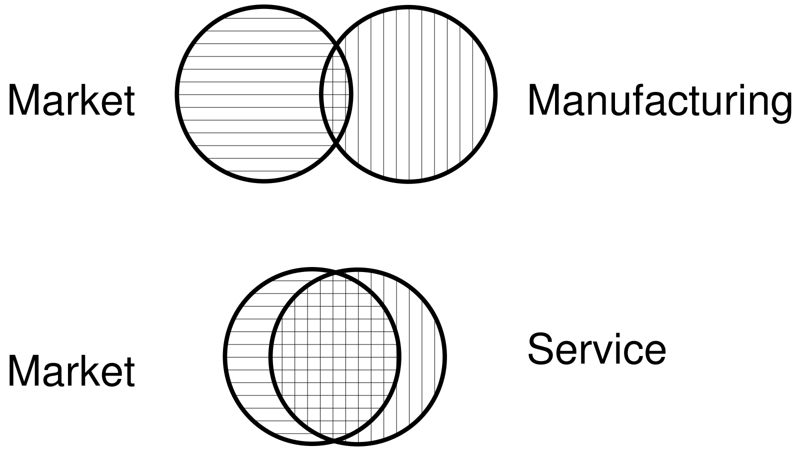

Figure 2.36: Buyer-seller relationships in manufacturing and service-oriented sectors [34]

closer than in manufacturing sector, see Figure 2.36. This properties apply to shipping as well. Maritime business is largely based on personal relationships, Panayides notes [62].

The quality is difficult to asses objectively, moreover in this service sector. What practically exists is the *perceived* quality. It is usual that a company consciously maintains their good name. It is sometimes costly, for example, preferring not to carry low-paying cargoes over a temporary ballast voyage or idle time. In shipping index, such a segmentation is not clearly visible.

Such a perception on other companies' reputation is a company-wide knowledge. Except in the case of black-listed companies, see Chapter 2, it is hardly possible to formalize it, for example, in numerical scores or a black-and-white policy. Within this 'allowed area' there is still a huge gray area which is subject to subjective interpretation.

The voyage charter hire, time charter hire and selling price of a ship depend upon not only the physical aspects of the ship itself, but other factors may play a more important role, see also Chapter 3. Those decisive factors are the reputation of the ship manager, the potential of obtaining cargoes in the voyages to follow, the assessment of consequences of international political events. These are not objectively verifiable.

Few success stories are marked with the success of shipping companies of obtaining contracts of affreightment in difficult time or fixing a longer time charter party just short before the rates are tumbling down. The capability or, some may entitle it a luck, for achieving an astonishing return, is evident.

2.4.2 Decision hierarchy

Decisions must be made every day from the small one like sorting which clients' faxes are to be considered seriously or not till choosing a certain option out of few on-going chartering or sale & purchase negotiations. There is always risk, since one is never sure if his decision is *fully* based on a strong foundation, i.e. information. The reality in daily practice shows that the information is rarely complete nor reliable. A decision maker must have a dare or boldness to take a risk to decide [45]. Postponing a decision is also a decision which has its price too.

Preferences of the company, manifested in the form of those of the chairman, directors and managers in hierarchical fashion, are important information. One knows them after sometime working or having been involved with the company or the persons of the company. With understanding those preferences, it is hardly possible to be able to make a reasonably good decision.

Providing a transportation service involves a chain of processes, a coordination among departments and their peoples. There are situations where interests of department collide. If it happens, the first thing is ensuring that the commercial interest of the company remains the highest priority. In a normal situations, where the ship in concern is in good conditions, the company follows the following hierarchy from the most important to the lesser ones: sale & purchase, chartering, operations and then technical (including crewing) [46].

Information on available vessels or available cargoes is relayed to all chartering staffs. Identical sister ships managed by different ship managers may have different interpretations, in terms of quality and price. The role of brokers can be decisive to start and to conclude a negotiation successfully. Doubtful brokers are definitely filtered out, without reading what they offer:

> *Everyday I ignore the e-mails from certain brokers without even reading what they say. This is because mostly they have stuff which is not of interest, they do not seem reliable (typical internet brokers) and just send our lists to everyone they can find. I would be wary of fixing with them and hence ignore them. I also skim over anything that says Panamax.*
>
> *The ones I take a closer look at are the ones that are addressed to me, from the brokers I regularly talk to or that we know of well*

[45] "The most important thing is, that you must have the boldness or dare to make a decision. Risks are always there, since you may never have a 100% certainty", Sjarief Hadiwidjaja, Branch Manager of Meratus Shipping, Surabaya, conversation, 1996.

[46] Jan Hagemann, Senior Director, interview, 2000.

> *and that suit the ships I am working specifically or that are the size/area that we usually work. Generally the most important e-mails come to my personal box as then I see it immediately, can respond immediately etc and the brokers/ clients I work with closely, always send their messages to my personal box.*
>
> *Reliability of a broker is important. Charterers that we have worked with before, who have a track record and we have a charter party with them and we know them well, always get priority.* [47]

Such qualitative aspects are definitely not to be overlooked in real-world shipping practice [48].

2.4.3 Strategy

In general the Sale and Purchase Department of Egon Oldendorff[49] acts very actively in the sale and purchase market. It follows the rule:

> *If a vessel is attractive and its price is low then buy it. Then charter it out.*[50]

They bought two Ro-ro vessels recently, and both are immediately chartered-out. The expertise of the organization does not make it possible to operate both vessels by themselves. The aspect of skill at the organization level is considered seriously. End of 1999, four vessels of Hoegh Lines (Norway) were bought by Egon Oldendorff. Those are multipurpose ships serving worldwide, Asia-West Europe-North America. Hoegh Lines and Egon Oldendorff agree to transfer the operations later in 2000, in order to enable learning from Hoegh Lines' current operations. Since 2000 Egon Oldendorff operates the vessels after setting up offices in several countries. Its service is called Indotrans Service. In 2003 the vessels were sold to the China Navigation Company Limited. Another rule is:

> *If the company badly needs a vessel but the price is high, the company prefers waiting.* [51]

[47] Viveka Mansukhani, E-Mail and interview, 31 May 2000

[48] "I would be working with brokers, whom I know very well or they work exclusively with certain charterer", Sebastian Dohrendorff, interview, May 2000

[49] A shipping company located in Lübeck, see later in sub-section 2.5.

[50] Peer Gröpper, interview, 22 May 2000. Sale and purchase of ships is basically carried out solely by Peer Gröpper. Since it involves a huge amount of money and longterm strategy of the company, he consults closely with Henning Oldendorff, Chairman. And the final decision lies at the later as well.

[51] Peer Gröpper, interview, 22 May 2000. Sale and purchase of ships is basically carried out solely by Peer Gröpper. Since it involves a huge amount of money and longterm strategy of the company, he consults closely with Henning Oldendorff, Chairman. And the final decision lies at the later as well.

There are measures of the company to be selective in charter negotiation: the company is not willing to fix a charter at any price[52]. Accepting too low charter rates too easily may harm the image of the company in general, since the company intends to position on the upper market segment, beyond the average market level [53]. Therefore a strong preference towards younger ships is to show to clients on their intention to provide a first class service.

A few companies pay a lot of attention at securing a high reputation, in order to secure a longer confidence among their client. This would expectedly ease them in turn to secure a higher volume or a longer term of contract. As a consequence of this, they would also be willing to accept rates, even lower than the failing market rate, as long as they could secure a close relationship with their important clients.

> *Long term strategy is also very important and we have often done a fixture which may not appear so attractive but that suits our long term plans, including positioning for next business or building up a relationship with a certain client.*[54]
>
> *A good reputation has been built on EO name. Many chartering deals rely very much upon this. As an illustration how useful this can be: due to a missed laycan, renegotiation on the freight rates was only possible, if the charterers trust us. And many contracts are based on this reason, moreover for high paying cargoes which require cargo handling expertise and skills in order to guarantee smooth shipments.*[55]

Proper functioning of service by the company's fleet is important. To obtain and maintain commercial success, it involves more. A good reputation must be maintained. The company strongly maintains the image that they are a first class shipping company, see also sub-section 2.4.1 earlier.

2.4.4 Experience, knowledge and education

In the course of time during conducting the shipping practice, a lot of valuable knowledge on how to conduct shipping business can be found in market reports sent by brokers or market research institutes. The following are examples:

---

[52] "Rate or volume attractiveness is important, but we would not even look at the business, if their size does not suit and we can only find out rate once we looked at the business", Viveka Mansukhani, interview, 31 May 2000.

[53] I would reject rates which are below the market level. Sebastian Dohrendorff, interview, May 2000

[54] Viveka Mansukhani, E-Mail and interview, 31 May 2000

[55] Mark Pistorius, interview, 4 July 2000

> *.. and with bunker price still rising the interest in time charter rather than voyage charter seems apparent* [56].

On center of cargoes:

> *In the Med there seems a small activity at the moment for standard types, and again Charterers are trying to push rates lower. Some cement and mineral stems were open for standard Handy types to both Continent and US Gulf destinations.*

Knowledge is spread in many places, departments and people. In order to be able to conduct a task well, for example, a chartering negotiation or bunker planning, one relies very much on advice from others. Information on cargo handling performance is obtained form the operations department. If it is not available, which is not unusual in bulk shipping, this department contacts agents at the ports of call. Bunker planning, can only be done in a close relationship between chartering and operation desks. Operations departments nominate few alternative bunkering ports, and they provide some idea on bunker price. The chartering department uses that information for an on-going chartering negotiations.

From experience one has learned a lot, for example:

> *"If the fuel price is high, then the voyage charter rate is also high. Time Charter becomes preferable".*
>
> *"If the rate is low and the technical department approves it, then low paying cargoes, such cement clinkers or scraps, would likely be accepted".*
>
> *"A ship laid up for a long time tends to have a lower value".*
>
> *"Our company's fixtures tend to be beyond the market level".*

There must e a long list of rules, if one wants to express them all. It becomes hardly possible to make it practicable. One cannot perform his job well using the above rules only. There is still some vague area which is difficult to express without ambiguity or which needs to be understood in context, for example:

> *"Reliability of partners, i.e. shipowners, charterers and brokers, are very important".*
>
> *"The market is firming".*
>
> *"We are willing to accept lower rate in order to maintain a relationship with important clients".*

[56] J.E. Hyde Freight Market Comment (6 June 2000)

Furthermore the knowledge is changing over time. The views on ideal ships may change over time, for example:

> *"Such a ship is no longer suitable for our company".*

The above showed also that expressing information in qualitative terms is inevitable. Numerical expressions are often *meant* as an approximation, for example : the bunker price monitor on 28 June 2000 in Gibraltar, see also Table 2.11. That IFO380 costs $162/tonne, *means* that the fuel costs *approximately* $162/tonne. The company will still accept it, if the price is slightly above that level. How much the deviation from that price he will accept may vary from person to person, or from company to company. It depends also the knowledge of the person in charge on the company, how well he *understands* the tendencies or preferences of the company (in this case manager or director), how they would have reacted, if he had ordered bunker there.

Nevertheless obtaining knowledge and expressing it as hard terms like the above is not an easy task, when possible. On the question which factors which determine the performance of a port, Pistorius responds with the following:

> *I have raised more questions than answer. But the question is a complex one that depends on the facts of the matter and cannot be answered simply. We would rate the business against our expectations on our* experience *at the port against the terms/ discharge rate that charterers wish. This will of course either raise or lower the freight rate dependent on the terms against the expected actual working conditions of the port. It is of course prudent to fix a vessel that is not only good for the cargo but* suits *conditions at the expected port of trade as this will maximize your turnaround.* [57]

[57] Mark Pistorius, e-mail of 14 August 2000

Time Charter

GOVERNMENT FORM

Approved by the New York Produce Exchange

November 6th, 1913—Amended October 20th, 1921; August 6th, 1931; October 3rd, 1946

This Charter Party, made and concluded in........day of........19......

Between ....

Owners of the good........ { Steamship / Motorship } ....of........

of........tons gross register, and........tons net register, having engines of........indicated horse power and with hull, machinery and equipment in a thoroughly efficient state, and classed........

at........of about........cubic feet bale capacity, and about........tons of 2240 lbs. deadweight capacity (cargo and bunkers, including fresh water and stores not exceeding one and one-half percent of ship's deadweight capacity, allowing a minimum of fifty tons) on a draft of........feet........inches on........Summer freeboard, inclusive of permanent bunkers, which are of the capacity of about........tons of fuel, and capable of steaming, fully laden, under good weather conditions about........knots on a consumption of about........tons of best Welsh coal—best grade fuel oil—best grade Diesel oil, now ....

........and........Charterers of the City of........

Witnesseth, That the said Owners agree to let, and the said Charterers agree to hire the said vessel, from the time of delivery, for about ....

........within below mentioned trading limits.

Charterers to have liberty to sublet the vessel for all or any part of the time covered by this Charter, but Charterers remaining responsible for the fulfillment of this Charter Party.

Vessel to be placed at the disposal of the Charterers, at ....

.... in such dock or at such wharf or place (where she may safely lie, always afloat, at all times of tide, except as otherwise provided in clause No. 6), as the Charterers may direct. If such dock, wharf or place be not available time to count as provided for in clause No. 5. Vessel on her delivery to be ready to receive cargo with clean-swept holds and tight, staunch, strong and in every way fitted for the service, having water ballast, winches and donkey boiler with sufficient steam power, or if not equipped with donkey boiler, then other power sufficient to run all the winches at one and the same time (and with full complement of officers, seamen, engineers and firemen for a vessel of her tonnage), to be employed, in carrying lawful merchandise, including petroleum or its products, in proper containers, excluding........ (vessel is not to be employed in the carriage of Live Stock, but Charterers are to have the privilege of shipping a small number on deck at their risk, all necessary fittings and other requirements to be for account of Charterers), in such lawful trades, between safe port and/or ports in British North America, and/or United States of America, and/or West Indies, and/or Central America, and/or Caribbean Sea, and/or Gulf of Mexico, and/or

Figure 2.37: NYPE Time Charter Party Form

Experience is useful. It teaches us not to repeat the same mistakes or to guide us to a prospective solution. Past experience helps also very to improve the efficiency of management. In chartering, every charter party is unique. But it contains similar situations, form time to time. Standardization is an effective tool. Its functionality is like a checklist for both parties, shipowner and charterer. Its design gives a good overview, and helps the user reminding if something is missing or forgotten. There are various standard forms are in use today. The forms of BIMCO[58] and NYPE[59] still seem very much in use today. Figure 2.37 show the front page of the NYPE Time Charter Party Form.

Education

Sebastian Dohrendorff was, at time of this research, a junior chartering manager, responsible for the Atlantic market. He works there since six months ago immediately after finishing his shipping education at Ludwig-Erhard-Schule in Kiel [60]. This is his first professional job in shipping. Previously he took an apprenticeship at Egon-Oldendorff too. He believes that formal education only is inadequate to conduct jobs in shipping.

Viveka Mansukhani, is chartering manager responsible for Pacific market, has been working in international shipping for quite some time. She pursued his shipping education in Hong Kong. After having been in shipping practice in a.o. Hong Kong and Singapore, she joined Egon Oldendorff.

Mario Giaffreda, a student of a shipping school Ludwig-Erhard-Schule in Kiel (Ausbildungsberuf zum Schifffahrtkauffrau/-man der Berufsschule an der Ludwig-Erhard-Schule) in Kiel[61], is apprentice at Egon Oldendorff. At the operations department he assists in particular Horst Nowak and Markus Eller. One of his tasks is collecting and distributing information concerning the actual positions of vessels and their expected time of arrival. At school he learns a.o. the basics of shipping, trading, economics and shipping laws.

2.4.5 Imprecision and uncertainty

It is of great importance to keep informed of the developments. Information overflow is inevitable. Nevertheless there is a way to keep the things simpler and under control, i.e. by allowing imprecision selectively. Table 2.13 illustrates the differences of the size of the bulk carriers' fleet according to

[58]The Baltic and International Maritime Council
[59]New York Produce Exchange
[60]see Mario Giaffreda
[61]http://www.les-kiel.de/frame.html

Class	Size (DWT)	Manager	Statistics
Handy size	10,000- 50,000	3500	4048
Panamax	50,000-10,000	1000	812
Capsize	over 100,000	400	482

Table 2.13: Bulk carriers' fleet according to practitioners

a shipping practitioner[62] and the statistics[63]. It is still not worrying some, for having this differences. Otherwise, having a rough idea on the size of vessels, charter rates or ship's prices are very helpful. Published reports can be imprecise, as shown by the followings:

> *Reports say that the Atlantic rates today are firm. It is not entirely correct. To be more specific, there are no cargoes coming from East Coast of both North and South America. It is in fact difficult to rely fully upon market reports, since those are not always relevant for daily negotiations*[64].

Many assessment and analysis can be very *effectively* expressed in a qualitative way. Or a vague way. On the other hand it is hard for example to express the forecasting in an exact numerical value:

> *Freight rates continue at a slow rise but the modern Eco types do attract good numbers. There is a good activity activity with a steady flow of new orders. We feel that the expected improvement on the freight level has still not reached its* anticipated level*.* [65]

It is difficult for a novel chartering officer, a student or an outsider of the business to figure out what it is exactly meant with 'anticipated level' in the above context. The context plays a decisive role in interpreting a textual assessment, like the following.

> *The larger Handymaxes are in demand and attracting the best offers. The smaller Handy sizes have seen a more marginal increase in earnings but this increase has to a large extent been absorbed by increased bunker prices, subsequently the smaller ships of the sector are not doing quite well as their larger cousins.*

[62] Dieter Gast, interview, August 2000
[63] [81]
[64] Sebastian Dohrendorff, interview, May 2000
[65] Lorentzen & Stemoco: Weekly market outlook week 36 (07/09/00)

Large and small Handy sizes are there. No clear and sharp distinction between those groups is necessary to have the texts easily understood, by the readers.

J.E. Hyde Freight Market Comment (6 June 2000):

> *What was clear was that the lack of fixing being done is not because there is a lack of business around but due to the* discrepancy *between Owners' and Charterers' respective ideas in freight values.*

For an experienced shipping practitioners, such qualitative and imprecise expressions are an effective way to relay message. On the other hand, for a novice that might lead to incorrect interpretation.

> *If the charter rates are firming, less paying cargoes, such as scrap, would have difficulties to be transported*[66].

Assessment on situations may differ considerably among experts. As illustrated by the following:

> *We noticed an article in last month's IBJ*[67] *magazine, a first class publication, continuing to predict some gray clouds on the horizon for 'Panamax' tonnage, mainly based on the new building programs. We do accept the reasoning but still maintain that for this year and into next, increased activity in the commodity markets will enable the overall freight market to cope with the influx of the new tonnage (famous last words?).* [68]

2.4.6 Value of information

Information available is hardly complete and it can be quantitative and/or qualitative. Information may need further analysis and subject to subjective interpretation. Information is available in abundance, and most of it is not relevant or useless. Useful information, on the other hand, is still scarce and expensive. As the charter party may involve any company of any part in the world, a challenge is always there to make sure that the operator deals with a reliable partner. MRC Business Information holds information on hundreds of thousands of companies world-wide. MRC provides information and make research on the company of interest concerning legal details and persons behind the company, business fields and prospects, finance and reputation. Furthermore MRC provides also information on ships. This

[66] J.E. Hyde, 30 June 2000
[67] *International Bulk Journal*
[68] J.E. Hyde Freight Market Comment, 6 June 2000

service, called CharterCheck, provides information concerning the history of the ship[69], the ownership, commercial and technical management and recent contracts.

CharterCheck's fee for vessel and cargo are $290 and $460 respectively. The interest towards providing information is not dominated by MRC. Others provide slightly similar services, such the Lloyd's Marine Intelligence Unit that asks $255 per week for providing the vessel tracking information, i.e. positions of the vessel (last reported location and estimated time of arrival). Clarksons Sale and Purchase Division offers a service for valuing specific ships for a fee of U.S. $ 750 for each valuation.

Influence of external factors

The transportation sector, which shipping belongs to, connects ports, areas and countries all over the world. All these possess its own situations and typicalities, in terms of macro economic, politics and cultural typicalities. The shipping faces these situations and react upon them immediately. Shipping companies have the necessity to have a close contact with their partner shipping companies, brokers, shippers, consignees and government officials. Their interpretations are important, since these may play a very important role in determining the selling price of their product, charter hire, see also **??**. The following is noted by Maersk Broker:

> *Japanese land prices dropped by 8 per cent in 1999 while residential prices dropped by 4 per cent on average. According to IMF this will continue to be a major threat on the Japanese recovery, as further provisions might be needed in the already strained banking sector.*
>
> *Following last months' bank mergers (the third of its kind in just 8 months) a new problem also faces Japanese corporations. Since banks are beginning to consolidate their loan portfolios due to mergers, a stricter and firmer attitude toward corporate debt and weak companies is assumed.*
>
> *This materialized by bankruptcy rates jumping to a record level in February, especially with the largest retailer bankruptcy in history, with increased pressure on bad debt portfolios and weak companies, Corporate Japan will now have to speed up its own restructuring and consolidation process to keep up with the pace of the Japanese banks.* [70]

[69] This can be of utmost importance, since ship's name and nationality can be easily changed.

[70] Maersk Broker - Japanese Market/economy Update for April / May 2000; fax dated 15 May 2000

2.5 Oldendorff Carriers: a profile

Egon Oldendorff GmbH Co KG is presented here as a dry-bulk shipping company, though it is *neither* a typical nor a pure bulk shipping company. The company was established in 1920, and is located in Lübeck. The company employs 2400 persons as a ship's crew and 185 persons in its eleven branch offices in five continents. Most of shore personnel at the headquarter (about 85%) are in the thirties or even younger, including its Senior Directors Jan Hagemann and Peter Twiss. The company structure is flat. The company does not have even an organization chart[71]. The organization is lean; important decisions are delegated to their staffs. Ten persons have a full responsibility to decide and sign the Time and Voyage Charter Parties respectively.

The affinity towards new technology, especially the information technology characterizes the company very much. The company employs an advanced IT infrastructure. The atmosphere is young, most employees are of below 30 years old. All facsimile messages are automatically scanned and distributed accordingly to the addressee's e-mail account. The usage of printers is organized in a group of desks. These printers are a combo facsimile and copier machine, where a fax can also be sent manually.

The lean organization and its efficient IT infrastructure enable them to move and to make decisions quickly. A lot of meetings for specific chartering and operations matters are often organized informally among 2-5 people just on the gangway, or just standing near someone's desk. The atmosphere is in general informal. Wearing a jogging suit is acceptable, when someone does not expect to welcome a guest.

None of personnel holds a university degree except two of them, Jan Hagemann and Tony Pearkes who hold a master degree. Apprenticeship seems to be an ideal way to participate in educating and equipping a trainee with real-world experience. It is also an ideal way to select and recruit future employees.

Egon Oldendorff is a parent company, having two subsidiaries Flensburger Schiffbau-Gesellschaft (FSG) and Concept Carriers. The FSG is a shipyard located in Flensburg in Northern Germany close to the Danish border and just north of the Baltic entrance to the Kiel Canal. The shipyard had been rescued, in March 1990, by Egon Oldendorff, after a 4 year bankruptcy period without any single orderbook. Since then, the shipyard has achieved a remarkable turn-around. It has booked a total of about 70 orders worth around DM 3 billion for delivery until 2004, fifteen years after the company was acquired. It represents a successful come-back for a yard, which has a reputation for quality workmanship, solid steel construction methods and for keeping delivery dates. The yard produces 7 to 8

[71] Jan Hagemann, interview, 2 May 2000

Egon Oldendorff	Concept Carriers
Self-unloading bulk trade	Steel parcel trade from Black Sea and from Asia Pacific
Handy/ Panamax bulk trade	Handymax bulk trade
Indotrans parcel trade	Scrap trade
Inter Asia bulk trade	Logistic projects
West coast parcel trade	
Multi purpose vessels	
Open Hatch Box Shaped Vessels	
Sale and Purchase / Projects	
Bulk transhipments	

Table 2.14: Trades and activities of Egon Oldendorff in 2000[72]

vessels of 20,000 tons deadweight per year with 600 employees[73].

Concept Carriers GmbH & Co KG was setup in 1995 to focus on obtaining cargoes using primarily time-chartered vessels. CC consisted of a team of 15 young staffs of below 30 years old in average. The objective of CC is being a pure cargo operator, without having won tonnage, within a shipowner's environment. Four persons have a full responsibility to decide and sign Voyage and Charter Parties. With financial and logistic backing of Egon Oldendorff, CC has better access to cargoes and to establish contacts. The parent company believes that "the youth of the company ensures the best motivation and eagerness to provide an excellent service to customers"[74].

The success of the Concept Carriers has 'infected' the parent company. Oldendorff becomes more cargo-oriented, meaning employing time-chartered tonnage. In 2000 half of the tonnage was chartered-in vessels. A screenshot of the fleet by end of 2004[75] 120 from 191 ships or 5,552,000 tdw from 7,765 000 tdw in other words 62% in number, 71% in deadweight are chartered-in vessels. This was also largely a result after the merger of both companies on 1 January 2001, which resulted a total fleet of 170 ships of around 7 million tons deadweight. Since then the company officially carries a new name, Oldendorff Carriers GmbH & Co KG, lead by Jan Hagemann (30) and Peter Twiss (31), as managing directors, and Henning Oldendorff as chairman.

Today Oldendorff Carriers the largest bulk shipowner in Germany, employs 3,400 people form 66 nations in shipping and shipbuilding. Usually

[73] http://www.oldendorff.com/index.htm, downloaded on 30 December 2004

[74] www.oldendorff.com/trades/trades2.htm, downloaded on 4 May 2000

[75] 30 December 2004

Oldendorff Carriers
Self-unloading bulk trade
Panamax bulk trade
Handy size bulk trade
CONCEPT steel trades (Handymax parcelling Black Sea/Asia, Asia/Med)
Breakbulk service South East Asia/Europe and North America
AUSTRANS bulk parcel service
Multi purpose vessels
Open Hatch Box Shaped Vessels
Bulk Logistics (Transhipment, Lightering, Topoff, Self-unloading barge)
Sale and Purchase, Newbuilding brokerage
Logistics Projects

Table 2.15: Trades and activities of Oldendorff Carriers in 2004[76]

they operate some 200 vessels, 80 are owned, and 120 are chartered-in vessels. Its fleet performs 8,000 port calls in 120 countries, and carries some 80 million tons of bulk and unified cargoes across the ocean[77].

The above company description does not suggest that a company of a completely different organisation style would not work well. The above is not *the* recipe to ideally conduct shipping business either. The above description emphasized the importance of knowledge, the formal and informal one, in an organisation. The formal knowledge is well-documented and clear, can be obtained from books and, usually from, formal education. The informal knowledge comes from own or someone else's experience. The usage of informal knowledge marks the role of intuitive actions and contextual understanding becomes evident, especially when the environment is complex, see also Chapter 4.

2.6 Conclusions of the chapter

1. Shipping is marked by an interplay of factors which are hardly, when possible, to express clearly and objectively.

2. Shipping indexes and shipping forecasts are inadequate to assist ship practitioner to conduct daily shipping tasks in chartering. Information and opinion from local agents, brokers, newspapers concerning

[77]www.oldendorff.com/hp/hp.htm, downloaded on 30 December 2004

rate prediction, backhaulage potential, cargo handling performance or claim risk play a much more significant role.

3. Shipping practice does not use any computer programs for assessing the charter value or selling price of ships assessment as a foundation for their decision. They rely very much upon experience and intuition.

4. The capability to understand the mechanisms and to precisely asses the size of the market (supply and demand) does not necessarily reflect the capability to conduct the shipping business in practice.

5. The shipping industry realizes the importance of maintaining the knowledge as asset of the company by collecting operational experiences and making them accessible to all departments. Formal knowledge, obtained from school or course, serves as a foundation. Nevertheless much of the knowledge, necessary to conduct the business accordingly, is gained mainly from experience.

Chapter 3

Existing Resources and Tools

This chapter elaborates the views and perspectives of the past research on shipping problems, and their ways addressing problems. A special attention is paid to the tasks which support the decision-making processes. In order to be able to make a decision satisfactorily, a decision makers relies on two things, namely resources and tools. Resources include information on the state of the shipping, world economy, forecasting, S+P and charter reports. Tools embrace methods or programs used to assist decision making or to generate information such as forecasting models or ship's value assessment methods.

3.1 Chartering negotiations

A chartering logbook does not exist actually. It is to denote the elaboration of this section which aims at reconstructing chronological processes of few chartering negotiations. Normally only recent or important documents are filed well. Ms. Viveka Mansukhani has provided copies she could collect on recently completed chartering negotiations. Some of her personal scratches are included as well. It is hardly possible to obtain a complete set of documents describing all stages of the chartering negotiation. Many details of telephone conversations and informal minutes of meetings are not documented in writing. Nevertheless the exchange of information shown in this section illustrates the functioning of ship chartering in practice. This 'logbook' reveals thoughts and considerations leading to the final decision. Most of the 'conversations' use standard terms and abbreviations widely used in ship chartering, which can be looked up in Appendix C.

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D-22713 Hamburg

TELEFAX

Ref : PS14124 Date : 8/25/00 10:44:40 AM

WE MIGHT DEVELOP THE FOLLOWING MODERN CAPESIZE BULKER BUILT IN RUMANIA BUT UPGRADED SPECIFICATIONS AND ALL WESTERN/EUROPEAN EQUIPMENT/MACHINERY (ORIGINALLY BUILT FOR BOCIMAR):

M/V Giuseppe Lembo - Ex Mineral Sakura

172.632 Mtdw on 18,02M
Blt 3/1999 Constantza
RI 100A1
Loa 295,83 Lbp 283,00 Beam 46,00 Depth 24,40 M
9/9 Ho/Ha 187.975/0 Cbm Gr/Bl
Gearless
B+W 18.880 BHP
13.5K/54T Ldn 14.6K/54T Blst ifo 380cst + 0 MDO

VESSEL LOADING TUBARAO ETS TUBARAO ABT 26/8 FOR DISCARGING CONSTANZA ETA ABT 13/14 SEPT ETS 21/22 SEPT

BEST OFFERS INVITED WE CAN GUIDE YOU ON PRICE

REGARDS
SCHIRRENSHIP/P SCHIRREN

Figure 3.1: Inquiry from broker

3.1.1 Short logbooks

MV GIUSEPPE LEMBO

25 August 2000. She receives hundreds of e-mails, faxes and letters from brokers, cargo owners and shipping companies. They offer their ships for an employment, as illustrated in Figure 3.1. She has to decide either to keep the mails for further consideration or to throw it into the trash bin. This is a filtering process. The action is unambiguous, either keep it or ignore it.

MV GIUSEPPE LEMBO is a Cape size vessel of a 170,000 dwt class. Mansukhani is responsible for Handy-Class of 10,000-45,000 dwt. This vessel does not attract her attention at all. This file is removed.

Beside the size of ship or volume of cargoes, another very important thing is know who is behind that fax or e-mail. There is a company-wide list of companies that are not allowed to make a commercial deal with, the so-called blacklisted companies, see also Chapter 2. This list is clear and binding for all. Then a grey area follows, there are still a plenty of not-blacklisted companies sending inquiries. From ad-hoc preferences of the director or company, her own or her colleagues' past experiences play a role now.

Swazi Sugar Association

Swazi Sugar Association let Galbraith London find a ship to carry sugar from Maputo to London. Galbraith informed Mansukhani, that they needed a vessel for the above-mentioned purpose.

30 May 2000. An inquiry from Galbraith London concerning the carriage of sugar is received by Patrick Hutchins, from the Atlantic desk. This matter is then taken over by Viveka Mansukhani, as this carriage can be of interest for MV LUCY OLDENDORFF's next employment. She is trading in the Pacific for which Ms Mansukhani is responsible. The cargo is 20,600 ton of bulk sugar to be transported from Maputo to London River. The laycan is 14-17 June 2000. Loading and discharging speeds are 2,000 and 1,500 ton per hour respectively.

During some telephone conversations, as she noted few more details concerning this inquiry. She notices that the laycan dates are critical. The Swazi Sugar Association, cargo owner, wishes a sate of about US$ 20/ton. Mansukhani demands a rate of over $30/ton, see Figure 3.2.

31 May 2000. She offers US$ 31.50 per ton, and adds extra clauses concerning demurrage, US$ 300 and US$ 5,000 per day at loading and discharging ports respectively. She responds:

Swazi Sugar Associat

Patrick/Philip - Ever Forest. Case you do a juggle around, remind you
the Swazi's are still in market for...

20,600mm bulk sugar
Maputo/London River
14/17 June
2000/1500 → sat shex
sugar cp high twenties.

and then you take in the Tiger Falcon?????

start market

$3000/$1500 - check if ok.

Try higher for London.

- draft 10m / Beam 25m
- LOA 183 ↳ stretchab

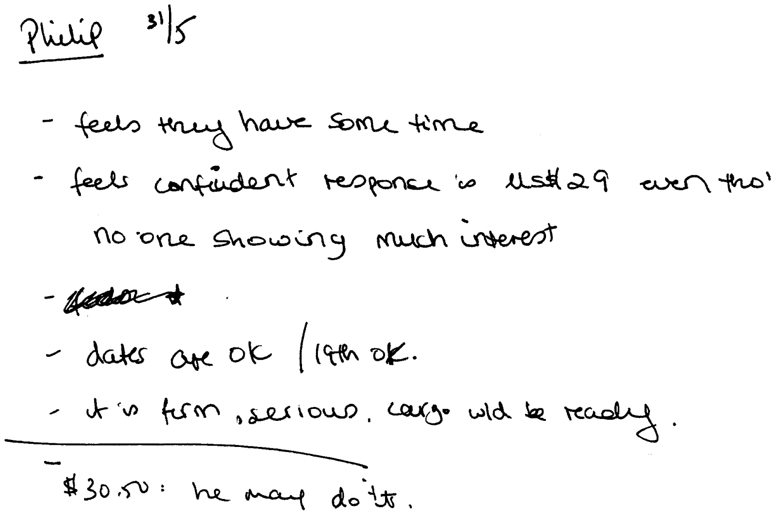
Philip 30/5 1815 hrs.

- dates are vital but he will check
- feels last done was over $30
- he may have a rate in the 20s.
- try low 30s.

→ ats at dischage / lts at load
→ 1977 cp / they may try pl long mt

Kent Ships Agency dept: (44 207) 626 6525
Alan Wiggs

Figure 3.2: Swazi Sugar - an early phase of negotiation


Philip 31/5

- feels they have some time
- feels confident responce is US$29 even tho' no one showing much interest
-
- dates are OK / 19th OK.
- it is firm, serious. cargo wld be ready.
- $30.50: he may do it.

Figure 3.3: Mapping the situation and guessing the response

DISCHARGE 1SP 1SB LONDON RIVER

LAYCAN 14TH-19TH JUNE 2000 (VESSEL NOW AT BOMBAY WHERE ETD 4TH JUNE AND ETA MAPUTO 15 JUNE SUB AGW WP AND UCAE)

FREIGHT US$ 31.50 PMT FIOST 1-1

LOADRATE: 2000MTS SATPM SHEX

DISCHARGE RATE: 1500 MTS SAT SHEX

DEMURRAGE US$ 3000 PD PR HDLTS AT LOAD

DEMMURAGE US$ 5000 PD PR HDATS AT DISCHARGE

OWNERS AGENTS LOAD/CHRTS AGENTS DISCHARGE

SUB DETAILS BSS CHRTS EXECUTED CP

6.25% ADDCOMM PLUS 1.25% TO GALBRAITHS LONDON

It is of necessity to have an idea what the charterers want. Mansukhani tries to map the situations and to guess the likely achievable charter hire, the negotiability concerning the laycan dates and the degree of seriousness of the Swazi Sugar Association in this early stage of negotiation, see Figure 3.3. The negotiation is interrupted, see also the next sub-sections 3.1.2 and 3.1.4 concerning the decision making OF MV LUCY OLDENDORFF's Charter Party.

MV WORLDSTAR

On 2 May 2000 Ernst Russ, a broker, offered MV WORD STAR to Egon Oldendorff. Mansukhani was interested to charter-in this vessel. The ship was to be delivered in St Petersburg, and to be redelivered in Boston-Galveston range in East Coast of USA. The trade would take about 40 days. Mansukhani sent a quick reply.

2 May 2000, 16:23 H. Ernst Russ Chartering resumes the intentions of Mansukhani:

MV WORLD STAR / ACCT EO

DELIVERY AFSPS ST PETERSBURG ATDNSHINC

LAYCAN 11/13 MAY 2000 0000-24000HRS

ONE TCT VIA GD AND SF PORTS AFLOAT ALWAY WITH IWL, IN/OUT GEO ROTATION, MULTIPLE LOADING

HIRE USD 4275 DAILY INCLOT PAYABLE EVERY 15 DAYS IN ADVANCE

REDELIVERY DLOSP 1 SP BOSTON/GALVESTON RGE PICO ATDNSH-INC

DURATION ABT 40 DAYS WOG

SUB CARGO/TRADING EXCLUSIONS

SUB BUNKER CLAUSE/ PRICE/ QUANTITIES

SUB CHARS BOD APPROVAL TO BE LIFTED 1800 HRS HBGF TIME 3RD MAY 2000

SUB FURTHER TERMS/DETAILS AS PER CHRTS EXECUTED NYPE

2 May 2000 16:45. Ernst Russ adds some additional information required by Mansukhani concerning the load capacities on tanktops, weather decks, hatch covers and tween deck. This information can be of use, in case Mansukhani intends to use the vessel for transporting heavy cargoes.

MV WORLD STAR / ACCT EO

TANK TOP - 26 MTS PER SQM

W/DECK - 3,5 MTS PER SQM

H/COVERS - 3,5 MTS PER SQM

T DECK - 2,5 MTS PER SQM

8 May 2000 13:30. Ernst Russ informs that the shipowners would expect a charter hire of US$ 4,800 per day. They gives a hint to Mansukhani, if she is really serious about the vessel, she would very likely get the vessel at US$ 4,700 daily [1]. Mansukhani comments on the fax sheet, that she expects a charter hire of US$ 4,650 per day.

[1] This method is also used to show the clients, how the broker works hard for them.

MV WORLD STAR / OLDENDORFF

LAYCAN 12/15 MAY

HIRE 4800 (DISCR AT USD 4700 FOR FIXING ONLY) [2]

TRADE EXCLS ISRAEL/TURKISH/CYPRUS OCC/LEBANON/

EX YUGO/NORWAY/SWEDEN/DENMARK/FINLAND/CUBA

CGO EXCL PLS PROPOSE

BOD 320/380 MT IFO/MDO

ALL SUBS DECL LATES COB TOM

SUB DETS

8 May 2000 14:28. Ernst Russ informs Mansukhani that the owners insists a charter hire of US$ 4,800 daily. More details pertaining a.o. allowed trading area are provided. A standard Charter Party form is proposed by the owners, namely the New York Produce Exchange (NYPE) Charter Party form. This phase is still not binding yet; a clause states that all agreement is subject to approval of the board of directors.

MV WORLD STAR/ ACCT EO

DELIVERY AFPS ST PETERSBURG ATDNSHINC

LAYCAN 12/15 MAY 2000 0000-2400 HRS

ONE TCT VIA GD AND SF PORT(S)/BERTH(S)/ANCHORAGE(S)

FM BALTIC TO USEC ALWAS AFLOAT ALWAYS WITH IWL, IN/OUT GEO ROTATION, MULTIPLE LOADING

TRADE EXCLS ISRAEL/TURKISH/CYPRUS OCC/LEBANON/

EX YUGO/NORWAY/SWEDEN/DENMARK/FINLAND/CUBA

HIRE USD 4800 DAILY INCLOT PAYABLE EVERY 15 DAS IN ADV

REDELIVERY DLOSP 1 SP BOSTON/GALVESTON RGE PICO ATDNSHINC

DURATION ABT 40 DAYS WOG

SUB CARGO EXCLUSIONS

BOD ABT 320 MT IFO AND ABT 130/150 MT MDO SAME ON REDELY

SUB CHARS BOD APPROVAL TO BE LIFTED 1800 HRS COB TIME 9 MAY 2000

SUB FURTHER TERMS/DETAILS AS PER CHRTS EXECUTED NYPE

The negotiation is interrupted, with unknown reasons.

3.1.2 MV LUCY OLDENDORFF/ Panocean

MV LUCY OLDENDORFF is currently trading in the Pacific. She has been offered to various brokers and ship operators, before her current Charter Party ends soon.

[2] Scratch of a chartering manager: “USD 4650, Cargo reverting”, E-Mail 8 May 2000

30 May 2000 12:35. Mansukhani receives a response from Clarckson-Dry Cargo, a broker, on her offer to them. The charterers, Panocean, intend to employ MV LUCY OLDENDORFF for a bulk cargo carriage in Singapore-Japan range, with a duration of approximately 30-40 days. The ship is to be delivered in Singapore. The redelivery will be at a port with Singapore-Japan range. Laycan dates are 9-12 June 2000. The charterers expect a charter hire of US$ 7,250 daily.

1. MV LUCY OLDENDORFF; {AND DETS}

2. ACCT : PANOCEAN

3. DELY: DLOSP[3] SINGAPORE ATDNSHINC

4. LAY/CAN: 9-12 JUNE 2000

5. ONE TCT VIA SA(S), SB(S), SP(S) AA, AWIWL TO S'PORE/JPN GE WITH L/HSS CGO IN BULK DUR ABT 30-40 DAYS WOG

6. REDEL: DLOSP 1 SP S'PORE/JPN RGE PICO ATDNSHINC

7. HIRE: USD 7250 DIOT PABLE 15 DAYS IN ADV

8. PAYMENT: 1ST HIRE AND VALUE OF CONSUMABLE BUNKER TB PAID W(I BKG DAYS AFT VSL'S DELY N CHTRS ARE ENTITLED TO DEDUCT FROM LAST SUFFICIENT HIRE PAYMENTS EST WONS DISBSMT

9. ILOHC: USD 2500[4] LUMPSUM

C/E/V FEE: USD 1000 PMPR

10. BUNKER CLS: PLS PROPOSE BEARING IN MIND CARGO IS 20,600 MTS M/M

11-22 . {hidden.}

She does not agree with point 9. She wants a US$ 3,500 lumpsum as an incentive for crew for hold cleaning.

30 May 2000 13:07. Mansukhani insists the laycan informed earlier[5].

LAYCAN : REPEAT CHRS LAST (NO BALTIME CLS)

30 May 2000 15:40. Clarckson wants a daily charter hire of US$ 7,300[6].

LAYCAN : REPEAT CHRS LAST (NO BALTIME CLS)

4. LAYCAN : REPEAT CHRTRS LAST (NO BALTIME CLS)

5. AS PER CHRSTRS LAST

6. REDEL: AS PER CHRSTRS LAST

[3]Mansukhani's note: 'passing'
[4]Mansukhani strikes it with '$3500'
[5]E-Mail from Viveka Mansukhani to Clarksons Dry Cargo, 30 May 13:07
[6]E-Mail from Clarksons Dry Cargo to Viveka Mansukhani, 30 May 2000 15:40

7. HIRE USD 7300[7] DIOT PABLE 15 DAYS IN ADV

8. PAYMENT: OK EXCEPT MAX USD 1000 PER PORT

9. ILOHC: USD 3000 LUMPSUM

C/E/V FEE: USD 1000 PMPR

10. BUNKER CLS: OK EXCEPT MIN IFO 550 MTS

13. AS PER CHRTS LAST

14. AS PER CHRTS LAST

17. REVERTING

30 May 2000 15:56. Mansukhani wants a charter hire of US$ 7,850 per day including overtime.

LAYCAN : REPEAT OWNERS LAST, OKAY SUBJECT TO CHRTS ADVISING INTENDED CARGO TO BE PART OF THIS WORDING

REDEL: REPEAT OWNERS LAST

HIRE USD 7850 DIOT PABLE 15 DAYS IN ADV

REPEAT OWNES LAST (WE ARE NOT ITF BUT THE BOYCOTT CLASE IN CP COVERS CHRTS AS DONE ON GRETKE OLDENDORFF)

Viveka scratches her thoughts, she believes that a fixture of $7,500 is feasible. Time is a critical factor. This seems to be the decisive factor:

LUCY OLDENDORFF /PANOCEAN

LAYCAN: 9- 14 NOON, NO BALTIME

INTN GRAIN

REDELY REPEAT, INTN FEAST

HIRE $7350 (feels $7500)

STOWPLAN REVERTING

SUBS + 24 HRS, STOW +24 HRS

I HAVE SAID I WOULD DO $ 7500 ON ERNST TO FIX.

LEAVE LUCY ALONE, DATES TOO TIGHT

No additional documents are available. The negotiation is interrupted.

3.1.3 Supporting information

How does Mansukhani estimate the charter hire? How does she know an appropriate charter value for her MV LUCY OLDENDORFF. Figure 3.4 illustrates the the J.E. Hyde Index dated 1 June 2000. A shipping index is made to provide a representative overview of the ship chartering.

[7] Mansukhani expects and notes it '$7850'

Charter negotiation (8 June 2000)

J.E. Hyde Shipping Index

Route	Type	Size	Details	01-06	08-06
1.	T/C	40,000-43,000 dwt	del Continent, trip Far East	9700	9500
2.	V/C	25,000 mt	5% HSS, USG/Algeria	21.50	21.50
3.	T/C	40,000-43,000 dwt	del/redel Spore-Japan, 1oTpac rv	9800	9700
4.	T/C	27000-30,000 dwt	del/redel Skaw/Passero, one Tatlantic rv	6600	6600
5.	T/C	30,000-33,000 dwt	del South Africa trip Continent	8700	8900
6.	V/C	25,000 mt	10% HS, USG/Venezuela	1250	12.50
7.	V/C	30,000-35,000 mt	scrap, USNH/South Korea	29.00	28.00
8.	T/C	35,000-40,000 dwt	del Singapore trip Biston-Galveston	9250	9100
9.	V/C	20,000-25,000 mt	steels, Black Sea/China	27.00	27.00
10.	V/C	25,000-35,000 mt	grain (sf 55'), Brazil/Antwerp-Hamburg range	19.10	19.10
11.	V/C	26,000-27,000 mt	bulk sugar, Queensland/Japan	18.00	18.00

?

??

MV Lucy Oldendorff
logs fitted bulkcarrier
1992 onomichi (Japan)
22.160 dwt/ 29,301 cbm grain
4 hold/4 hatches
gear 4x30 t
speed: 14 knots

Acct: Shinwa
Time Charter
Del: S'pore
Redel: Japan
Vlength: 35 days
TCE: $ 5639day

Acct: Swazi
Voyage Charter
Cargo: sugar
Lport: Maputo
Dport: London
Vlength: 50 days
TCE: $ 5832/day

Figure 3.4: J.E. Hyde Index dated 1 and 8 June 2000

The J.E. Hyde Shipping Index uses the size of ship, namely deadweight, as the only attribute representing a ship's characteristics. Eleven main bulk trades represent the main world's bulk trades. It becomes evident that such an index is inadequate to address the need of the industry. The negotiations MV LUCY OLDENDORFF/Shinwa and MV LUCY OLDENDORFF/Swazi are not covered by those indexed adequately.

How does she then know certain appropriate charter hire values for the ships, for those trades? Shipping Index gives too rough information about the industry; and a chartering practitioner cannot do about it. On should listen to views of brokers, cargo owners, media and all possible sources. From recent charter fixtures one can see the tendencies of the market. Such charter fixtures, published by brokers, are a collection of specific fixtures, see 3.2.2.

3.1.4 Decision making

The above are screenshots of communications of Mansukhani with brokers. Parallel negotiations of MV LUCY OLDENDORFF with a number of candidate charterers are conducted with a variety of speeds of progress. New options may evolve in the course of negotiations. Doo Yang, for example, intends to employ another vessel, MV ANTONIE OLDENDORFF, should they fail to obtain MV LUCY OLDENDORFF. Table 3.1 shows nine serious options taken for further considerations. Both popular types of charter parties, Voyage and Time Charter, are handled. Most negotiations are carried out through a broker, some details of the charterers, such as name and location, are not disclosed yet.

Negotiation 1 would expectedly deliver the highest Time Charter Equivalent (US$/day); that means Negotiation 1 is the most profitable one. TCE and Gross Profit per voyage prove not always to be the only considerations for making the decision. She decided to choose Negotiation code 8, with the following reasonings:

> *The negotiation with Shinwa on* MV LUCY OLDENDORFF*, negotiation code 8, is chosen since the negotiation has reached at an advances stage. The Charterers are willing to pay more than the market, perhaps due to the time limit the charterers have. They have most likely nominated a ship. The market in Pacific is better at this moment than in Atlantic. T/C is somehow less risky.*[8]

Panocean and Shinwa are willing to pay a much higher charter higher for MV LUCY OLDENDORFF, i.e. $7,500/day and $ 7,850/day respectively, whilst the average time charter hire for its class, a 22,000 dwt bulk carrier is about $ 5,900 /day.

J.E. Hyde reported[9] that the fuel price tend to increase. Increasing fuel price drives the shipowners to release their ship in a time charter negotiation, in order to avoid risks involving the voyage costs volatility due to the uncertain fuel price. At the moment of negotiation the Pacific market is firmer than the Atlantic market. Therefore she is reluctant to let the ship trade the Atlantic market after the end of the charter party, even though the time charter equivalent is highest among the others, see the negotiation code 1.

The last reasoning, says Mansukhani, is that the negotiation has reached an advanced stage. More details related to the negotiated charter party have become known to her. Those details include the delivery date, possible background information concerning the reputation of the charterers, potentials and risks related to the development of fuel price and ideas for the next charter party [10].

The above negotiation shows that the objective of the chartering negotiation is to obtain an acceptably satisfying result, instead of an optimal result. Probabilities of events of all available alternatives are not quantifiable.

[8]Viveka Mansukhani, E-Mail and interview on 31 May 2000

[9]J.E. Hyde report dated 30 May 2000

[10]The company expects from the staff to be able to make decision quickly too [21]

SHIP	LO	LO	LO	LO	LO	LO	LO	LO	AO
CHRS	Swazi Sugar	Pan-ocean	Doo Yang	-	Toepfer	-	-	Shinwa	Doo Yang
C/P	V/C	T/C	T/C	V/C	V/C	V/C	V/C	T/C	V/C
CGO	sugar	-	-	-	urea	pig iron	soda ash	-	-
LPRT/ DEL	Maputo	S'pore	S'pore	Visakha-patnam	Shuiba	Visakha-patnam	Momba-sa	S'pore	Visakha-patnam
DPRT/ REDEL	London	S'pore	S'pore/ S.Korea/ S.Japan	Inchon	Haiphong	Port Kelang	Jakarta	Japan	Inchon
DURATION	50	35	30	35	38	20	42	35	36
TCE	5,832	5,358	4,131	4,991	4,714	5,715	5,205	5,639	5,403
Code#	1	2	3	4	5	6	7	8	9

Table 3.1: MV LUCY OLDENDORFF/ MV ANTONIE OLDENDORFF : a chartering negotiation summary

3.2 Usable resources

Resources contain information which materializes many forms, such as published shipping indexes, market forecasts, market reports, expert's estimates, news and port information form local agents. Shipping practitioners spend a lot of time to obtain reliable information, to enable assessing the situations satisfactorily. Extensive phone calls, visits or lunches become important since one cannot rely merely on official and published information. The later is often too late or too inaccurate or too general. Few situations are unclear, which can be subject to interpretation. In practice subjective opinions and even gossips can therefore be valuable[11]. In this section the contents of those reports will be illustrated.

3.2.1 Tasks

Maritime forecasting and market research studies are the most common applications of maritime economics [73]. Maritime forecasting is concerned with predicting events on the shipping market as a whole, the prospects as a broad category of ship types and the overall level of supply and demand, see for examples Beenstock and Vergottis, Wergeland or Tang [8, 81, 75]. Maritime forecasting has a little relevance with the daily tasks of chartering and operations at operational management level.

Shipping market research is concerned with studying the economic actions of individuals or companies within the market or a market segment. It means a study of a specific ship, ship type, trade flow or business unit, generally relating to a specific business decisions [73]. Those matters concern the chartering and operations departments very much. The staffs of those departments are concerned with the prevailing rates of specific routes of interest for their ships.

Tasks addressed in the market research are a.o. [73]:

1. How will freight rates develop on the route?
2. What is the size of the market that is accessible to me and what share might I win?
3. What ship type will be cost effective in providing this service?

In daily practice, a chartering staff perhaps is not interested in the second and third questions, which usually the task of his manager. To perform his task, forecasts are irrelevant. The emphasis in market research is identifying the factors that will significantly influence the success or failure of a commercial decision. Estimating the value of a ship belongs to this category, as illustrated below.

[11] Henry Mintzberg and Tom Peters in [19, p. 166]

Usage of information	Past	Now and short term future	Long term future
Specific	Insurance & claims	Negotiation	Strategic management
Market	Strategic management	Strategic management	Strategic management

Table 3.2: Usage of information

Form of information	Past	Now and short term future	Long term future
Specific	Expert's estimates Fixture reports	Expert's estimates	None
Market	Shipping Index	Shipping Index	Shipping Forecasts

Table 3.3: Availability of information

Information is used by all levels of management and for various purposes. Past information, such as past newbuilding and secondhand prices of ships, past time charter hire and freight rates, can be of interest, see Table 3.2. The operational management level concerns in particular with specific matters, i.e. a certain ship's price or freight rate levels of a specific route which is usually not covered by shipping index. The interest in specific matters marks this level of management, since upon this information they can conduct the job. As shown earlier in Section 3.1, a shipping index does not cover most of information needed for daily chartering activities. Such a shipping index is useless to conduct a chartering negotiation well.

Recent fixture reports can be of interest, in order to be able to estimate the prevailing rates of a specific size of ship, of a specific route or trade. Past prevailing rates or secondhand or newbuilding price of a ship can be of interest in case of marine casualty. In case of cargo claims or hull and machinery claims, one needs to trace back to the past situations, past charter rates or past prices.

The operational management level does not concern very much with long term forecasting. Information of a market segment, for example a segment of a shipping index, does not concern them very much either. Its information is too general to be useful. The later is of interest to the strategic management level, the chairman or president director of the company.

Not all information is needed. Long term forecast of a very specific trade or of a certain ship is not that useful, and it is rarely available. Specific information on current prevailing rates is very relevant for daily shipping practice. A chartering staff must have the capability to estimate the prevailing rates of her/ his ship. They must act as an expert in his own field, see Table 3.3. In a bigger issue concerning S+P or huge damage claims, it is a common practice, to ask an independent broker's opinion. Such a step is useful in order to make sure that the company, even a successful one, assesses the values more accurately. It is evident that daily activities cannot rely on available information, both shipping indexes and shipping forecasts. Nevertheless attention has been paid very much in developing forecasting methods instead, as will be shown later in this section. A little effort has been made for addressing daily shipping problems.

3.2.2 Fixture reports

Time charter, voyage charter, sale and purchase fixtures are useful information. Those are published daily by Baltic Exchange, and distributed daily or weekly by various ship brokers, such as Wonsild & Sons A/S or Ernst Russ. Those fixture reports contain solely fixtures settled few recently. The information is plain, brief without comments, for example as follows[12] :

> TIME CHARTER
>
> "MV WASHINGTON TRADER" 2000 74000 dwt dely S Korea 9/15 June trip via Queensland redel Far East $ 1250 daily - NYK
>
> "MV GLOBAL F" 1998 73729 dwt dely Hong Kong 15/25 June trip via Indonesia redel Japan $ 12500 daily - MOL-Navix
>
> GRAIN
>
> "MV LARA" 6000/5 hss US Gulf/Egypt + options end June $16.50 fio 10000/7000 - Cargill
>
> COAL
>
> "MV CAPE MARIA" 150000/10 Richards Bay/ Hadera 1/10 July appprox $9.30 fio scale/20000sx - NCSC
>
> MISC
>
> "MV AVRA" 55000/10 phosrock Casablanca/Lasero Cardenas mid June $11.85 fio 12000sc/8000sc

Such fixtures contain specific chartering situations. Those are helpful, and often used as a reference during chartering negotiation, to estimate the prevailing rates for a specific trade.

[12] Wonsild & Son A/S Shipbrokers, dated 06 August 2000

3.2.3 Forecasting reports

Describing carefully and precisely situations, either past, current or future, involve not only numerical but qualitative information as well. Long term forecasts are not closely relevant to daily shipping practice, but those can be of use for the top management to shape the mid and long term strategic decisions of the company. Numerous exogenous factors, experts' opinions on on-going events and their effects to shipping become important to them. Some differences in the opinions may occur:

> *We noticed an article of the last month's IBJ magazine*[13] *continuing to predict some grey clouds on the horizon for Panamax tonnage, mainly based upon the new building programs. We do accept the reasoning but still maintain that for this year into the next, increased activity in the commodity markets will enable the overall freight market to cope with the influx of new tonnage.*[14]

In shipping maritime forecasts have a poor reliability. Nevertheless, forecasts are still needed, since one needs to have a view of the future [73]. The following sub-sections highlight few forecasting reports.

Maersk broker report

Reports on a country's economy involve qualitative aspects which are to be digested before arriving at an action. Maersk Broker' report on Japanese Market/Economy is an example of it. It comprises for points: political issues, general economics / macro factors, company / industrial views and financial markets.

Political issues elaborate on the dissatisfaction of the public on the policies and the overall management of the government concerning the handling of the government upon the casualties of natural disasters (volcanic eruptions). Japan has been hit by more than 100 earthquakes in 2000 some measuring more than 6.5 on the Richter scale.

Under "General economic factors" it mentions the improvement of the consumer confidence and the improved GDP growth. The Moody's ratings on yen-dominated domestic securities issue has been lowered. Under the section "Company / industrial news" it illustrates few figures reflecting the industry and its conclusions:

> *Japanese bankruptcies soared by 21 percent per year-on-year in July with 1,617 bankruptcies in July alone. Total accumulated corporate debt in bankruptcies doubled in July compares*

[13] *International Bulk Journal*

[14] Robert Matthews, J.E. Hyde London Freight Market Comment dated Friday 7 July 2000

> *to June and has now reached a post-war high of yen 4,260 billion. Most of debt is though attributed to the bankruptcy of the retail chain Sogo totalling yen 2,290 bn.*
>
> *To match the recent recovery in demand for steel, major steel makers have been increasing output at their main production plants, and the crude steel output is expected to reach the psychologically important figures of 100 million tons this fiscal years for the first time in three years.*[15]

Financial markets elaborate the appreciation of the Japanese Yen, which was primarily seen as a result of the Bank of Japan ending of the zero interest rate policy, in place since 1995. The Yen /US$ started the month of August around the 109 level ending the month at around 106, a strengthening of about 103.

Fairplay Forecast

This forecast is written by Maritime Strategies International for Fairplay. The report starts with a general overview on the world economy:

> *... forecast for the next ten years based on annual growth rate of 2.6 percent, and has assumed a sustained recovery in Asia - including stronger grain imports and a much improved economic performance in Japan. MSI has also excluded any major economic recessions during the coming decade and a significant upwards shift in energy prices.*[16]

In the supply side, assumptions are made based upon the MSIS's belief that the old tonnage of over 20 years old will grow. Their assumption on the supply side is that the key factor in assessing future development is the size of 25+ year-old fleet that is potentially available for scrapping. Their further assumptions:

1. Increasing scrapping
2. Vessels of over 30 years old will still be allowed to sail
3. New-building tonnage's delivery is higher than the scrapping.

On the demand side they assume that steam coal will play a more important role in the coming decade, as India and South East Asia have been building new coal-fired power plants. West European stem coal demand is also expected to rise, continuing a revival that started after a major interruption in the first half of the 1990s, caused mainly by the UK's 'dash for gas'.

[15] Japan Market Update by Maersk Broker, Copenhagen, fax dated 25 September 2000
[16] Fairplay Market Forecast - Dry Bulk 2000

Route / Duration	Deadweight (t) min	Deadweight (t) max	Charter type	Last week US$/d	This week US$/d	Outlook
Trans Atlantic r/v	45000	47000	V/C	8250	8250	steady
	42000	43000	V/C	7500	7500	steady
	37000	38000	V/C	6750	6750	steady
	28000	32000	V/C	6250	6250	steady
USG/ Far East	45000	47000	V/C	10250	10250	steady
	42000	43000	V/C	9750	9750	steady
	37000	38000	V/C	9000	9000	steady
	28000	32000	V/C	8250	8250	steady
Pacific r/v	45000	47000	V/C	8400	9300	softening
	42000	43000	V/C	8800	8700	softening
	37000	38000	V/C	7400	7400	softening
Continent/ Far East	45000	47000	V/C	10000	10000	steady
	42000	43000	V/C	9500	9500	steady
	37000	38000	V/C	8500	8500	steady
	28000	32000	V/C	7500	7500	steady
Mediterra nean/ Far East	45000	47000	V/C	10250	10250	steady
	42000	43000	V/C	9500	9500	steady
	37000	38000	V/C	8500	8500	steady
	28000	32000	V/C	7500	7500	steady
Far East/ Europe	45000	47000	V/C	9000	9000	softening
	42000	43000	V/C	8400	8400	softening
	37000	38000	V/C	7500	7500	softening
12 months T/C	45000	47000	T/C	10000	10000	steady
	42000	43000	T/C	9400	9400	steady
	37000	38000	T/C	8200	8200	steady
	28000	32000	T/C	7500	7500	steady

Table 3.5: Lorentzen-Stemoco Handy Size Outlook, dated 22 June 2000

In the grain trades, the 1990s have been a decade of under-achievement. But the decade is set to end on a more positive note, MSI believes, pointing to underlying growth in imports by Latin America, Africa, the Middle East and much of developing Asia. Population growth alone will drive grain expansion, but this will be coupled by limitations on production growth, not least because of limited potential to increases harvest areas in importing countries.

As a result, grain imports will rise faster than consumption over the next ten years and seaborne cargoes will average more than 200M tonne

Route/duration	Cargo (ton)	Charter type	Last week US$/d	This week US$/d	Outlook
hss Gulf/Continent	55000	V/C	15.75	16.00	firm
hss Gulf/Japan	52000	V/C	23.75	24.00	firm
Trans Atlantic r/v	-	T/C	12000	12250	firm
Pacific r/v	-	T/C	11500	11500	easing
Trip Atlantic/ Far East	-	T/C	12000	12250	firm
Trip Far East / Atlantic	-	T/C	11400	11250	easing
12 months T/C	-	T/C	11000	11250	firm

Table 3.7: Lorentzen - Stemoco Panamax outlook, dated 22 June 2000

per year, reaching 240M tonne at the end of the decade. As imports by developing countries rise, so will the incentive to develop cargo-handling facilities, which will be the greatest benefit to Panamaxes, MSI believes. But sub-50,000 DWT handy tonnage will remain the main workhorse of the grain trade, accounting for almost 60 per cent of required DWT demand in 2010.

Lorentzen and Stemoco

Lorentzen & Stemoco publishes the Weekly Market Outlook for both dry and wet bulk cargo. The dominant markets are Pacific and Atlantic markets, which are highlighted and commented, for example :

> *Better rates could appear for handy size tonnage plying the Black Sea to Far East steel trade. Since there is a shortage of suitable vessels in the area, this could eventually have an effect on the trade.*[17]

[17] Lorentzen & Stemoco Weekly Market Outlook, on Handy size sector of the dry bulk shipping, 11 August 2000.

Route	Deadweight (t)		Charter type	Delivery/ Loading ports	Redelivery/ Disch. ports	Cargo/ Remarks
	min	max				
1	35,000	45,000	trip time	Continent	Far East	-
2	25,000	-	voyage	US Gulf	Algeria	5% HSS
3	40,000	45,000	trip time	Singapore	Japan	Transpacific round voyage
4	25,000	30,000	trip time	Skaw	Passero	Transatlantic round voyage
5	30,000	35,000	trip time	South Africa	Continent	-
6	20,000	-	voyage	US Gulf	Venezuela	10% HSS
7	30,000	35,000	voyage	USNH	South Korea	scrap
8	35,000	40,000	trip time	Singapore	Boston-Galveston	-
9	20,000	25,000	voyage	Black Sea	China	steels
10	25,000	35,000	voyage	Brazil	Antwerp-Hamburg range	any grain (sf 55')
11	20,000	23,000	voyage	Queensland	Japan	bulk sugar

Table 3.9: J.E. Hyde Shipping Index

Handy size tonnages are divided into few classes, according their size and trading area. Lorentzen & Stemoco uses a 'standard' bulk carrier of age less than 15 years old and having cranes on board. The sizes of ships of handy size class are clustered into five groups, see Table 3.5. For Panamax class bulk carriers, all ships are groups into one, see 3.7. Those definitions on the ship are apparently adequately accepted and understood by the shipping practitioners. The outlook is expressed in qualitative terms, such as stable, firm, easing or softening.

3.2.4 Market index

J.E. Hyde Handysize Index divides the Handy size bulk shipping into eleven routes. Each has its own typical size of ships, see Table 3.9. Figures 3.5 and 3.6 show the development of the Time Charter and Voyage Charter Indexes.

Efforts to provide a more objective assessment on the development of dry bulk market is performed by the Baltic Freight Future Exchange (BIFFEX). The index they publish is made by a number of panelists consisting of influential shipping market research companies and ship brokers, in London.

3.3 Tools

Tools comprise methods or programs assisting shipping practitioners to conduct their job. To this date the tools used basically do not differ very much from those used in the past. Apart from the fact that computers have become an important part of running ship business, the way the things are conducted are still manual. Many assessment and planning tasks are still performed manually. No computer program supports the employee for assessing the values of ship or to generate forecasts. The shipping practitioners rely much on the skill to conduct their job.

The next section elaborates a simple and very useful tool to help assess the merit of a voyage, called the voyage calculation. Then it will be elaborated on methods used shipping research to address shipping problems, particularly concerning valuation and decision making tasks.

3.3.1 Voyage estimation

Voyage estimation is a procedure for calculating the return/ profitability a ship will make for a particular voyage [61][18]. The calculation is made by a

[18] There is not standard term for denoting this procedure. Many prefer using the term 'estimation' instead of 'calculation' to indicate that the values used are *meant* as estimations or approximations. As port or canal disbursements, claims, charter hire and other outstand-

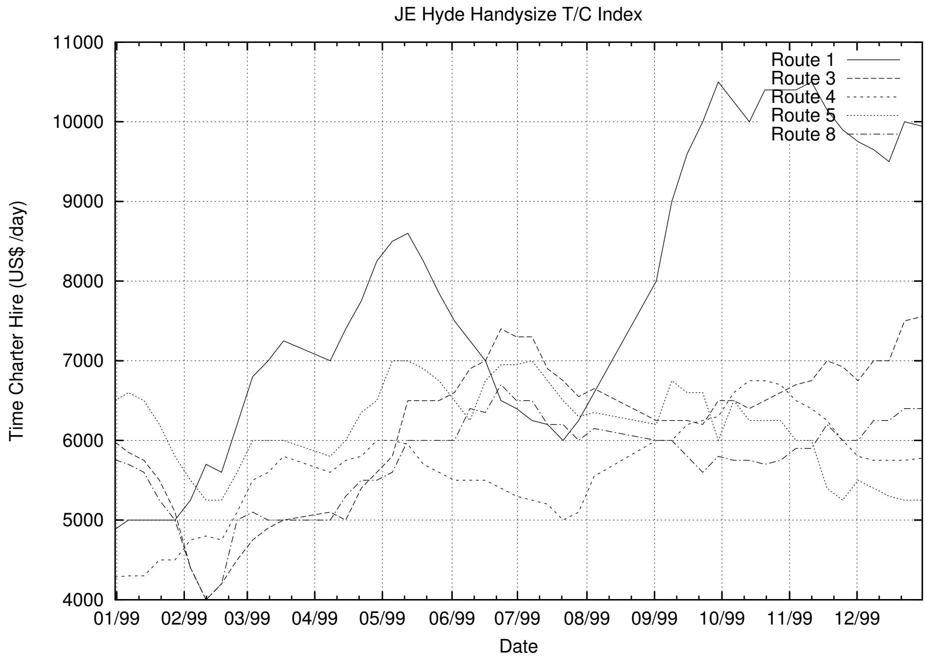


Figure 3.5: J.E. Hyde Time Charter Index 1999

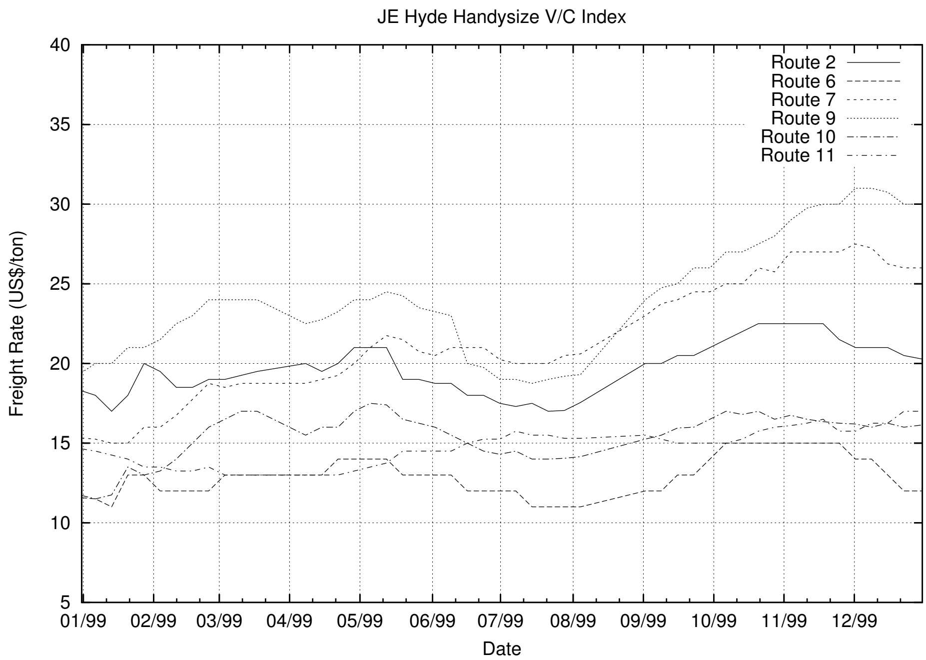


Figure 3.6: J.E. Hyde Voyage Charter Index 1999

chartering staff in the beginning of a chartering negotiation. He may need to adjust some values in it as the negotiation progresses. Figure 3.7 shows a classical voyage estimation form. To this date such a structure does not change very much. Available software enables the user to accomplish such a calculation faster plus additional facility such as sensitivity analysis.

The voyage estimation incurs all aspects involved with the operation of a ship. Important variables are time, cost and income:

1. Time depends upon: (a) voyage distance between redelivery ports (b) possible deviations (c) cargo handling time
2. Costs are determined by (a) port and canal dues (b) claims (c) commissions
3. Income is determined by: (a) amount of cargo loaded (for voyage charter) (b) length of voyage (for time charter)

Two important information delivered by the voyage estimation are Time Charter Equivalent (TCE) and Gross Profit per Voyage (GP). TCE and GP play an important role in decision making, beside other factors such as the progress of negotiation and some subjective preferences.

Table 3.11 shows a sensitivity analysis of a voyage chartering negotiation of MV LUCY OLDENDORFF. The redelivery port of the previous charter party is Mumbai (Bombay), and the voyage estimation is assumed to start from Bombay too. The cargo to be carried is soda ash. Mansukhani has an eye on obtaining cargo from Bangkok area, therefore the redelivery port will be in Bangkok. Its route will become Mumbai - Mombasa - Port Kelang - Jakarta - Bangkok. She applies safe assumptions on loading and discharging rates, bunker price, sailing days are reasonable, as she has included 1.2 days as extra sailing days and 2 extra port days. And those assumptions are fixed. The sensitivity analysis gives her a good overview on the relation between freight rates and their results. It helps her very much to respond fast in this negotiation.

3.3.2 Statistics

There are two categories of statistics, descriptive and inferential statistics [26]. Descriptive statistics is used to organize and summarize the data in samples and populations. This includes procedures of ordering and grouping data into distributions and procedures for representing the data graphically. Inferential statistics is used to make educated guesses (inferences) about populations based on random samples from the populations. The

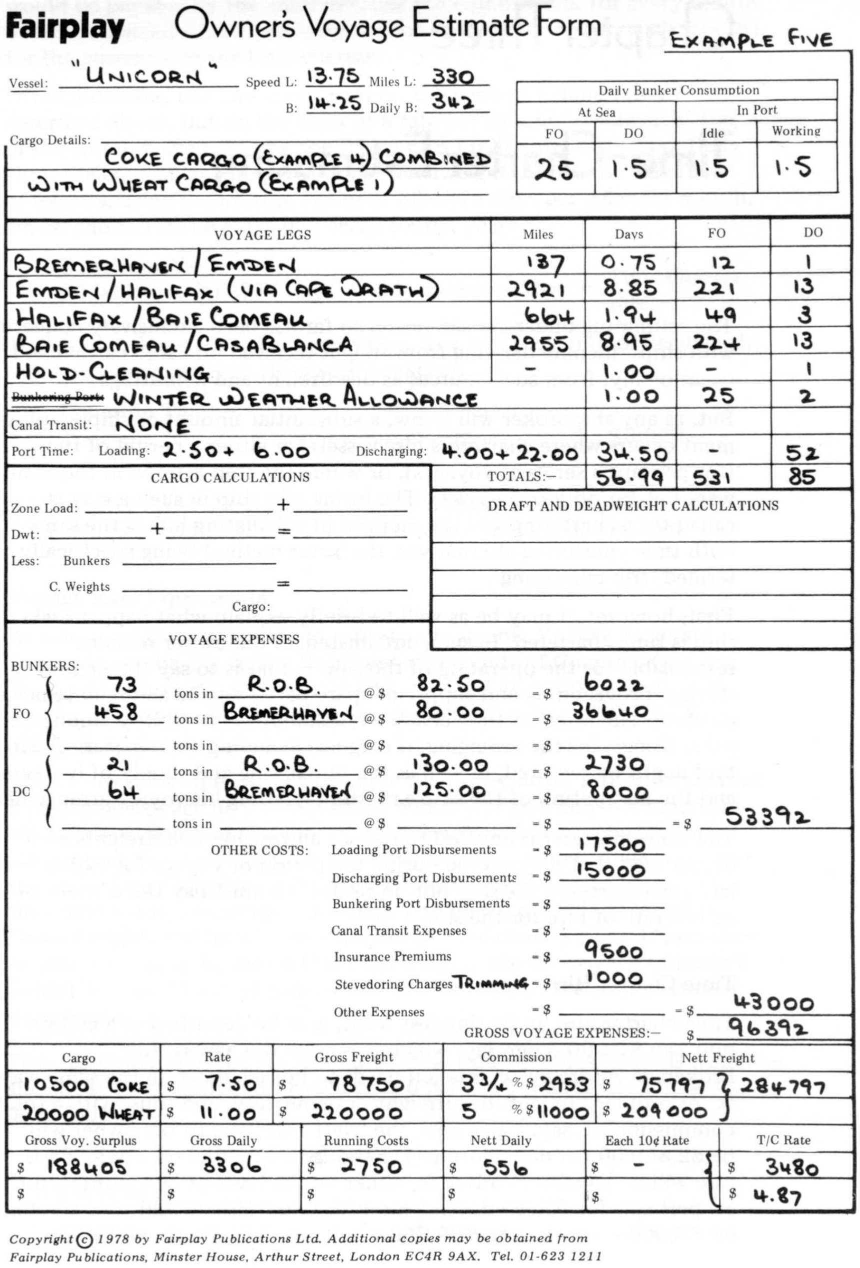
ings are still open, approximations are useful information, as the company's management wants to be kept informed on the merits of the operations of their ships.

Baltic Capesize Index	
1	Arrow Chartering (UK) Ltd.
2	Branchero Costa & C SpA
3	Braemar Shipbrokers Ltd.
4	H Clarkson & Co Ltd
5	Fearnleys A/S
6	Galbraith's Ltd.
7	EA Gibson Shipbrokers Ltd
8	Howard Houlder & Partners Ltd
9	Howe Robinson & Co Ltd
10	Ildo Chartering Group
11	Simpson, Spence, Young Shipbrokers Ltd
12	Sobelnord SA (Dry Cargo Dept.)
13	Socomet Chartering

Baltic Panamax Index	
1	Branchero Costa & C SpA
2	H Clarkson & Co Ltd
3	Fearnleys A/S
4	Galbraith's Ltd
5	E A Gibson Shipbrokers Ltd
6	Howard Houlder & Partner
7	Howe Robinson & Co Ltd
8	Ifchor SA
9	John F Dillo & Co
10	Simpson, Spence & Young Shipbrokers Ltd
11	Yamamizu Shipping Co. Ltd

Baltic Handy Index	
1	Angus Graham & Partners
2	H Clarkson & Co Ltd
3	Fearnleys A/S
4	Howe Robinson & Co Ltd
5	J.E. Hyde & Co Ltd
6	John F Dillon & Co
7	Lawrence (chartering) Ltd
8	A N Peterson A/S
9	Simpson, Spence & Young Shipbrokers Ltd
10	Yamamizu Co Ltd

Table 3.10: Baltic Index panelists[19]



Fairplay Owner's Voyage Estimate Form — EXAMPLE FIVE

Vessel: "UNICORN" Speed L: 13.75 Miles L: 330
B: 14.25 Daily B: 342

Daily Bunker Consumption			
At Sea		In Port	
FO	DO	Idle	Working
25	1.5	1.5	1.5

Cargo Details: COKE CARGO (EXAMPLE 4) COMBINED WITH WHEAT CARGO (EXAMPLE 1)

VOYAGE LEGS	Miles	Days	FO	DO
BREMERHAVEN / EMDEN	137	0.75	12	1
EMDEN / HALIFAX (VIA CAPE WRATH)	2921	8.85	221	13
HALIFAX / BAIE COMEAU	664	1.94	49	3
BAIE COMEAU / CASABLANCA	2955	8.95	224	13
HOLD-CLEANING	-	1.00	-	1
~~Bunkering Port~~ WINTER WEATHER ALLOWANCE		1.00	25	2
Canal Transit: NONE				
Port Time: Loading: 2.50 + 6.00 Discharging: 4.00 + 22.00		34.50	-	52
TOTALS:—		56.99	531	85

CARGO CALCULATIONS

Zone Load: +
Dwt: + =
Less: Bunkers
C. Weights =
Cargo:

DRAFT AND DEADWEIGHT CALCULATIONS

VOYAGE EXPENSES

BUNKERS:

	tons	in	@ $	= $	
FO	73	R.O.B.	82.50	6022	
	458	BREMERHAVEN	80.00	36640	
DO	21	R.O.B.	130.00	2730	
	64	BREMERHAVEN	125.00	8000	
					= $ 53392

OTHER COSTS:

	= $	
Loading Port Disbursements	17500	
Discharging Port Disbursements	15000	
Bunkering Port Disbursements		
Canal Transit Expenses		
Insurance Premiums	9500	
Stevedoring Charges TRIMMING	1000	
Other Expenses		= $ 43000
GROSS VOYAGE EXPENSES:—		$ 96392

Cargo	Rate	Gross Freight	Commission	Nett Freight	
10500 COKE	$ 7.50	$ 78750	3 3/4 % $ 2953	$ 75797	284797
20000 WHEAT	$ 11.00	$ 220000	5 % $ 11000	$ 209000	

Gross Voy. Surplus	Gross Daily	Running Costs	Nett Daily	Each 10¢ Rate	T/C Rate
$ 188405	$ 3306	$ 2750	$ 556	$ -	$ 3480
$	$	$	$	$	$ 4.87

Figure 3.7: A classical form of voyage estimation [61]

TCE	Freight	TCE	Freight	TCE	Freight
4450	34.19	4950	36.05	5450	37.91
4550	34.56	5050	34.42	5550	38.29
4650	34.93	5150	36.80	5650	38.66
4750	35.31	5250	37.17	5750	39.03
4850	35.68	5350	37.54	5850	39.41

Table 3.11: Sensitivity analysis of a V/C negotiation : MV Lucy Oldendorff - Mombasa/Jakarta, dated 30 May 2000

later is a very powerful tool which is available in statistics, which is frequently used to reveal 'the secret' knowledge hidden by the data. Statistical procedures are tools for learning about the world by learning from data [26]

A very important notion in statistics is the concept of probability. Probability indicates the relative amounts of a certainty that an event will occur. An event is a value or range of values on the variable being measured. An example of an event is the size of vessel lower than 10,000 dwt. All observations on ships smaller than 10,000 dwt are instances of this event. Very similar to the concept of probability is the relative frequency. A relative frequency refers to what has been observed in the past, and it is obtained by collecting data. On the other hand probability refers to the future. It indicates the chance of some event occurring in the future. As far as the *numbers* are concerned, the mean, variance or distribution of both relative frequency and probability are the same, except the interpretation is quite the opposite. Probability may also be interpreted as giving an estimated relative frequency of an event in future random sampling from the population.

Regression and correlation are procedures for describing how the scores in two populations are related. Regression is used to find the best fitting line that relates the scores. Correlation is used to describe the *strength* of the linear relationship, it does not describe the causality of a relationship.

Design characteristics and performance

Wijnolst and Bartelds [79] endeavored to answer the question "Are there bulk carriers consistently over-performing or under-performing the overall market ?" using the period time charters and grain charter index of Panamax bulk carriers 1989 - 1994.

After some indexing procedures, middle values are removed, leaving the data split into two poles, ships with low and high charter rates. Correlation techniques are then applied for both groups, to find out whether design characteristics including age of vessels play inherently a role in its commercial success.

A factor which plays an important role is the quality of the ship management. This is in fact the perceived quality or reputation of the ship management. And this is a subjective factor. An assessment on the value of ship are expectedly to produce a better result, if the subjective perception on the way the ship is managed is the same. This can be achieved when the valuation is made from the view of one party, i.e. one shipping company with its own philosophy and its own way to conduct the business.

He reveals that there are no specific design characteristics resulting in an outstanding economic performance. He concludes:

1. Only a small number of bulk carriers either overperform or underperform the market systematically.
2. The overperforming and underperforming vessels do not show typical design characteristics, except fuel consumption. The more subjective factors like the quality of management may play an important role.
3. Sum of charter hire and fuel costs are more or less constant, at approximately US$ 13,000 per day for all ships, irrespective of age.
4. Really one factor which determines the average charter rates, namely fuel consumption. And that the charter market is almost perfect.

Price-volume relationship in sale and purchase market

Alizadeh and Nomikos investigate the price-volume relationships in the market for second-hand dry bulk vessels [6]. Econometric techniques are employed to investigate both relationships between price changes and level of trading activity, for three different vessel classes as well as a general dry bulk price index. They found the existence of a significant positive relationship between price changes and activity in the sale and purchase market for dry bulk vessels.

3.3.3 Econometric modelling

It appears that a huge number of research papers have been focusing on understanding the *functioning* or *mechanisms* of the shipping system. Freight rate and ship's price movements have attracted many shipping researchers' attention; and there is a large literature on the properties of freight rates [76]. Tinbergen believes that ship's prices and freight rates tend to move cyclically. He suggests that a sinusoidal function would be adequate to model the ups and downs of the prices and rates.

Evidences from modern literature show that freight rates and the second hand values of ships follow random walks. Berg-Andreassen studies the freight rates of the dry bulk markets of the Baltic Freight Index (BFI). He concludes from the indexes within the 1985-1988 period are not cyclical, but they move randomly. That means that high prices are not necessarily followed by lower prices.

Goncalves develops a method for determining the optimal policies for ship chartering [27]. He believes that forecasting models are useful, but inadequate to solve the problem. Nevertheless forecasting is at he first step towards a more rational decision making process [20]. His views on the method development for obtaining optimal chartering policies ".. to consider a stochastic process of freight rates with some sort of mean reversion. In this way, the effects of shipping cycles and short term seasonality would be included. For this case, I expect a more complex mathematical development in particular with respect to optimal policies and parameter estimation. Possibly, the discrete time version with simpler policies will be a starting point".

Forecasting has a poor reputation in maritime circles. The argument that forecasts are never right is often put forward with a great conviction by shipowners who have been far too successful in business to have their opinions taken rightly [73].

Evans evaluates the performance of shipping markets [22]. In short term he believes that shipowners are profit maximizers and that market rates are equal to marginal costs. It is an evidence that the existence of allocative efficiency of resources. He relies his analysis on the assumption that the knowledge of the market is perfectly known. The exchange of information between ship brokers in local, regional or international exchanges ensures that the current state of supply and demand is known with some degree of certainty.

Adland [5] investigated the performance of theoretical models for vessel evaluation and investment decisions in shipping. He introduced non parametric freight rate models in maritime economics, a methodology that is often used in empirical financial research but has yet to be applied to shipping. The research can possible uncover the efficiency of the second-hand market or can yield superior return from asset play.

He shows a relationship between time charter rate and the values of a vessel. Freight rate and time charter rate have a very close relationship. These represent long-term expectation of earning. Second hand values lie between newbuilding and scrap values. The price of new vessels generally represent the steel, outfitting material, labor costs and yard's profit. Likewise, the scrap value is the price the demolition yard is willing to pay for the recoverable steel and material content of the ship.

Adland believes that the capacity adjustment is the main driving force

[20] Rational means a. relating to reason; not physical; mental. b. agreeable to reason; not absurd, preposterous, extravagant, foolish, fanciful, or the like; wise; judicious; as, rational conduct; a rational man [1].

in freight market mechanism. The supply-demand mechanism is viewed as a process: "when there is too little supply, the market rewards the inventors with high freight rates until ships exit from lay-up and more ships are ordered..."

3.3.4 Decision theory

Decision theory is an attempt to formalize the decision process by taking account of the expected circumstances and by involving probabilities where they are quantifiable, either from previous experience or from market research [23]. The consequence of any decision is expressed in terms of a payoff or a loss and is the result of the interaction of the action taken and the actual state of the world which prevails.

Non-probabilistic criteria for decision making

Decision is made based upon three options, see Table 3.12:

1. Maximin rule: which is based on finding the smallest *payoff* for each action and the choosing the action for which this is largest.
   Maximin (A_i) = max(min($x_{i1},\ x_{i2},\ x_{i3}$))
2. Maximax rule finds the largest possible *payoff* for each action ad chooses for which this the largest.
   Maximax (A_i) = max(max($x_{i1},\ x_{i2},\ x_{i3}$))
3. Minimax rule is based upon the idea to make a very cautious decision based which is least harmful, i.e. least loss. This rule finds the maximum *loss* for each action and then chooses the action where this is the smallest
   Minimax (A_i) = max(min($y_{i1},\ y_{i2},\ y_{i3}$))

Applying the negotiation data of Mansukhani to the above:

The above table is not sufficient to describe the decision making process really conducted in practice of shipping. Other aspects pay an important role, namely the reputation/ name of the charterer, stage of negotiation, cargo potential at main world's regions. The information of the later is not always numerical. It is not clearly either the degrees of importance of those aspects among each other.

More complicated problems are best considered using a decision tree [23]. A decision tree is a graphical method of expressing, in chronological order, the alternative actions that are available to the decision maker and the choice determined by chance [30].

The diagram grows from left to right as a logical sequence of events unfolds. The decision tree diagram comprises decision forks and chance

Pay-off	Situations		
Action	Θ_1	Θ_2	Θ_3
A_1	x_{11}	x_{12}	x_{13}
A_2	x_{21}	x_{22}	x_{23}
A_3	x_{31}	x_{32}	x_{33}
A_4	x_{41}	x_{42}	x_{43}

(a) Pay-off table

Loss	Situations		
Action	Θ_1	Θ_2	Θ_3
A_1	y_{11}	y_{12}	y_{13}
A_2	y_{21}	y_{22}	y_{23}
A_3	y_{31}	y_{32}	y_{33}
A_4	y_{41}	y_{42}	y_{43}

(b) Loss table

Table 3.12: Pay-off and loss tables

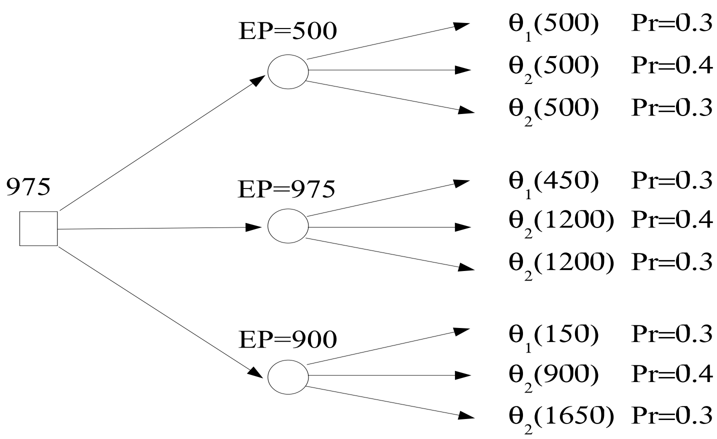


Figure 3.8: Decision tree

forks. The probabilities and expected payoffs at each chance fork are computed and at each decision fork the action with the largest expected payoff is chosen.

Remarks

The decision theory requires that all information must be input and presented numerically. And the degrees of importance among the variables must clearly / numerically be defined. All decision-making problems contain similar features [23], see also Chapter 4, sub-section 4.2.1:

1. a choice or a sequence of choices
2. information is partly available or if information is available it can be subjective
3. possibility of obtaining further information at a cost.

Applying the decision theory: a case of chartering negotiation

Now we explore the feasibility of applying the decision theory for a real case, the chartering negotiation of MV LUCY OLDENDORFF by Ms Mansukhani, mentioned earlier in this Chapter. Table 3.13 shows the probabilistic pay-off and loss tables. Many fields of the above tables are empty, or not known. The decision maker does *not* quantify the values for various situations and their respective chances. The values in the table are changing continuously during the negotiation, and she still does not attempt quantifying the empty fields. Quantifying the payoffs in various situations and the probability of occurrence of those situations are not viewed necessary.

Decision making has also a time limit. The limitation is not only determined by the the laycan dates of the ship, but also the assessment on the state of negotiations with other parties on the very same object. Just short before a negotiation reaches a mature stage, where only minor terms are to be agreed upon, a decision maker will make a clear cut, which one will be chosen.

All processes of negotiations can suddenly be halted. In most on-going negotiations there is a clause stating that the board of director may lift the agreement. This is a risk which has to be taken into account. The things which seem to be very promising during the process of negotiation can suddenly be meaningless, when the other party decided to make a deal with another party. A point to note which considerations are decisive: Not only to a negotiation with a reasonable return, but also a negotiation which best lead *to fixing the charter party*, as shown by the Mansukhani's chartering negotiation illustrated earlier in Section 3.1.

The decision theory proves impracticable in ship chartering. The shipping practitioners assess the chances of success of fixing a charter party, but they do *not* force themselves into quantifying the probabilities of events. They are comfortable with they way it is carried today. And it is the natural way of decision making. Formalizing today's natural way of decision making to a mechanistic way laid out by the decision making theory would slow down the process of decision making and it would simplify the complexity of decision making very much.

Expressing a strategic alliance consideration, which may allow a low time charter equivalent, in the way it is expressed qualitatively, is better and more understandable than in the form of scores. Applying the method would mean degrading the expertise degree of the expert [19].

3.3.5 Views on shipping practice

Newbuilding market is fluctuative. Macro-economy, demand for and supply of ships, exchange rates affect the S+P prices of ships. In order to develop the right strategy (right time, right place, right currency), sufficient information and *experience* is required [45, p. 145]. What kind of experience is it? Gardner et al examined the role of seafarers in UK. For some 70% of shore-based shipping jobs it is considered essential for the candidate employees to have gained seafaring experience [15]. Jobs falling under this category are from survey, maritime operations till financial positions (insurance, banking, chartering). The remaining 30% is seen of advantage if the candidate has seafaring experience. Therefore a number of successful shipping managers have seafaring experience in the past. The British government recognizes 'the need to maintain the pool of people with seafaring skills and experience to fill jobs in the shore-based maritime-related economy'.

Intuition always plays an important role in shipping practice. Various tasks concerning the value assessment and decision making in chartering, sales and purchase involve intuitive judgments. Ship valuation is an important task in shipping. Prices recommended by a shipbroker rely very much upon his knowledge, his experience and, which Pineus calls "the feeling in his little finger". The reality of shipping today is still relevant with the description of Pineus. Further more Pineus argues [63]:

> *To know the market and its tendencies in the overall field is the professional talent of the broker, acquired after long experience. There may be particular trades where the specialist broker may be the greater authority. The assessment of the 'trend of the market" is no exact science, it is rather a knack of the professional man, the broker.*

Norman (1979) argues that shipowners are too strongly influenced by *current* spot rates in their assessments of future market conditions, and that

Pay-off	Situations		
Action	Θ_1	Θ_2	Θ_3
Swazi	x_{11}	N/A	N/A
Panocean	x_{21}	x_{22}	x_{23}
Doo Yang	x_{31}	N/A	N/A
Toepfer	x_{41}	N/A	N/A
P(Θ_j)	N/A	N/A	N/A

(a) Pay-off table

Loss	Situations		
Action	Θ_1	Θ_2	Θ_3
Swazi	N/A	N/A	N/A
Panocean	N/A	N/A	N/A
Doo Yang	N/A	N/A	N/A
Toepfer	N/A	N/A	N/A
P(Θ_j)	N/A	N/A	N/A

(b) Loss table

Table 3.13: Probabilistic pay-off and loss tables applied for Mansukhani's negotiation

this is the reason why owners are seemingly *irrational* in their contracting decisions[21] [27].The valuation process in practice follows the following procedure: first is look at similar vessels sold recently or currently offered for sale [5]. Then compare its age. A rule of thumb: ship is depreciated over 15-20 year. the depreciation is 5-6% annually . Third, speed. 2% value difference per knot. Clearly valuation process is quite simplistic and subjective, and is not directly related to the expectations of future earnings .

Adland observes that the shipowners do not always decide rationally [5]. This adds to the irregularity of the market. "Since shipowners are constantly trying to second-guess the cycle, crowd psychology is believed to play an important role in this game and adds to the irregularity". In spite of his advocation for using mathematical models, he admits The results can not yet challenge the existing valuation method in shipping.

3.3.6 Research agenda

The methods mentioned earlier in sub-sections 3.3.2 and 3.3.3 can be summarized as follows: They treat shipping system as a blackbox, see Figure 3.9 (a). Then they aim at making it more transparent, to make the *relations*

[21] Spot market is a clearance market for vessels and cargoes immediately available in a small geographical area.

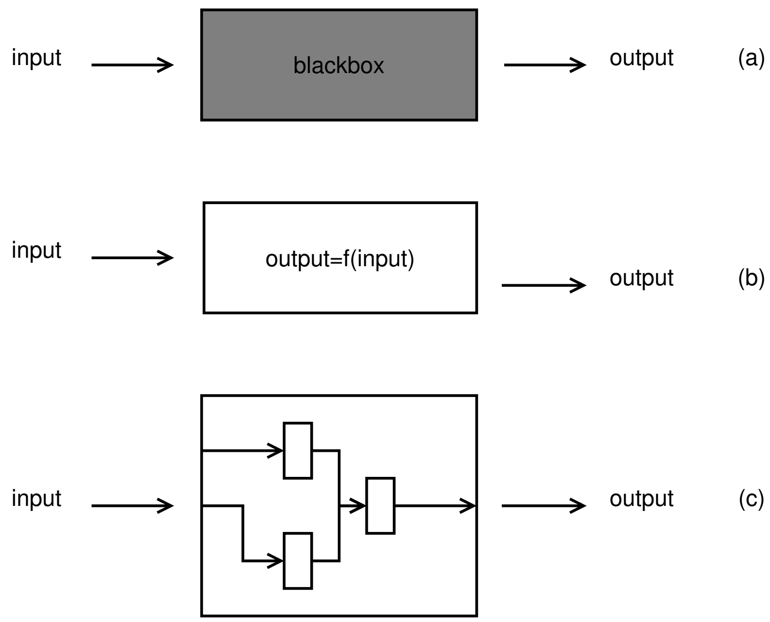


Figure 3.9: Shipping as a blackbox

between input and output 'more visible', Figure 3.9 (b), e.g. using statistical techniques. Or, sometimes the system is treated as a *causal* process, see Figure 3.9 (c), e.g. using econometric modelling.

A lot of research has been undertaken and has contributed very much for conducting macroeconomic analysis. But shipping index, forecasts and forecasting models, for example, are of less use for those who conduct daily shipping practice.

Datz suggests that manager should decide based on facts and *not* on intuition. On the other hand, he believes that in order to make forecasts useful it is imperative to include the *user's view* on the developing situations, as he sees it [16]. Apparently this seems a general view of the shipping research agenda today, see also for example Beenstock and Vegottis, and Evans and Marlow [8, 23].

The fact that rational decision making procedure does not apply well in many decision making tasks in daily shipping practice seems to be overlooked, see Section 3.1. Intuitive way of accomplishing tasks has not been considered as a research subject seriously. The paradox between the views on the way shipping is run and the fact that rational decision making does not work satisfactorily in daily shipping practice, on one hand, and the selection of topics and the 'mechanistic' views on the shipping system and the choice of methods conducted in shipping research to this date, on the other hand, confirms the necessity to have a new way of looking at the shipping tasks. By doing so, the development of tools usable for shipping practice can be implemented.

3.4 Conclusions of the chapter

1. In value assessment, soft factors, such as the quality of management, play a significantly more important role than the physical aspects of the ship.

2. Solving a problem does not always require thoroughly analytical and theoretical understanding on the matter. Problem solving frequently means *imitating* or *repeating* the way past similar problem was solved. Knowledge for solving problem seems to be hidden behind the term 'experience'.

3. All specific information, e.g. price estimation, is provided by experts (brokers or consultants), that base upon their experience and views on the prevailing market. Shipping indexes are too general to be useful for addressing daily chartering matters.

4. The decision making in practice does not follow the rational decision theory. The objective is not to obtain the optimal solution, but to obtain an acceptable solution.

5. Qualitativeness, vagueness, subjective preferences, experience and intuition are treated as important factors in shipping. Nevertheless, those aspects do not seem to have been seriously taken into account in the shipping research agenda today.

Part II

Concept building and implementation

Chapter 4

Towards the Concept of Compatibility

4.1 Introduction

4.1.1 Lessons learned

Chapter 2 showed us that ship practitioners rely very much upon their intuition. Their experience, information and views from brokers, shipping agents and newspapers are very important sources for assessing generally prevailing charter hire values and sale & purchase prices of ships more accurately. Published indexes and statistics can be useful too. They are viewed as a rough guide. But they are not always of direct relevance to actual daily negotiations. Many trades and ships, with their specific design characteristics, are not covered adequately by those index. The indexes are too general to be practicable.

The shipping research community has been working hard to support the shipping industry by developing e.g. forecasting tools. Shipping market models have been developed in order in order to understand the process, the functioning of the market, and in turn it can be used for a.o. predicting the shipping market tendencies. To conduct daily tasks in shipping, such models are of little use.

Shipping practice is still marked by decision-making processes which are fast and intuitive. Ship's value assessment tasks or forecasting tasks rely very much upon the capability of the managers to assess, and they do not rely on fancy tools.

The gap between both worlds, that of research and shipping industry respectively, in terms of the way they view the problems, is probably not that small. Findings shown earlier in Chapter 3 show that rational decision makings are not necessarily practicable. Intuitive actions which mark many decision-making actions in the industry, seem to be less appreciated by the shipping research community.

The daily portraits of shipping business can be summarized as follows:

1. Information manifests in various degrees of precision, accuracy and detail. Information can be quantitative (numerical) or qualitative (textual, graphical). It is hardly free from subjectivity.
2. Time frame for making a decision is limited.
3. Knowledge needed for running shipping business comes mainly from evolving experience. Formal knowledge alone is not adequate to conduct shipping business accordingly.
4. Past information and past experiences on operations in various ports and situations are very useful.

The above points will be elaborated in Section 4.2.

Shipping research today seems to be interested in addressing the shipping system as a process, as a mechanism. Efforts to reveal and to understand the *functioning* of the system have received a lot of attention. Modeling and statistical techniques are frequently used. It is not surprising and it does not deviate very much from the point of departure of most modern social and physical sciences resting on the assumption that processes whether natural or artificial, could be mathematically analyzed and understood [48]. This viewpoint seems still to apply to today's shipping research.

The state of the art of shipping research today can be described by a combination of the following two factors: (a) view differences (b) unsatisfactory results. Firstly, the way a practitioner addresses problems may be substantially *different* from the way models are supposed to work. Practitioners may know things but they are not always in position to explain them precisely and consistently.

Secondly, current forecasting tools, for example, are not usable in daily practice of shipping business. Forecasting models, which may produce more accurate figures, are designed for a sector of shipping. These figures are usually of no direct relevance for conducting chartering or sale and purchase negotiations.

Whilst shipping research today is still predominantly process-oriented, see sub-sections 3.3.5 and 3.3.6, another way of looking at things done in shipping is regarded as necessary. A decisive point has been reached now to rethink about the direction. Given the failures of the approaches employed in shipping research today, we believe it would be of a great use to take a few steps back, to understand the circumstances of shipping, persons involved in it, how tasks are conducted, before jumping in a hurry proposing a (probably new) solution path.

4.1.2 Determining directions

In addition to empirical findings and the state of the art of shipping research in Chapters 2 and 3, a striking question to be answered is to choose a direction, which way to choose.

The history of science and technology is marked a.o. by learning from the nature. We have benefited very much from this learning, which may prevent us from 'reinventing the wheel'. From animals or plants, we may borrow or even copy the superior designs, concepts, experiences or ideas, and apply those to our problems. Learning from others provides also the opportunity to awaken our inner warning system not to repeat the same or similar mistakes [55]. And as every choice in life it is always exposed to risks, risks of failure, risk of not finding the right answer or risks of not reaching the objective.

The shipping sector is managed, its problems are solved on daily basis. Some operators or persons have shown superior performance over the others. Some others may have shown the contrary, at least for a certain period of time. This highlights two things of interest: human and time. Human performance in solving problems, some are very complicated ones, can be of superior quality. The capability to foresee the future charter rates or sales prices can be astonishing. It is not intended to categorize it as a luck or not. What we can notice are the hard facts.

Another point: the above performance may be inconsistent. In certain time, some are superior over the other, and at some other period of time vice versa. Given this real example, having two sides of properties, we believe we would benefit very much from understanding ourselves, as a human. In the relation to the shipping tasks, a human can be associated in the role he plays, for example as a decision maker or a chartering manager or a shipbroker or a local agent.

Artificial Intelligence (AI) is proposed to offer a fresh perspective on the way we look at the shipping problems today. AI research has both borrowed from and contributed to research on human problem solving [72]. It is a branch of computer science that studies the computational requirements for tasks such as perception, reasoning and learning, and develops systems to perform those tasks[1] [44]. AI is a diverse field whose researchers address a wide range of problems, use a variety of methods, and purse a spectrum of goals, for example:

1. studying the requirements for expert performance for specialized tasks
2. modelling common sense tasks
3. studying behavior in terms of low-level processes using models inspired by the computation of the brain

[1]For more definitions on AI, see the glossary.

4. studying planning as a psychological process
5. developing devices that cooperate with people to amplify human abilities.

4.2 Foundations

4.2.1 Bounded Rationality

A classical view on decision making

Decision making is a process by which a manager responds to opportunities and threats by analyzing options and making decisions about goals and courses about actions [20]. And a decision is a choice among available alternatives, see also 3.3.4.

The classical model of decision making rests on the following assumptions, namely that a manager

1. has perfect information
2. can clearly define the problem
3. knows all relevant criteria and could accurately weight the criteria according to their preferences
4. does not change their preferences
5. does not have any time constraint
6. chooses the decision with the maximum payoff.

The processes of the classical model of decision making involve the followings:

1. listing alternatives and consequences
2. ranking alternatives from low to high
3. selecting the best alternatives.

The empirical findings in shipping practice contradict the above classical model of decision making[2]. A decision maker does not define the goals explicitly; he does not have all information needed. The degrees of precision, detail and accuracy of information are initially low.These improve along with the process of negotiation and during the operations. In line with the changing size of information, in terms of its degrees of detail, precision and accuracy, his preferences may change. Human preferences are not always consistent.

[2]see also the chartering negotiation performed example of Mansukhani in sub-section 3.1.2

Information is available excessively, but useful information is still scarce and expensive. For example, information on the cargo handling performance of a remote port can of huge importance, but it is not always easy to obtain. To obtain more precise and more detailed information, it takes time and costs. Moreover when an operator has never called the port; this situation is not unusual, since bulk carriers basically do not have fixed routes nor fixed schedules. Appointing a local agent who is not well-known before hides some risks and costs. Reliable information is not always guaranteed available.

Time is an important factor concerning the decision making. It may relate to the progress of the negotiation and external events which may drive him to decide timely. Profitability is a very important factor for decision making. But it does not necessarily mean that the decision maker strives for the profit maximization. It seems that a decision maker strives for acceptable solution instead of an optimum solution.

Bounded Rationality

Chapter 2 and 3 have taught us that many decisions in shipping practice are not made rationally. Objective probabilities of future events of, such as bad weather, high fuel prices or magnitude of cargo damage, are not explicitly known. Shipping practitioners may use some subjective probabilities, but they do not quantify them numerically. As shipping connects nearly all parts of the wold, this sector is volatile to exogenous factors, such as weather and political events of a country. The influence of exogenous factors on the shipping system is tremendous. This enhances the size of complexity of the system. The uncertainty plays an important role.

In his theory of bounded rationality, Herbert Simon[3] argues that the capacity of a human is limited and it is too small to address the complexity of the real world rationally. The complexity of the world is marked with the incompleteness and inadequacy of human knowledge, the inconsistencies of individual preference and belief, the conflicts of value among people and groups of people. Nevertheless a human is able to solve the complex problems by simplifying the problem formulation drastically. By applying approximate and heuristic techniques, the complexity of the problem can be downsized [72].

Optimization techniques, under the umbrella of the operations research, are a prominent content in management science. Linear and dynamic programming are among a few which are frequently used to solve managerial problems, see [30]. Simon argues that the usage of optimization tools will only be of use if the uncertainty is absent or full probability distributions for uncertain events are available. The classical theory of decision making will

[3]Nobel Prize Laureate in Economics 1978

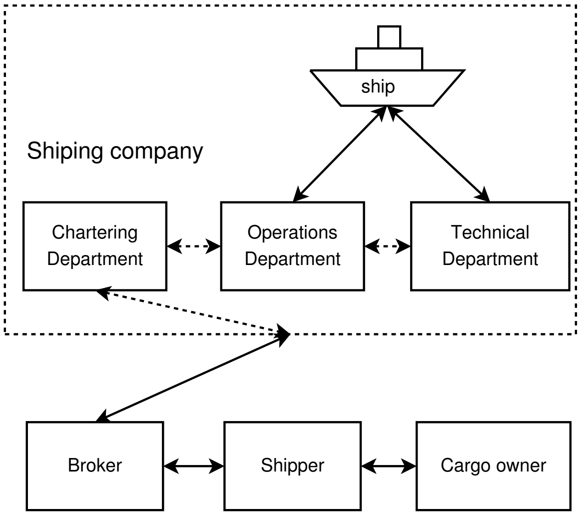


Figure 4.1: Main communication relations between parties in during chartering negotiations

never handle any real problem satisfactorily, unless the uncertainty does not play a central role [70].

4.2.2 Information and complexity

Data is a collection of facts. Data materializes in the form of numbers, characters, or pictures [3, 2]. Data on its own has no meaning. After some processing or analysis, data becomes information, which is meaningful to the user. The meaning of information to a person may differ to another person. A shipping index which is useful for ship chartering community may be meaningless to non-shipping people. Shipping indexes highlighting the market of ships over 10,000 dwt size are basically useless for operators of 3000 dwt bulk carriers, since those ships are not covered at all. Besides the value of information depends also on the skill of the person in concern.

A system is a collection of entities and relations. Shipping as a system, contains entities, e.g. ships, cargoes, ports, operators, and relationships, e.g. route, broker-shipowner relationship. Figure 4.1 shows main communication relationships between the shipowner, and the charterer during a chartering negotiation. The charterer has a main contact with the chartering department representing the shipowner. The shipowner is a shipping company, a system, consisting of few sub-systems namely departments and ships.

After signing the Charter Party and the ship is then delivered to the charterer, the department of operations of the ship owning company takes over the command. This department becomes the main contact with the charterers. Depending on situations, the relationships may vary from one case to another, see Figure 4.2. The way all parties act reflects the quality of their relationships. Between close long-time partners, the parties may allow late payments or being *friendly* to claims. The other extreme exists as well, a new partner, or company which is supposed to have a bad reputation. The space between them is huge. These relationships will be known after one knows the preferences of the management. Since it is hardly possible to express it sharply, a consultation between managers is necessary.

Many variables affect the shipping industry, from fuel price until political events. Their effects to the industry is difficult to determine. Many information exists in qualitative form and is subject to interpretation. The complexity of a system arises when information is unreliable, or irrelevant,or when there are too many interacting variables which possess some non-linearity properties [9, 68, 84]. A system can be viewed as a complex system when it is composed of sub-systems and its nature of relationships is imperfectly known [74]. Shipping can therefore be viewed as a complex system.

In order to handle such a complex system, the size of the problem must be cut down, Simon argues . By doing so problems can be solved more easily. Using approximation or heuristic heuristic techniques, among a few, may open a way to better handle complex problems [72].

4.2.3 Precision, accuracy and detail

In daily conversations accuracy and precision are mixed up inappropriately, as illustrated by the Webster Unabridged Dictionary: precision is the quality or state of being precise, exact limitation; exactness; *accuracy*; strict conformity to a rule or a standard: definiteness [1].

Accuracy is a synonym for correctness. It describes the nearness of the value to the true or standard value. Precision is the degree to which all measurements are close to each other[4]. The more precise the data, the closer to each they are, the smaller is the scatter area of the data, see Figure 4.3[5].

It is difficult to estimate the situations weeks or days ahead. Estimated arrival date (ETA), estimated remaining bunker on board at arrival (ROB) are few things which are of importance for many parties involved. Cargo owners makes sure the cargo readiness. Other items such as crew change, bunker, ship inspection depend very much on this information. Therefore

[4]http://webphysics.iupui.edu/NH/Projects/TEAMS%5B2%5D/err6.htm, downloaded 2 August 2004

[5]Suppose we are aiming at a target, trying to hit the bull's eye (the center of the target) with each of few darts. The figures show some representative pattern of darts in the target; http://honolulu.hawaii.edu/distance/sci122/SciLab/L5/accprec.html, downloaded on 2 August 2004

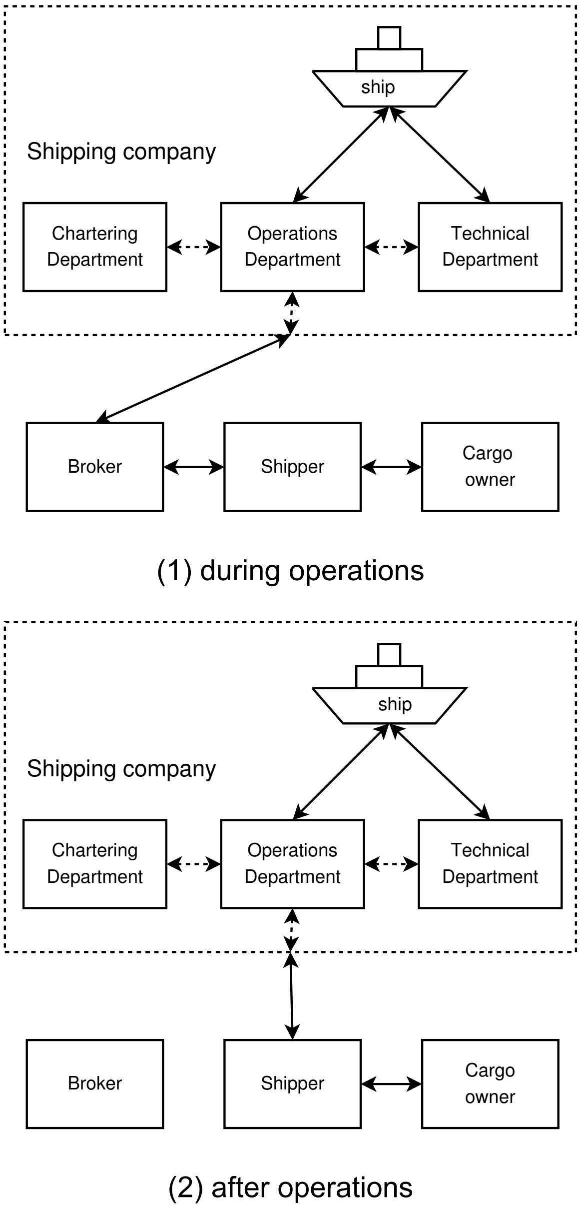


Figure 4.2: Main communication relations during and after operations

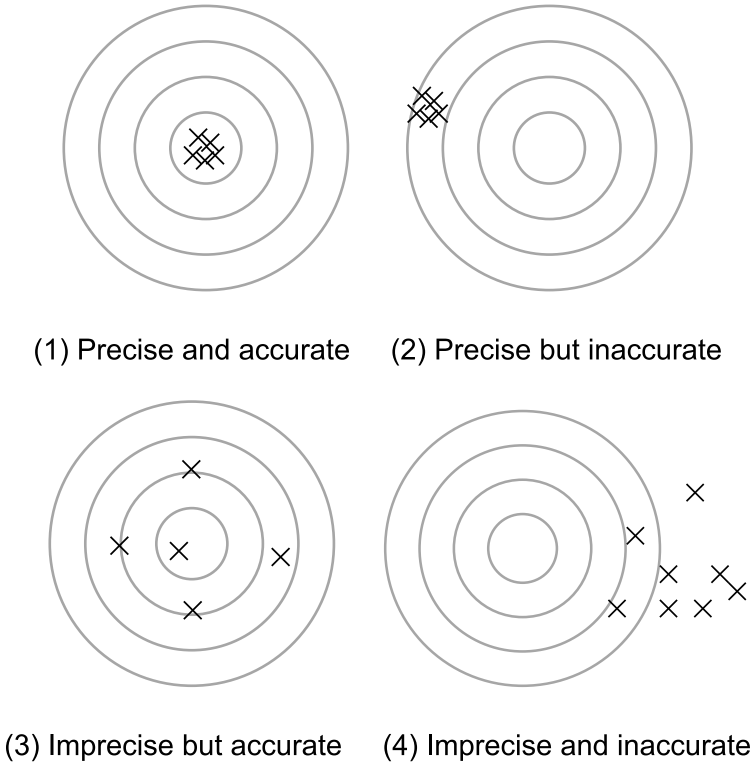


Figure 4.3: Accuracy and precision

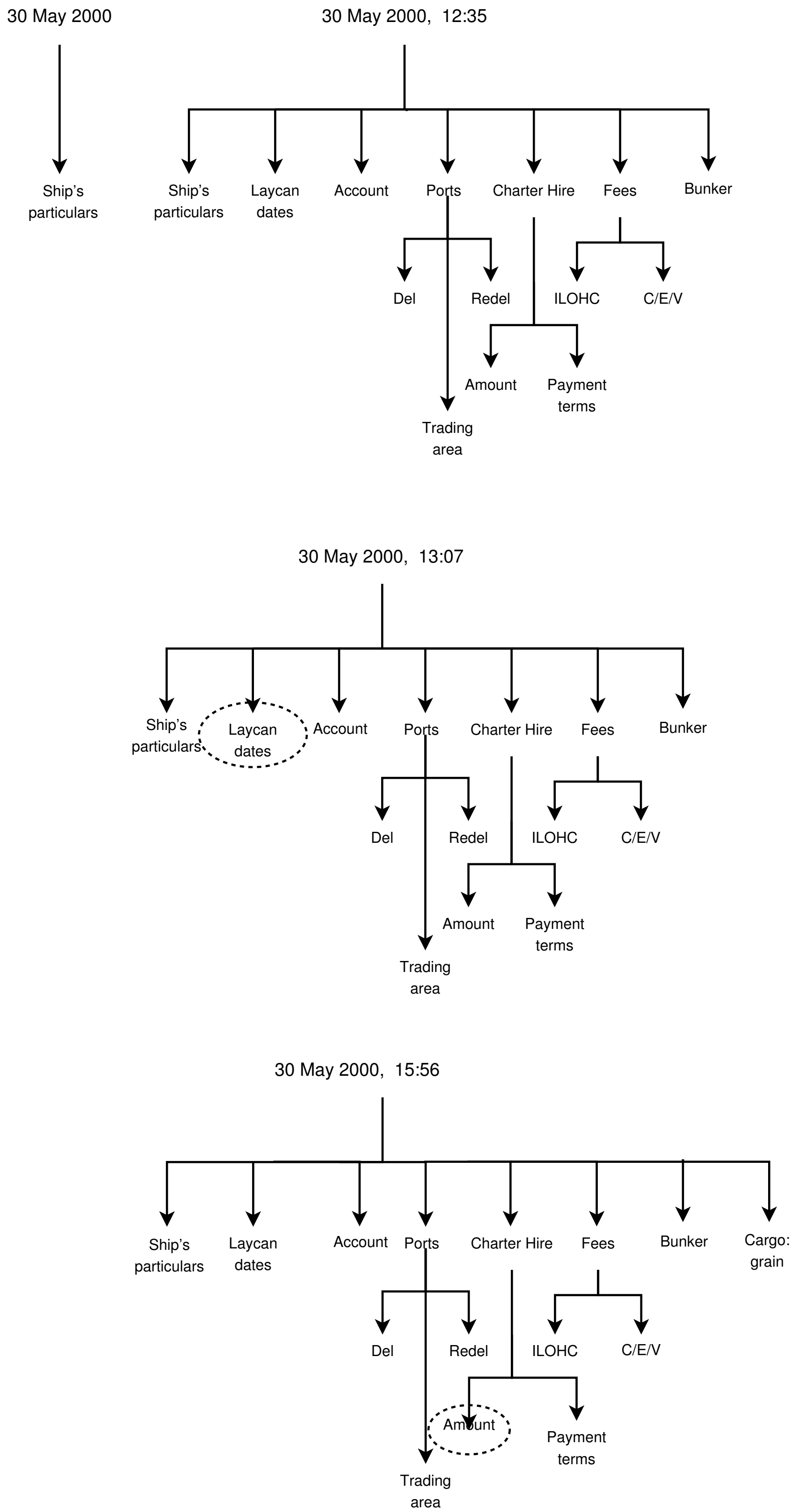
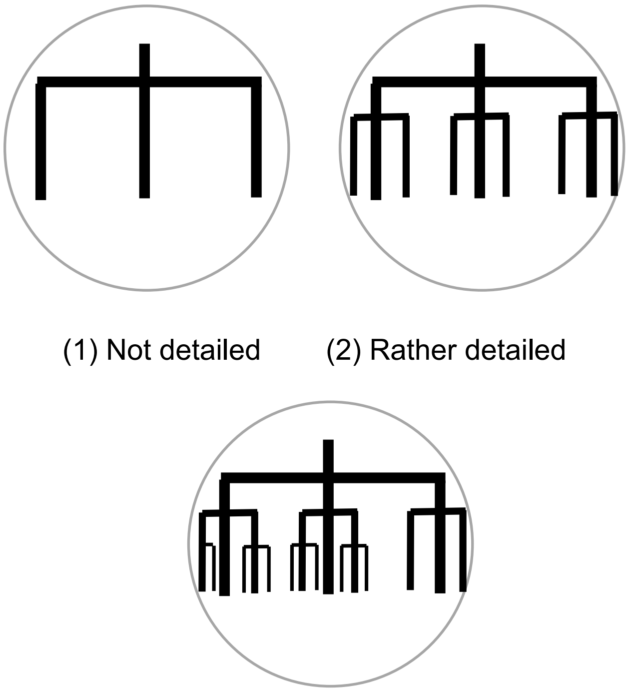


Figure 4.4: Evolving degrees of details



(1) Not detailed (2) Rather detailed

(3) Detailed

Figure 4.5: Degree of details

the information is regularly updated. The information becomes more precise in the course of time, as illustrated below[6]:

> PRIOR NOTICE OF ARRIVAL 5/3/2/1 DAYS.
>
> OWNERS CONFIRM VESSEL IS SELF TRIMMING, SINGLE DECK BULK CARRIER FOR GRAIN
>
> LAST THREE CARGOES: PEAS/SUGAR/CONCENTRATES[7]
>
> FULL ITINERARY UP TO DELIVERY: VESSEL IS IN BOMBAY NOW, DISCHARGING PEAS, WHERE ETD 4 JUNE AND THEN BALLASTING TO SINGAPORE FOR BUNKER AND DELIVERY WHERE ETA 11 JUNE, SUB AGW WP AND UCAE
>
> LOCATION OF CRANE: REVERTING

During the negotiation some inaccuracies are corrected as well. Accuracy and precision improve in the course of time.

---

[6] Viveka Mansukhani, E-Mail, 5 June 2000

[7] Concentrate is the desired mineral that is left after impurities have been removed from mined ore [3]. Example of concentrates are lead, copper, nickel iron or zinc sulfide concentrates.

Another property of data which is used daily concerns the degree of details of data. It describes the size of variables or branches contained in or presented by the data, see Figures 4.4 and 4.5. At the beginning of a negotiation, the content of information is very brief. Usually it contains the data of the ship offered, or on the cargoes offered for carriage. In spite of such incompleteness, a chartering staff may guess other details. This is enough to obtain the first impression, whether he is interested in it or not. It leads to the first action, he asks to the broker for more information.

The degree of details of information evolves in the course of time, see Figure 4.4. More branches are growing in the course of time, which means more details are available and those are subject for negotiation. Italic bold letters are topics which have not been agreed by both parties, charterers and owners. The topics circled are subject mentioned in fax during the negotiation. It does not necessarily mean that the remaining topics have been agreed by both parties.

4.2.4 Intuition, reasoning and experience

Knowledge is an informal notion describing something that a human, a formal system or a machine can possibly use in order to perform a certain task of functionality [65]. Knowledge engineering is a process for formalizing the expert's knowledge into the knowledge base. The knowledge base is where the program stores fact and associations it 'knows' about a subject area [11].

Heuristics are strategies usually based on past experiences, that simplify the task of problem solving and generally will lead to the correct answer. This approach is optimal in the sense that this has a reasonably high probability of success coupled with low costs or efforts [8].

The way the problem solving is carried out is related closely to the skill degree of the person. Dreyfus and Dreyfus [19] categorize five degrees of expertise: beginner, advanced beginner, competence, proficiency and expert. A beginner learns and does things strictly following a certain order or flow chart or rule. His horizon is limited to the formal knowledge, and context-free. On the other extreme, an expert does not need to follow procedures strictly. He does things in context, intuitively and fast.

An example from ship operations: stowage planning. It is a task to allocate the positions of cargo to be loaded onto ship. The diagram showing the positions of cargoes on board is called a stowage plan.

A closer look at the way a student is taught in a course, how he carries out his first planning tasks and a glimpse at how an experienced planner carrying out his job, confirm the argument of Dreyfus. A student must follow

[8] www.general.wa.edu.au/u/kraepeln/bs/bs130/bounded.htm downloaded on 17 September 2004

procedures of creating a stowage plan strictly. Aspects concerning the state of ship such as draught, trim, stability and strength, cargo properties must be taken into account. The following items taken from a stowage planning course of a shipping school illustrate a part of the above-mentioned stowage planning procedure[9]:

1. Differentiate different types of containers.
2. Identify the importance of the metacentric height.
3. Identify the concepts involved in calculating GM of a ship.
4. Plot a ships position on chart
5. Calculate distances from port to port and work out ETA.

For a student or an unexperienced stowage planner stowage planning activities are effortful. He has to consider a lot aspects before he can start creating a plan. He has to calculate every aspects on the state of the ship involving trim, draught, stability and strength. A change in the number of containers to be loaded affects the state of the ship in terms of her stability, bending moment etc. He does not have the capability to assess the degree of importance of numbers yet. For every slight change in number of containers to be loaded, he may find it necessary to recalculate. To create a simple stowage plan, it would cost him hours.

As one has gained months or years of experience in this field, the above situation looks different. He does not need to calculate the state of ship for every slight change of cargo amount. He knows that a slight change does not affect the state of ship very much. He knows what *a slight change* means. Understanding this vague term *'a slight change*' is very useful. It enhances the efficiency to accomplish the task: if the magnitude of the change of cargo amount belongs to the set 'slight change', then he does not need recalculate the state of ship pertaining her actual stability etc. After taking a quick glance at the loading list and the arrival conditions of the ship, an experienced planner knows roughly and quickly, how the problems should be solved.

Stowage planning is a search process, a search for the best slots to where the containers to be allocated. In contrast to a beginner, an expert does not try *all* possible alternatives. He guesses a few promising solution concepts which may lead to a reasonable solution. A new planning task reminds him of past similar planning sessions. By doing so, an experienced planner may accomplish a stowage planning task in a much shorter time, and perhaps with a better quality too, than a novel one.

The above capability of performing a task better and/or faster is result of learning. That marks a shift from a beginner to an expert. Learning

[9]Taken from the curriculum of the course “Container ship planning, stowage and stability” (code ND CC 203) at the Colombo International Nautical and Engineering College (CINEC). http://www.cinec.edu/departments/nd_cc203.htm downloaded on 11 December 2004

enhances the capability of solving problems. What does he do when he does problem-solving? Riesbeck and Schank believe that 'human experts are not systems of rules, they are libraries of experiences' [66]. A new problem reminds an experienced person similar problems he faced in the past, stored in his library of experiences. By doing so it enables him to perform a similar task better. Simon calls it 'learning' [48].

Wittgenstein explored our understanding about language, meanings of words and objects. He suggests that an object, like a table or chair, is polymorphic and cannot be classified by a single set of necessary and sufficient features but instead can be defined by a set of instances that have family resemblances [78]. In learning a foreign language, besides from grammatical rules, one may learn form examples how to use a word. Immitating how to use words for similar situations helps expedite mastering a language [64].

Chapter 2 showed us that a formal education only is not adequate to be able to run shipping business. Learning directly, or learning by doing, how shipping practitioners communicate with shipping communities (e.g. agents, authorities, brokers, charterers and owners), how they assess situations and try to understand the tendencies of market is of necessity. Apparently this idea has widely been accepted by shipping schools. Apprenticeship is obligatory for students. He learns how chartering inquiries are processed, how negotiation is conducted, how to handle special clients etc. He may look at and learn from past voyage records, past charter parties. He will learn that old charter parties are *reused*. After some necessary modifications on the parties involved, delivery and redelivery ports and dates and some additional clauses, a new charter party can be prepared in a short time. It is more efficient to use a past charter party than to draw it from scratch. It prevents him from reinventing the wheel.

He learns how the company acts towards special requirements of special clients, he learns also to figure out the preferences of the company concerning partnership with other companies, or even learns to figure out less desirable profile of companies. By listening from more experienced chartering practitioners, he will receive uncountable amount of hints and actual information.

He learns understanding contexts. He learns 'reading' situations, charter rate trends, influence of events, local or international events on the operation and commercial aspects of operating the ship. He learns from cases.

The higher the degree of expertise, the better he is to perform things fast and intuitively. It is not exaggeration to mention that “an expert does not think, he simply knows it”. Since intuition is knowledge. The higher degree of expertise, the more intuition is used. Dreyfus and Dreyus mention, “When things are proceeding normally, an expert does not solve problems and does not make decisions; they do what normally works” [19].

In his experiments, Kahneman shows a few vertical bars with different

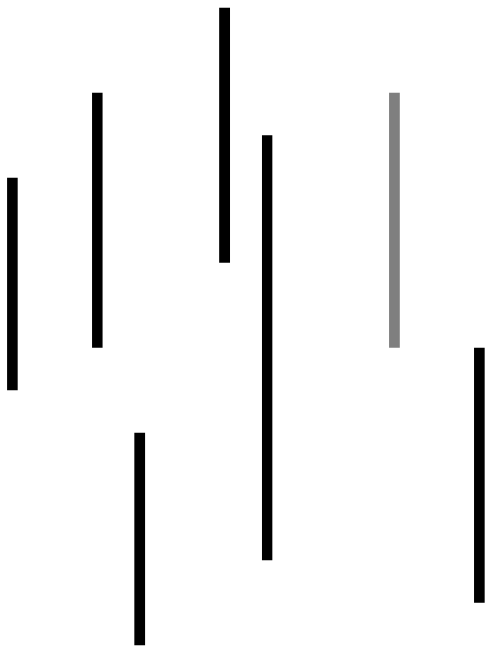


Figure 4.6: Recognizing the average as intuitive process [35]

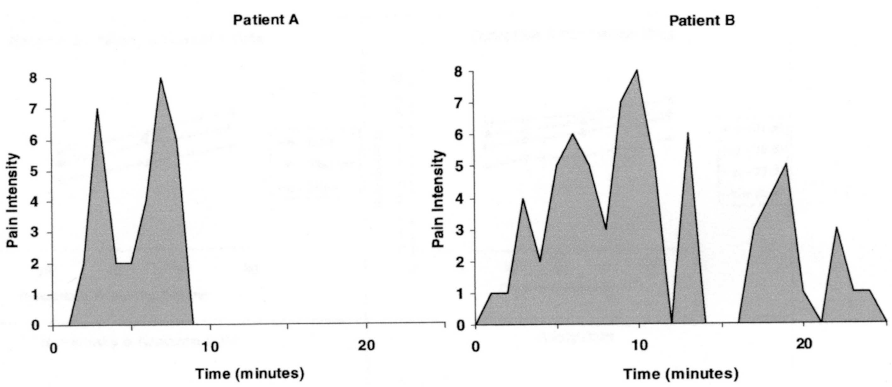


Figure 4.7: Pain measurement [35]

lengths to viewers, see Figure 4.6. The viewers can estimate well the average length of the bars. But they have a difficulty to estimate the total length of the bars. Higgins uses the concept 'accessibility', which means the ease with which particular mental contents come to mind . Average is more accessible than the sum. They can estimate the average length of the bar *not* by calculating the sum of bars' lengths divided by the number of bars. The sum operation is not an intuitive act, it is a deliberate act, and it is effortful and much slower compared to the intuitive act [35].

Another finding of Kahneman concerns the way a human perceives events. Figure 4.7 shows a graphic containing the degrees of pain of a patient. Viewers believe that patient B suffers more than patient A. But the patient A feels he is more suffering. The worst moments and the values in the end episode are weighted heavier.

Kahneman suggests that intuition is automatic, effortless, associative and difficult to control or modify. Reasoning, on the other hand, is slow, effortful and deliberately controlled. Intuitive thinking operates on basic representations with relatively little elaboration or extra computation. The basic representation of sets includes average values of features, but does not normally include their sums [35].

Experience is the accumulation of knowledge or skill that results from direct participation in events or activities [3]. Remembering past successes are useful. The ways those problems were solved, can be reused or copied to solve current problems. Past failures can be useful too. Those failures mean warnings. Hints and warnings are very powerful knowledge, heuristic knowledge. Remembering all experiences are not practicable and are not possible, due to limited human capacity to store those. Selectively forgetting unuseful experiences are necessary.

Every chartering negotiation is unique. The parties, ship's and cargo conditions, weather, macro-economic and political situations are different. The details of Charter Parties are therefore always different from previous ones. But one realizes very much that a big part of the Charter Party is standard. It is efficient if one does not have to draw a Charter Party from scratch every time he concludes a chartering negotiation. A standard Charter Party form is helpful to address this problem.

It is helpful to expedite accomplishing the chartering tasks, and to ease preventing from forgetting or overlooking essential clauses. There are a number of standard Charter Party forms available, such as those of the New York Produce Exchange (NYPE) or of the Baltic and International Maritime Council (BIMCO). This is an act of reusing good clauses which are applicable for current case. The practice has gone a bit further. Not only the use of standard Charter Party is widely popular, one uses also past Addendum or Rider's Clauses.

The above method is efficient, and it works. Inappropriate or even incorrect data can easily be modified, when necessary. The Charter Party for

MV LUCY OLDENDORFF reuses another past Charter Party with Shinwa. Few lines/ clauses are incorrect. That not all data can be taken over from an old similar Charter Party is taken for granted. In turn those can be logically amended. By doing so, improvements of as past Charter Party can be performed easily [10].

> MV LUCY OLDENDORFF
>
> ACCT: SHINWA KAIUN KAISHA. LTD., TOKYO
>
> DEL DLOSP SINGAPORE ATDNSHINC
>
> LAYCAN 0000HRS 11 JUN/ 2400HRS, 2000 LOCAL TIME
>
> FOR ONE TCT VIA SA(S)/SB(S)/SP(S) AUSTRALIA TO SE ASIA AA AWIWL WITH LAWFUL CGO INTENTION GRAIN DURATION ABT 30-40 DAYS WOG.
>
> REDEL DLSOP 1 SP JAPAN/SPORE INCL. S.KOREA/MALAYSIA/FULL INDONESIA/PIPICAO ATDNSHINC
>
> HIRE USD 780 PDPR INCLOT PAYABLE 15 DAYS IN ADVANCE
>
> BOD TO BE ABOUT 400-650 MTS IFO AND 50/80MTS MDO. OWNERS GUARANTEE VSL HAS SUFFICIENT BUNKER TO PERFORM CHRTRS INTENDED VOYA EX ESPERANCE, WEST AUSTRALIA TO JAPAN. BUNKER ON REDELIVERY TO BE ABT SAME QTTY AS ON DELIVERY PRICES AS AGREED IFO 170/MDO 230 PMT BENDS.

First group: logical amendments and additional lines:

> REDEL DLSOP 1 SP JAPAN
>
> LINE 2: HALFMOON SHIPPING CORP AS OWNERS
>
> LINE 58: DELETE 'SEOUL' AND INSERT 'FRANKFURT'
>
> LINE 115: DELETE 'TOKYO' INSERT 'LONDON'

Second group: Improvement of past Charter Party, the following lines are to be added:

> LINE 171: AFTER 'VESSEL' INSERT 'HER SEAWORTHINESS, MAINTENANCE'
>
> CLAUSE 46: DELETE, INSERT: 'OWNERS TO APPOINT THEIR OWN AGENTS FOR AVERAGE AND REPAIRS AND ALSO FOR ANY OTHER OWNERS BUSINESS WHEN REQUESTED BY THE CHARTERERS. OWNERS (PROVIDING CHARTERERS DO NOT THEMSELVES INCUR ANY AGENCY FEE IN WHICH CASE SAME TO BE FOR OWNERS ACCOUNT) ARE ALWAYS ENTITLED TO AVAIL THEMSELVES WITHOUT ANY AGENCY FEE TO OWNERS, OF CHARTERERS AGENTS FOR CREW MAIL AND SIMILAR NORMAL MINOR VESSEL ITEMS AS FAR AS AGENTS CAN MANAGE'
>
> CLAUSE 71: INSERT VESSEL DESCRIPTION AND ADD FOLLOWING 'WITHOUT PREJUDICE TO OTHER TERMS AND CONDITIONS OF THIS CHARTER PARTY, VESSEL'S SPED AND CONSUMPTION AS DESCRIBED SHALL BE APPLICABLE THROUGHOUT THE DURATION OF THIS CHARTER PARTY; ALWAYS IN GOOD WEATHER CONDITIONS OF UP TO BF 4 AND DSS 3"

[10] E-Mail Viveka Mansukhani, dated 5 June 2004

> CLAUSE 86: 'CHARTERERS TO SUPPLY BUNKERS IN ACCORDANCE WITH INTERNATIONAL STANDARD ISO 8217:1996, CLASS RME 25 (FOR IFO 180 CST) AND DMB (FOR MDO).
>
> CLAUSE 87: INSERT 'OWNERS TO GIVE CHARTERERS NOTICE UPON FIXING AND THEN 5/3/2/1 DAYS NOTICE OF DELIVERY. OWNERS TO KEEP CHARTERERS CLOSELY ADVISED OF VESSEL'S POSIT

Sharing experience proved to be useful and necessary. Especially in branches where the situation changes rapidly, such in the field of finance and high technology. In the filed of corporate venture capital for example, an systematic experience sharing is organized. The importance of experience is well realized. But not everybody has the opportunity to obtain the experience by doing. Benchmarking studies and seminars are few things which can contribute to improve the knowledge in an organization effectively [33].

4.3 A survey on methods

4.3.1 Expert systems

An expert system is a program which uses the heuristic expert knowledge for analysis, or synthesis purposes [48]. MYCIN is a well-known example of an expert system whose task is to provide diagnostic and therapeutic advice about a patient with infection [11]. The description of expert system below is largely borrowed from MYCIN. The MYCIN's knowledge is represented as an array of rules, such as:

> IF: There is evidence that A and B are true,
>
> THEN: Conclude there is evidence that C is true.

The above form is also presented in one of the following shorter forms:

> If A and B, then C
>
> A & B $\rightarrow$C

The antecedent of the rule is the premise or left-hand side (LHS) and the consequent is the action on the right-hand side (RHS).

A chained mechanism can be illustrated as follows:

Rule 1	If A, then B
Rule 2	If B, then C

Now we have input data equal to A. The consequent or the result is C. This is called forward chaining or data-directed inference. The fact that the data is known (A), it drives to deduce a conclusion (C). In full form the above is written as follows

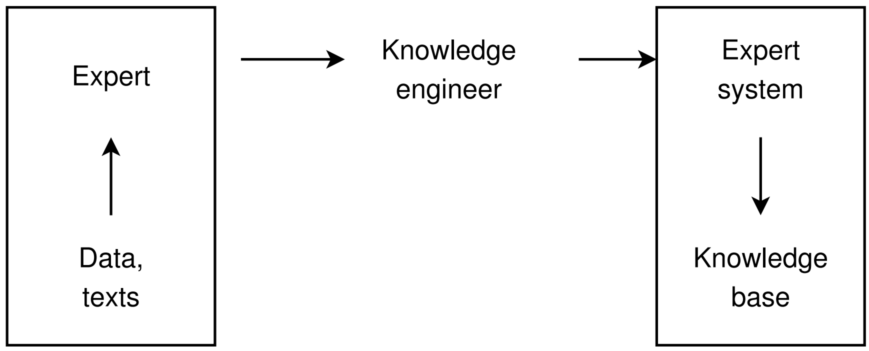


Figure 4.8: Transfer of expertise [12]

Rule 1	If A, then B
Rule 2	If B, then C
Data	A
Conclusion	C

MYCIN on the other hand uses the backward chaining or a goal-directed control strategy. For the same implicit rule as above "If A, then C", the backward chain rule looks like this:

Goal	Find out about C
Rule 1	If B, then C
Rule 2	If A, then B
Question	Is A true?

The MYCIN expert system contains a large collection of rules, which are collected by a knowledge engineer. He translates it into a form suitable for the expert system, see Figure 4.8. This process is called knowledge engineering. A finished rule may look like this [12]:

RULE 200	
IF	1. The site of the culture is blood, and 2. The stain of the organism is gramneg, and 3. The morphology of the organism is anaerobic, and 4. The portal of entry of the organism is GI
THEN	There is strongly suggestive evidence (certainty degree = 0.9) that the organism is bacteroides.

It is noteworthy to mention that the consequent (RHS) mentions the so-called certainty degree, which means the degree of truth of the statement in concern. The concept of certainty degree is comparable to the membership value in the fuzzy set theory.

The process of transferring knowledge from an expert to a knowledge engineer is not an easy task, as the knowledge engineer has far less knowledge of the discipline - medicine - than the expert does. In this discipline, a knowledge engineer can be viewed as a novice. A communication problem, which often arises, is , for example, the vocabulary used by the expert uses to talk about his discipline with a novice is probably inadequate for high-performance problem-solving. The knowledge engineering process is laborious and manual. After a period of time of service, the program has not automatically become smarter, since the program has no capability of learning from every diagnosis session made.

Applying the rule-based expert system in the domain of chartering, the rules may look like these, see also Chapter 2:

RULE 01	
IF	Fuel price is high
THEN	Time Charter Party is preferred over Voyage Charter Party (certainty degree = 0.9)

RULE 02	
IF	1. Ship is smaller, and 2. Ship calls more ports
THEN	Profitability is less accurate

RULE 03	
IF	Charter rates are firming
THEN	Less paying cargoes like scraps have difficulties to find carriers

An expert system can be implemented well if the experts can can express the domain knowledge unambiguously and consistently [40]. It becomes evident soon, that applying expert system in ship chartering is impracticable, for the following reasons: a. it is difficult, when possible, to express the chartering knowledge sharply, unambiguously, and consistently. b. the rules will hardly be complete c. modifying and adding rules are manual and laborious. Nevertheless, an expert system can still be of use for a limited scope of a very specific area.

4.3.2 Fuzzy Set Theory

Sets

A crisp set is marked by its sharp boundary expressing 'an object either belongs to this set or not'. Suppose $\bar{A}$ is a complement of a set A, defined as a set of all elements in the universal set which are *not* in A, see Figure 4.9. X is defined as the universal set. Its important properties are:

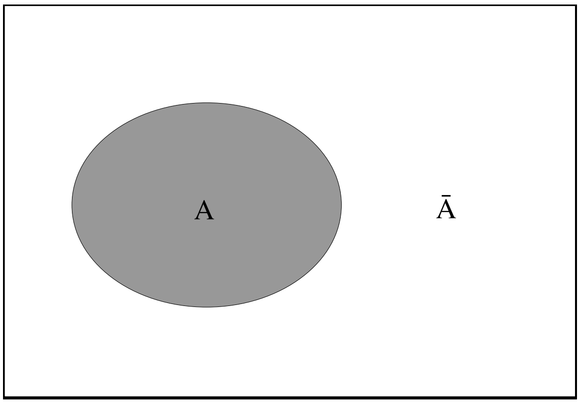


Figure 4.9: A crisp set A and its complement

Union	$A \cup \bar{A} = X$
Intersection	$A \cap \bar{A} = \oslash$

The union property represents the law of excluded middle.

The first scene in Chapter 1 raised a question whether a ship is suitable for the company's trade. This situation can expressed as "whether a ship belongs to a set of suitable ships". Suppose the size of ship to be searched is approximately 10,000 dwt. When a broker offers a ship of 150,000 dwt, then such a task can very easily answered, namely rejecting it. At this point there is no ambiguity at all, that a 150,000 dwt ship definitely does not belong to the set of suitable ships.

It soon becomes clear that when the ship offered is a 10,250 dwt or a13,000 dwt bulk carrier, the matter becomes different. It is apparent that the reality addresses such a matter not in a binary term, i.e. either yes or not, one or zero. Such a black-and-white categorization does reflect the reality well. There is a grey, ambiguous area within which an object may belong to more than one sets. A particular ship can be viewed as both suitable or unsuitable. It is far more realistic to reformulate the question into "to which degree can we view this ship as a suitable one?". Whether an object belongs to a set or not, it is a matter of degree.

This phenomenon is not a probability problem "what is the probability that a 10,250 dwt can be viewed as a 10,000 dwt?" or "what is probability that a 13,000 dwt ship can be viewed as a small handy size bulk carrier". The probability concerns with an event. The above concerns the vagueness or the imprecision of a concept of "a 13,000 dwt bulk carrier" or "a small handy size bulk carrier", see [37].

The above is the underlying idea behind the fuzzy set theory, proposed by Lotfi Zadeh in 1967. A fuzzy set is defined as a set with an unsharp boundary, see Figure 4.10. The degree to which an object belongs to a

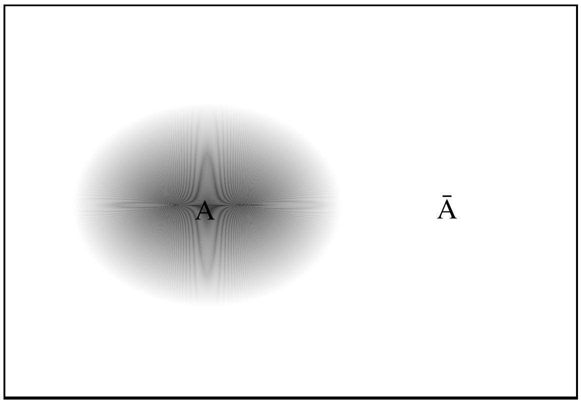
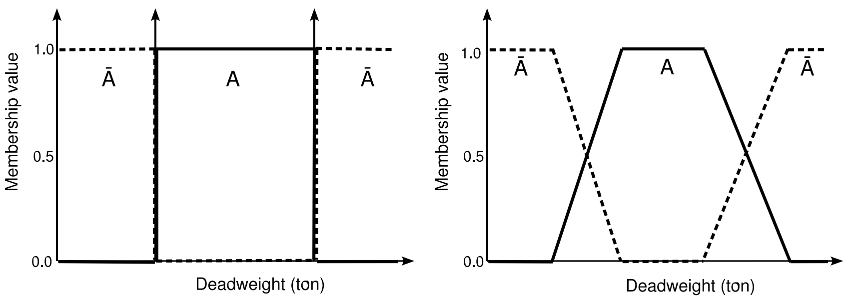


Figure 4.10: A fuzzy set A and its complement



(a) Crisp set (b) Fuzzy set

Figure 4.11: Membership function of a crisp and a fuzzy set

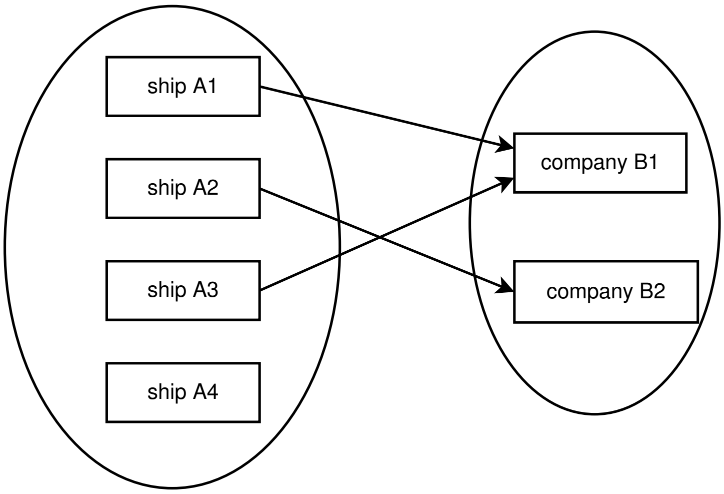


Figure 4.12: Mapping crisp relations *'belong to'*

set is called a membership value, which can be determined by a so-called fuzzy membership function.

Consider a universal set X and a two fuzzy sets $\tilde{A}$ and $\tilde{B}$ defined on X. The standard fuzzy union of $\tilde{A}$and$\tilde{B}$ is defined by the membership function via the formula: $(\tilde{A}\cup\tilde{B})(x) = max\,[\tilde{A}(x),\tilde{B}(x)]$ for all x$\in X$. The standard fuzzy intersection is defined as $(\tilde{A}\cap\tilde{B})(x) = min\,[\tilde{A}(x),\tilde{B}(x)]$.

The standard fuzzy operations do not satisfy the following two laws of the crisp set operations, namely the law of excluded middle and the law of contradictions. This is a consequence of the imprecise boundaries of fuzzy sets, see the Table below

	Crisp set	Fuzzy set
Law of excluded - middle	$A \cup \bar{A} = X$	$A \cup \bar{A} = \ max\,[\tilde{A}(x), \bar{\tilde{A}}(x)]$
Law of contradiction	$A \cap \bar{A} = \oslash$	$A \cap \bar{A} = \ min\,[\tilde{A}(x), \bar{\tilde{A}}(x)]$

Relations

Crisp relations describe the presence or absence between elements. Mapping is a method to represent the relations visually. Figure 4.12 shows 'belongs to' relations, between elements of the sets 'ships' and 'companies'. Another representation is using coordinates, like: R={<ship A1, company B1>, <ship A2, company B2>, <ship A3, company B1>]. Those relations can be then presented in a Cartesian diagram too [37]. Furthermore another way of presentation is also available, using a matrix or a crisp relation

R_{crisp}	company B1	company B2
ship A1	1	0
ship A2	0	1
ship A3	1	0
ship A4	0	0

Table 4.1: Crisp relation table *'fit to'*

R_{fuzzy}	company B1	company B2
ship A1	0.8	0.7
ship A2	0.2	1.0
ship A3	1.0	0.4
ship A4	0.3	0.2

Table 4.2: Fuzzy relation table *'fit to'*

table, as illustrated in Table 4.1:

The crisp relations provide information solely about either the presence or the absence of relations. In various situations such a way of describing a relation does not very much capture the reality. In a relation 'fits to' for the above ships and companies the relation may look different. Few ships may fit very well, the other less well or not at all. There is a certain degree of how well the ships may fit to a company, which is not taken into account in the crisp relations. Fuzzy relations view the quality of a relation as a matter of degree, how true the relation is, as illustrated in in Table 4.2:

Properties of relations [37]:

1. Reflexivity: an element is equivalent to itself; <x,x>
2. Symmetry: <x,y>=<y,x>
3. Transitivity: <x,y>, <x,z>=<x,z>

Equivalence relation is defined as a set of elements which can be viewed as equivalent in terms of a specified characteristic. The equality among elements of a set marks this equivalence relation. For a crisp relation 'belong

Belong to	Ships	mbv
B1	A1, A3	1.0
B2	A2	1.0
None	A4	0.0

Table 4.3: Crisp equivalence relation

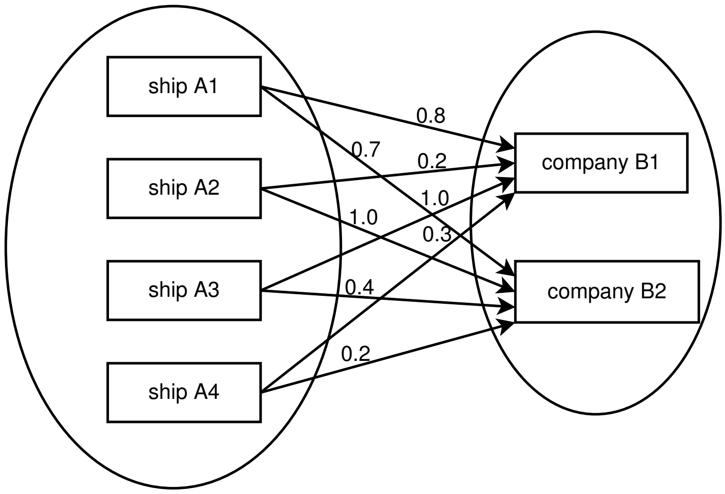


Figure 4.13: Mapping fuzzy relations '*fit to*'

Fit to	Ships			
	mbv≥ 1.0	mbv≥ 0.9	mbv≥ 0.6	mbv≥ 0.3
B1	A3	A3	A1, A3	A1, A3, A4
B2	A2	A2	A1, A2	A1, A2, A3
None	A1, A4	A1, A4	A4	-

Table 4.4: Fuzzy equivalence relation

to', a ship is defined clearly whether she belongs *either* to a company B1 or B2 or none of the companies, see Table 4.3. A fuzzy relation 'fit to' means that if a ship fits to a certain company is a matter of degree, see Table 4.4

Another type of relation called proximity relation, or tolerance or compatibility relation, is a generalization of the equivalence relation. This relation is reflexive, symmetric but not necessarily transitive. Elements that are related by a proximity relation are viewed as compatible (in some prescribed way) but not necessarily equivalent. A proximity relation can be defined using two or more characteristics, for example defined as ships (a) having size of about 10,000 dwt (b) with charter rate of about US$ 5000/day and (c) belonging to company Bx. The classes as a result of compatibility relation are called compatibility classes.

Fuzzy numbers

What is the meaning of *approximately 14 knots?* This implicitly contains two things:

- it contains a subjective *concept of interval*. Values around 14 knots can be treated as 14 knots. These values may lie within a range, for example between 13.5 up to 14.4 knots.
- it contains a concept of *degree of membership* for its each value members. A value 14 is closer to 13.95 rather than to 13.00. Therefore it is a higher degree of membership to claim that 13.95 is *equivalent* with 14, rather than to claim 13.00 equivalent with 14.

This is the underlying reason for applying the fuzzy set theory[11] for addressing the notions of imprecision. An approximative number, like approximately x, is called a fuzzy number $\widetilde{x}$. A fuzzy number $\widetilde{x}$is a *set* of numbers around an exact number x. When a vessel sails at an actual speed of 13.97 knot, which deviated very slightly from the can be treated *fully* the same as a meaning a set of exact numbers around 14, which may have various degrees of truth. This degree of membership, also called *membership value,* has a value between 0 and 1, meaning totally wrong and fully true respectively.

An exact number we use everyday, called also *a crisp number*, is a special case of a fuzzy number. An exact number can defined as a fuzzy number having only one member with a degree of membership 1. Degrees of truth are defined using a function, called a membership function. This membership function, may take several forms, and can be expressed in straight mathematical functions[12], see Figure 4.14.

For the sake of computation efficiency, a trapezoidal function will be chosen, see Figure 4.15. This trapezoidal membership function is defined as follows:

$$membership\,value(x) = \begin{cases} 0, & x \leq a \\ \frac{x-a}{b-a}, & a \leq x \leq b \\ 1, & b \leq x \leq c \\ \frac{d-x}{d-c}, & c \leq x \leq d \\ 0, & d \leq x \end{cases}$$

DSW Algorithm

Arithmetical operations with fuzzy numbers are operations with sets. First of all a fuzzy number is to represented in such a way which can easily

[11] The fuzzy set theory was introduced by Lotfi Zadeh in 1965.

[12] This function may remind us to a probability function. The probability theory deals with *expectation* of a future event, based on something known now[37]. From its point of view, the question addressed would be “What is the probability that 13.50 can be viewed as 14.00?”, which makes less sense.

The uncertainty resulting from the imprecision of meaning of a concept is addressed by the fuzzy set theory in different way. The question will be “How true is it to view 13.50 as 14.00?” Further extensions to nun numerical values can easily be implemented, such as “How true or acceptable is it to view a 35,000 dwt as a big ship?”

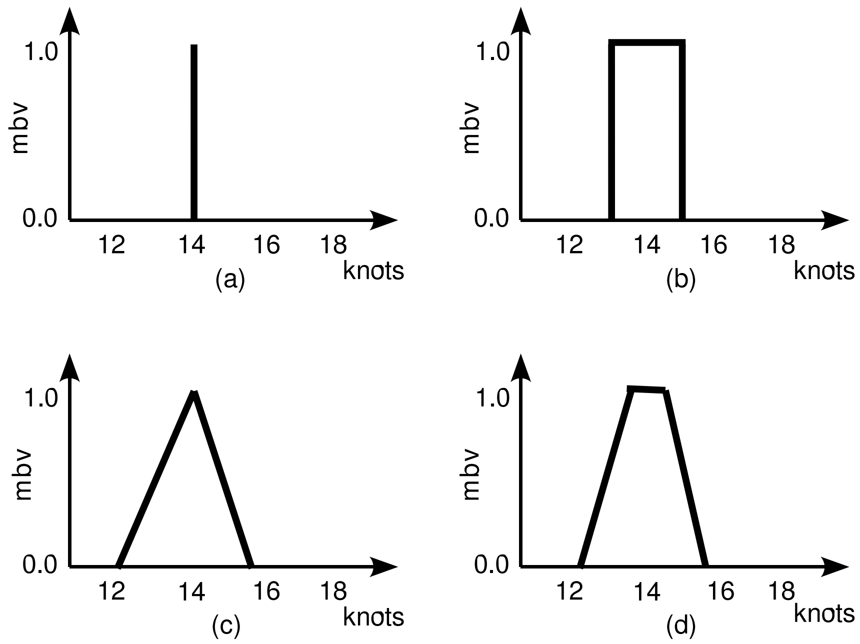


Figure 4.14: Crisp and fuzzy numbers

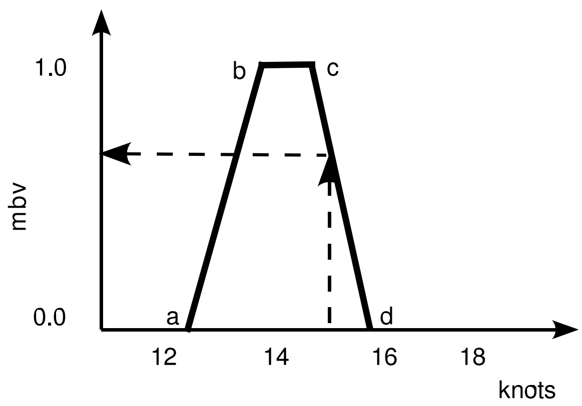


Figure 4.15: Trapezoidal membership function

handle arithmetical operations. A trapezoidal membership function, taken as an example see Figure 4.16, are sliced into a few partitions, according to the fuzzy number's representative membership values.

So a fuzzy number approximately 14, denoted as $\widetilde{14}$, can be defined in various ways:

using 2 $\lambda-$cuts, i.e. $\lambda = 0$ and $\lambda = 1$:

$$\widetilde{14} = \left\{ \frac{0}{12.25} + \frac{1}{13.75} + \frac{1}{14.25} + \frac{0}{15.75} \right\}$$

using 3 $\lambda-$cuts, i.e. $\lambda = 0$, $\lambda = 0.5$ and $\lambda = 1$:

$$\widetilde{14} = \left\{ \frac{0}{12.25} + \frac{0.5}{13.00} + \frac{1}{13.75} + \frac{1}{14.25} + \frac{0.5}{15.00} + \frac{0}{15.75} \right\}$$

For every $\lambda-$cut, e.g. $\widetilde{14}_{0+}$, it gives an interval of values, see also Figure 4.16.

$$\widetilde{14}_{0+} = [12.25,\ 15.75]$$
$$\widetilde{14}_{0.5} = [13.00,\ 15.00]$$
$$\widetilde{14}_{1.0} = [13.75,\ 14.25]$$

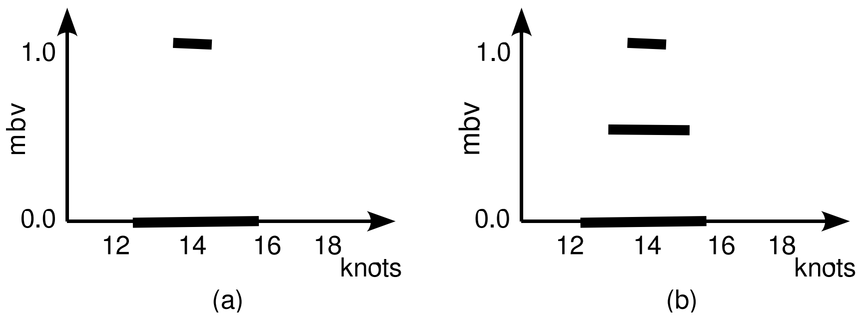


Figure 4.16: Representation of a fuzzy number with $\lambda-$cuts

The next step is to implement arithmetical operations, for example, *approximately 14 plus approximately 5*, or $\widetilde{14} + \widetilde{5}$. The DSW algorithm (Dong, Shah, and Wong 1983 in [68]) is applied. The DSW is described as follows:

1. Select a value where .
2. Find the interval(s) in the input membership function(s) that correspond to this .
3. Using standard binary interval operations, compute the interval for the output membership function for the selected -cut level.

4. Repeat steps 1-3 for different values of to complete a -cut representation.

The following calculation session is instructive for explaining the DSW algorithm. To be calculated: $\widetilde{14} + \widetilde{5}$. Number of lambda cuts is three, i.e. $\lambda = 0,\ 0.5\, and\, 1.0.$

$\widetilde{14} = \left\{ \frac{0}{12.25} + \frac{0.5}{13.00} + \frac{1}{13.75} + \frac{1}{14.25} + \frac{0.5}{15.00} + \frac{0}{15.75} \right\}$and

$\widetilde{5} = \left\{ \frac{0}{4.00} + \frac{0.5}{4.45} + \frac{1}{4.90} + \frac{1}{5.10} + \frac{0.5}{5.55} + \frac{0}{6.00} \right\}$

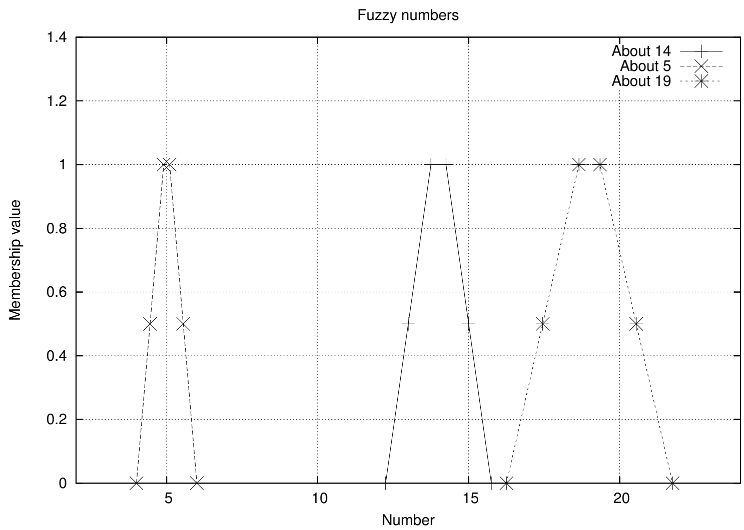


Figure 4.17: Fuzzy arithmetic operation: addition

$\widetilde{B}_{\lambda+} = [min(f_\lambda),\ max(f_\lambda)]$, where $f_\lambda$is an arithmetical operation for the corresponding λ- cut. Now the results are:

$\widetilde{14} + \widetilde{5}\ =\ \widetilde{19}$, where

$\widetilde{19}_{0+} = [12.25,\ 15.75] + [4.00,\ 6.00] = [16.25,\ 21.75]$

$\widetilde{19}_{0.5+} = [13.00,\ 15.00] + [4.45,\ 5.55] = [17.45,\ 20.55]$

$\widetilde{19}_{1.0} = [13.75,\ 14.25] + [4.90,\ 5.10] = [18.65,\ 19.35]$, as illustrated in Figure 4.17. Applying other operations, such as multiplication or division, follows the same procedure.

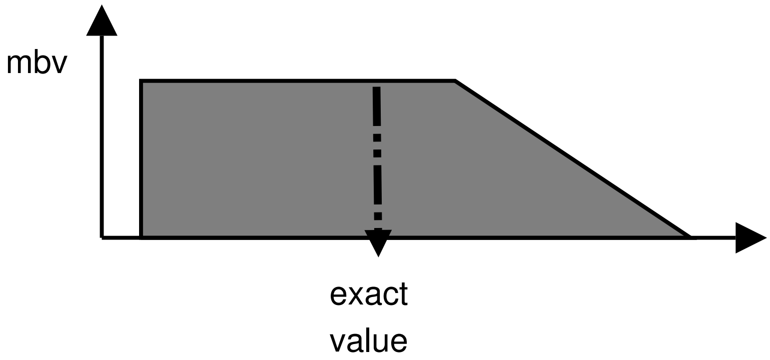


Figure 4.18: Defuzzification

Defuzzification

Decisions or actions are usually sharply determined, for example a voyage charter party is fixed at US$ 25/ton exactly, not approximately US$ 25/ton. The purpose of defuzzification is to convert a fuzzy set into an exact number that, in some sense, best represent the fuzzy set. A common process is to determine the value for which the area under the graph of the membership function is equally divided. This method is called a center of gravity defuzzification method, as illustrated in Figure 4.18.

4.3.3 Case-Based Reasoning

It is safe to assume that problems are unique; all problems are different. Taking a closer look at this statement, the reality shows that a majority of problems have a resemblance to one or more past problems [38]. A certain degree of similarity to the past problems is evident. It explains the phenomenon that an experienced practitioner solves problem much faster that a novice. He can do that since he has collected numerous problem-solving sessions. He recognizes similarities between his current problem to the past ones. Only in very few occasions, he needs to think hard to accomplish his job, otherwise he simply does it, without thinking [19].

Similar problems tend to have similar solutions, see Figure 4.19. Consider two spaces, problem and solution spaces respectively. Case-Based Reasoning can be seen as using the principles of similarity acting on two different spaces, problem and solutions. A known similar problem is retrieved. Usually its solution is close to the solution of current problem.

Figure 4.20 shows the basic idea of the Case-Based Reasoning methodology. If one faces a new problem, he is reminded of similar problems known in the past. Those known problems are not necessarily the prob-

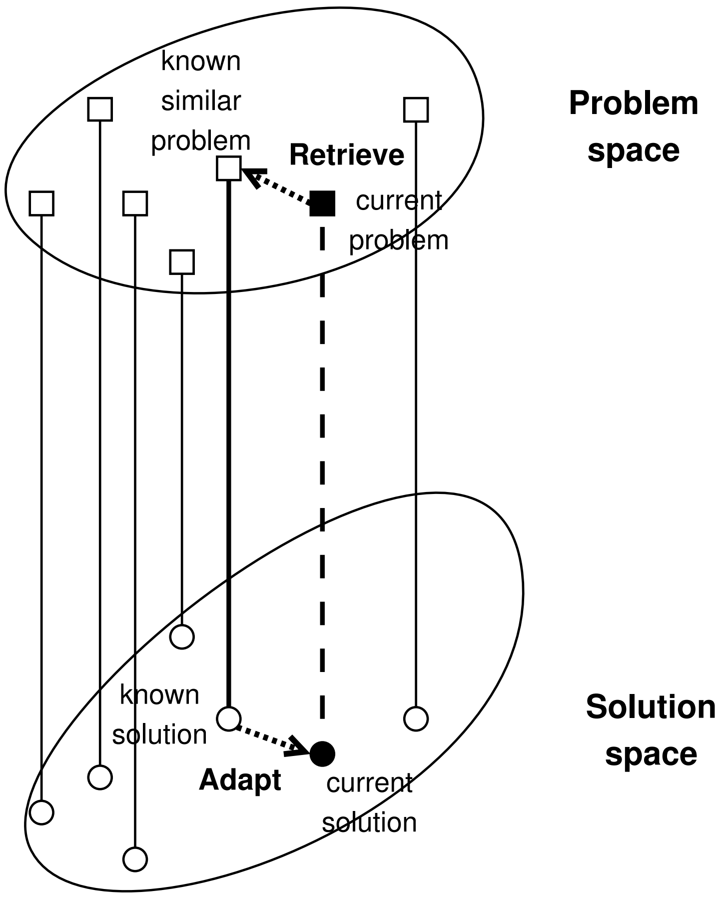


Figure 4.19: Problem and solution spaces [42]

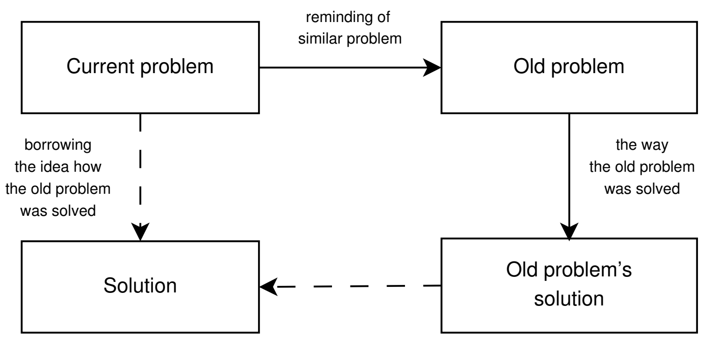


Figure 4.20: Basic idea of CBR [43]

lems he faced personally, but those can also be problems faced by his colleagues. The problems are indexed according to their similarities to the new problem. The way (one of) the most similar problem was solved can be *borrowed* to solve the new problem. By doing problem solving can be accomplished efficiently.

The root of CBR is found in the works of Roger Schank on dynamic memory and the functioning of reminding of earlier situations (episodes or cases) in 1982 [4]. CBR has benefited very much from earlier works on philosophy, in particular that of Wittgenstein on the meaning of language. He stated that the meaning of any object is hardly possible to *define* precisely. The meaning of an object depends also on the context. And, comparing objects is easier than defining the properties of an object. An effective way of describing an object is by presenting it in association of or in a set of other objects [48, 78].

In the reality of shipping, it is difficult to define '*a good ship*'. Framing it within a context of a certain shipping company and a certain trading route, the difficulty of defining *'a good ship'* decreases. And this task becomes much easier, when we associate it with an *existing* ship.

The following definition is applied within the CBR. A case is an object which represents specific knowledge. It contains knowledge at operational level [39]. A case contains three major elements, and it can be expressed as a tuple as follows:

Case = < stored problem, stored solution, outcome[13]>

Query = < new problem >

Outcome is additional information on the problem-solving session, which can be textual and/or numerical. Casebase is where cases are stored and organized. This is where the knowledge of the system is stored, called also knowledge-base.

The concept of 'being experienced' is defined as having faced numerous situations, having solved a variety and/or numerous problems. A shift from being a beginner to being an expert involves learning. Therefore learning is defined: collecting cases. CBR is capable of learning by storing the newest experience into their casebase.

Aamodt and Plaza proposed a four-step CBR methodology, to embrace the aspects of reminding of similar problems, using the way a similar problem was solved, see also Figure 4.21 [4]:

RETRIEVE. A new problem is matched to known problems stored in the casebase. Their similarity values are calculated. Cases are then indexed. One or a few most similar cases are then proposed to the user and the user chooses one of them. Alternatively this procedure can be defined in

[13] or called 'effects' [65].

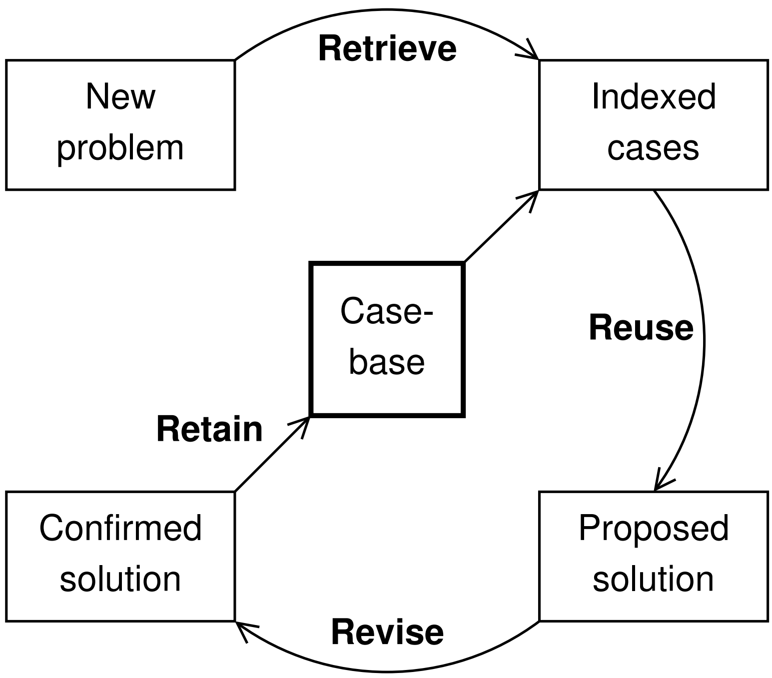


Figure 4.21: Case-Based Reasoning methodology

advance, for example the most similar one is, or n most similar ones are automatically chosen. There are two types of similarity value calculations, local or global similarity calculations. Local similarity deals with the values of a single attribute or a feature. The global similarity calculations represent the holistic view of the case. The relative importance of the attributes is reflected by their weights. For more details, see below.

REUSE. The chosen case acts as a guide for solving current problem. The problem is solved by borrowing the idea how the chosen case was solved. To do this, one can simply copy or adapt the solution concept of the chosen case, whenever necessary.

REVISE. This phase is complementary to the previous one. If the proposed solution is not satisfactory, then the solution is modified.

RETAIN. Retain phase is the learning phase of the system. After completing a session, e.g. problem-solving or a planning session, the result is added with a remark. The result is then saved into the casebase. This session is now instantly available for the next task session.

Similarity measurement

The notion of similarity plays an important role in cognitive processes. Similarity values range from 0.00 to 1.00. Equivalence is the state where the similarity value is maximum, i.e. 1.00. Similarity is defined as the deviation from the equivalence. A common method to measure the similarity is by calculating the distance, which is called the nearest neighbor method [78].

An object may be of simple structure or of complex one. An simple object contains one attribute only, such as deadweight or time. A complex object is composed of more than one attributes, such ship, which can be described using deadweight, speed etc. The attribute similarity value can be calculated using a distance measurement or using a fuzzy membership function. The usage of a fuzzy membership function is preferred, see its illustration in Figure 5.24. The global similarity value is calculated for all attributes of the case and query.

$Similarity(Q, C) = \frac{\sum f(Q_i, C_i) \times w_i}{\sum w_i}$, where

Q : query
C : case
i : individual attribute
f : similarity function for attribute i
w : weighting of attribute i

The function f is the attribute similarity function in the form of, for example, a trapezoidal function or a fuzzy associative map, as illustrated in Figure 4.22 and Table 4.6 respectively.

4.4 Examples from our neighbours

By taking few steps back from our shipping domain, we may observe the domain differently. And to observe and understand it well we may need new ways of doing things which we have not known before. In our domain we are not familiar with those tools yet, but to some these are well-known tools or even toys. And this is the case with this research. To enable developing a method which effectively address the problems in practice, it could very useful to have an eye on methods and their applications in performing similar tasks, eventually in domains other than shipping.

Applications can be distinguished as follows:

1. according to domain: e.g. airline, mechanical engineering, law, transport.
2. according to task: e.g. classification, diagnosis, design.

4.4.1 Residential property valuation

Financial institutions grant mortgages and purchase mortgage packages on the secondary market as investments. Appraisals are needed to grant most

Data needed	Method used	Error (median)
2 attributes	$\$/ft^2$	10%
10 attributes	Statistical formula	8%
10 attributes	Fuzzy-neural net	7%
11-30 attributes	Fuzzy CBR	5%
Site inspection	Human appraiser	3%

Table 4.5: Attributes versus error

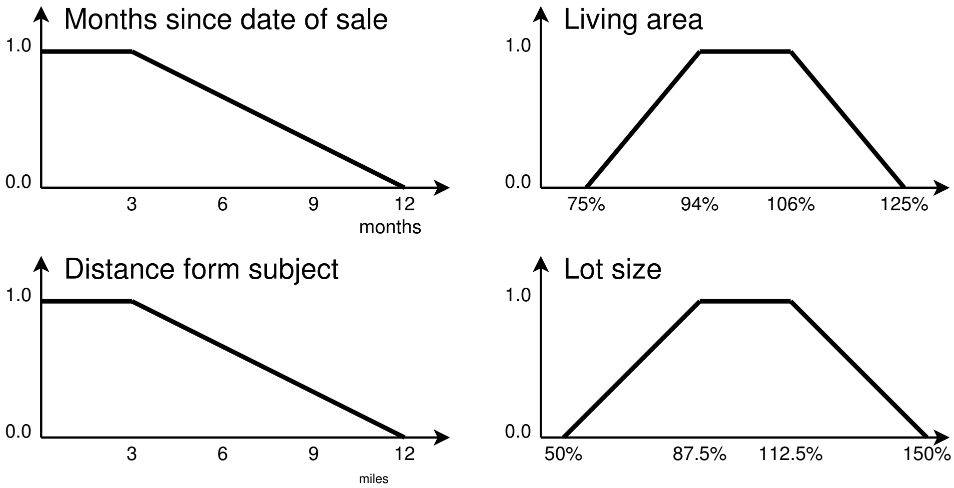


Figure 4.22: Attribute preference membership functions

new mortgages and to evaluate the current value if mortgage packages that may be purchased. The usual way of appraising the value is by inspecting the site and assessing it manually. This process is costly, about \$500 per object, it lasts about three to four days.

The Table 4.5 shows that such a manual method produces the least error compared to other methods. Another finding shown there is that the increasing number of attributes used leads to an increasing accuracy of the assessment [10]. The site inspection producing the best assessment accuracy may be interpreted as an act which incurs more attributes; their size and details are unidentifiable.

Bonissone et al. at General Electric developed a Fuzzy CBR - based method, called PROFIT (Property Financial Information Technology) for tackling this task. After entering the attributes of the property in question, PROFIT retrieves similar cases form the casebase. Six attributes are considered: address, date of sale, living area, number of bathrooms and bedrooms. Similarity calculations are performed between the property in ques-

		Case					
		1	2	3	4	5	6+
Query	1	1.00	0.50	0.05	0.00	0.00	0.00
	2	0.20	1.00	0.50	0.05	0.00	0.00
	3	0.05	0.30	1.00	0.60	0.05	0.00
	4	0.00	0.05	0.50	1.00	0.60	0.20
	5	0.00	0.00	0.05	0.60	1.00	0.80
	6+	0.00	0.00	0.00	0.20	0.80	1.00

Table 4.6: Number of bedrooms - fuzzy relation

tion (query) and the cases stored. The similarity value of each attribute is calculated using the a trapezoidal fuzzy membership function, see 4.22. The attribute similarity value of two other attributes, i.e. number of bedrooms and bathrooms, is calculated using a fuzzy relation, see 4.6. The combined similarity value is obtained using weighted aggregation. Similar cases are then ranked.

The best four to eight cases are selected. The relative of importance of each case is determined from its total similarity value. The values of those cases are than used to calculate the price of the house in concern, using weighted sum method.

4.4.2 Weather forecasting

Reliable forecasting is important for the airline industry. It determines the schedules of the flights. very airport need specific and short-term weather forecasts, the so-called Terminal Aerodrome Forecasts (TAFs). Two aspects of weather are regarded very important, i.e. the cloud ceiling height and the horizontal visibility. These are of importance to guarantee a safe air traffic from and to the airport [67].

There are two types of weather forecasts: (a) long-term and wide area (b) short-term and specific location. Numerical Weather Predictions (NWP) conducted are based upon data sent by weather stations, weather buoys, satellite images and atmospheric probes. The NWP models are run statically and produce weather forecasts on a six hourly basis. The output of the NWP forecasts are long-term oriented and cover a wide area. These serve as a basis for many other forecasts depending on purposes .

For a fine grain forecasting, as TAFs, knowledge on the climate of the immediate region is used by human forecasters. A reliable and widely used technique for accomplishing this task is called the Persistence Climatology (PC) forecasting. PC forecasting bases the prediction for the present weather situation on the outcomes of similar past cases. This is a way

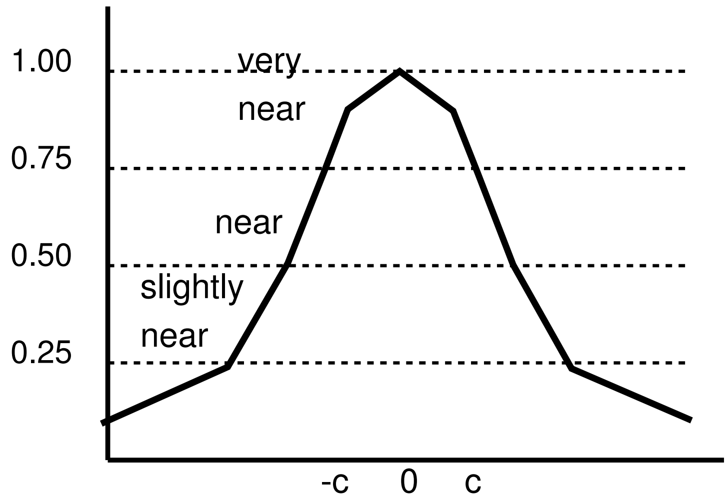


Figure 4.23: Difference as a measure of similarity

solving a new problem by analogy. This resembles the idea of the CBR methodology [28].

Hansen developed the WIND-1 system, a CBR-based forecasting model [29]. This system contains two parts, first a large database of weather observations containing over 300,000 hourly observations. The second part is the fuzzy k-nearest neighbors algorithm. This algorithm applies the CBR methodology. The fuzzy set theory is applied to conduct the similarity measurement. Expert forecasters determine the fuzzy relationships between attributes. Three types of basic measurements: (a) difference of values $(x_1 - x_2)$ (b) ratio of values (x_1/x_2) and (c) nominal attributes. Figures 4.23 and 4.24 illustrate the usage of the difference and ratio for determining the similarity value. The similarity value between nominal attributes is determined using a table, called also the fuzzy associative memory, see Table 4.7.

The relative importance of the case is determined from its similarity. Then the cloud ceiling heights and horizontal visibilities are estimated using weighted sum method.

4.4.3 CLAVIER Project

CLAVIER used at Lockheed Missiles and Space Company is one of the first commercial CBR applications [78], developed in 1987 and used in 1990. Elements used at aircrafts and missiles are made up from composite materials. These expensive materials are made from layers of carbon-fiber products, such as Kevlar. To form them into single laminated components

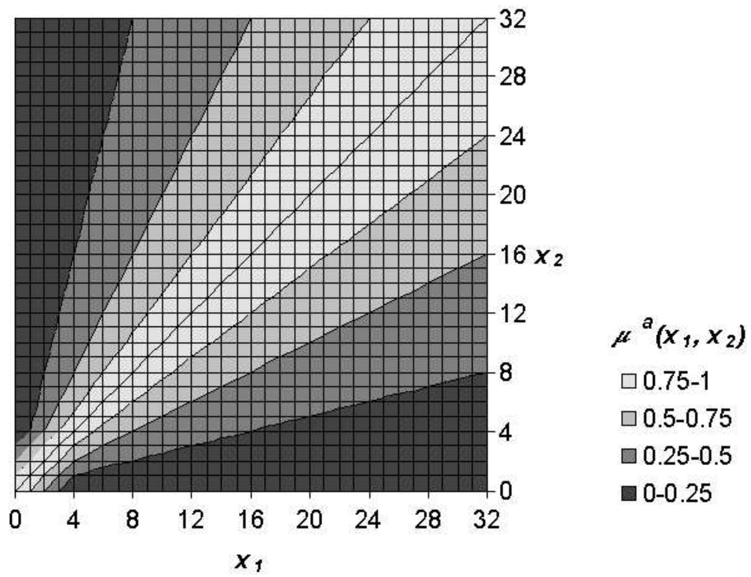


Figure 4.24: Ratio as a measure of similarity

	Nil	Drizzle	Showers	Rain	Snow
Nil	1.00	0.02	0.03	0.01	0.01
Drizzle	0.02	1.00	0.50	0.50	0.05
Showers	0.03	0.50	1.00	0.75	0.10
Rain	0.01	0.50	0.75	1.00	0.25
Snow	0.01	0.05	0.10	0.25	1.00

Table 4.7: Nominal attribute similarity table

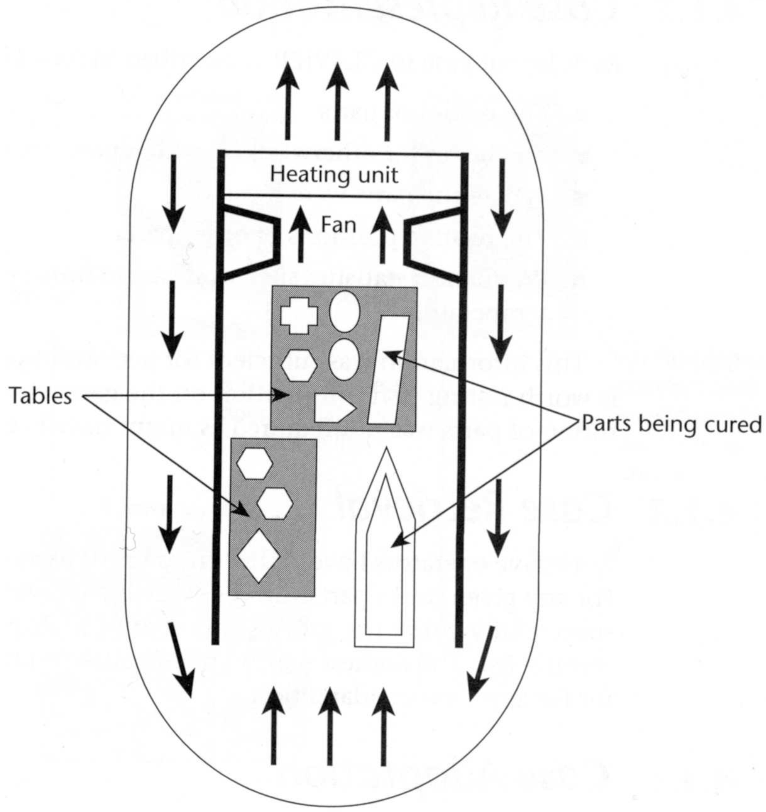


Figure 4.25: Clavier - task

before using them, those components are treated, or called *cured*, in a large oven, called an autoclave. If curing is not successful, the components must be discarded.

The components of various sizes are placed in the autoclave simultaneously, see Figure 4.25. In practice the operators relied upon the drawings of previous layouts to inform how to layout the autoclave. Since the components are rarely identical the risk of failure always exists. The curing characteristics of the autoclave are unknown, and each component has its own curing characteristics too.

Rule-based expert system was developed. It failed, the operators were unable to formulate the rules for curing the components adequately. Thermodynamic modeling failed too. Learning from the success of the natural way the operators solved the layout problems, the following strategy is taken: reuse previously successful loadings.

The process is described schematically by Figure 4.26. Parts or components are categorized according to their priority. For any given list of parts, Clavier seeks to retrieve past layouts that successfully cured the highest

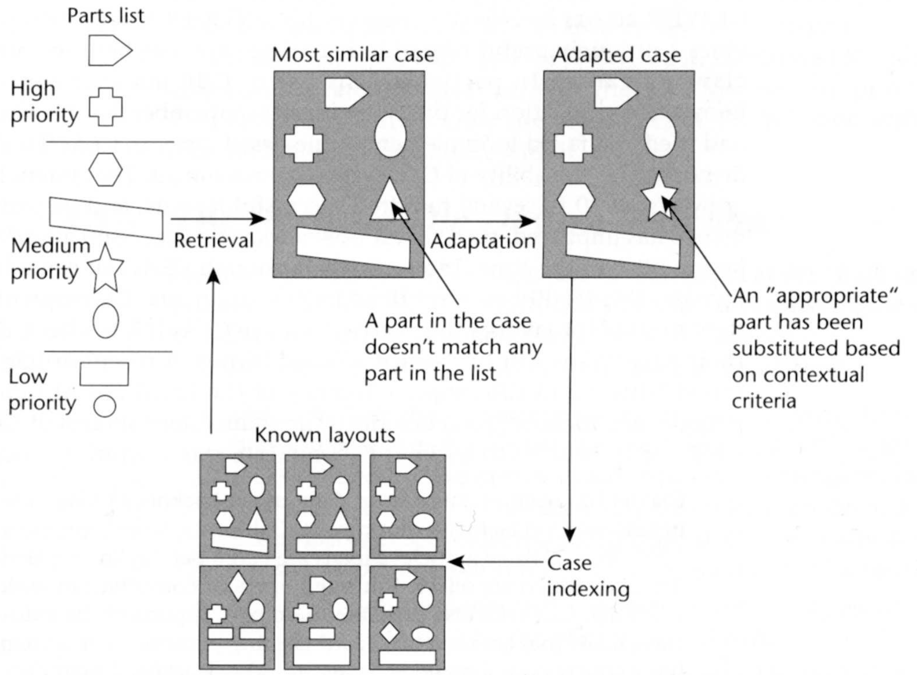


Figure 4.26: Clavier - process

number of high-priority parts. The operator chooses one of the layouts, called the chosen case, and he may adapt it when necessary. When the chosen case is not completely filled by parts on waiting list, Clavier can substitute a non-matching part with a similar part.

The benefits of employing Clavier are evident: pressure of work decreases, the expertise of the experts as a corporate asset is secured, the system can be used to train new personnel.

4.5 Concept of compatibility

4.5.1 Definition

The concept of compatibility serves two purposes: (a) It describes the way a shipping practitioner conducts tasks, solves problems. (b) It is a foundation on which the development of solution tools will be based.

The following summarizes two situations. A ship practitioner knows that a certain ship can replace another vessel which has to be docked soon. Secondly, an experienced shipping practitioner is capable to assess a charter hire quickly. The above addresses two types of situations. The former deals with comparing a ship with another ship to serve the *same purpose*,

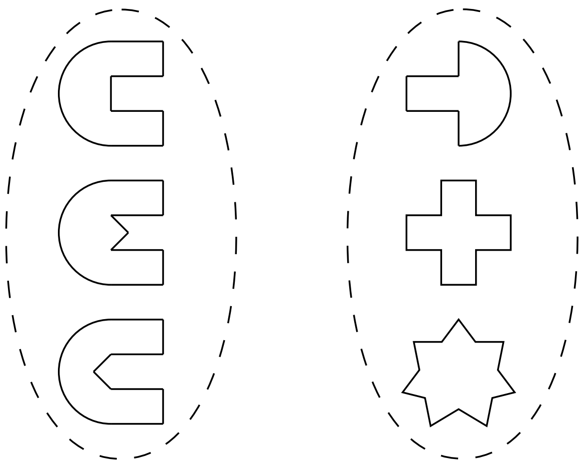


Figure 4.27: Entity compatibility

whilst the latter concerns with the question if a vessel *fits* to a certain charter hire.

Being 'compatible' means being capable of existing in harmony or being capable of bein in combination with others[14]. The above definition embraces two important concepts, namely grouping and matching. Grouping concerns with entities having *the same role* to serve a certain purpose, for example. Matching concerns entities having *different roles* to serve a certain purpose. Entities are object in concern, for example ships. Purpose of having a ship is associated with operating a ship, e.g. coal carriage. A decisive factor is *not only* the physical properties of the ship, e.g. design characteristics and age, but the capability *to fulfill her role* to accomplish a task or job or to serve a purpose. The above leads us to two types of compatibility: (a) entity compatibility, and (b) relation compatibility.

4.5.2 Entity compatibility

Entity compatibility concerns with the degree of fitness of two or more entities, elements or objects which have the *same functionalities* or *roles* to serve a purpose. It represents the concept of inter-changeability, see Figure 4.27.

Sister ships can be regarded as (almost) exactly the same, as both have exactly the same design characteristics. A ship may not be compatible to replace her sister ship, if important requirements are not fulfilled satisfactorily.

[14] More on this definition see Glossary.

Suppose ship A carries coal, fixed for a long term contract. Due to collision she is damaged, ship A must be replaced by a compatible one immediately. The contract states that the ship owner guarantees the coal carriage, and any problems related to the ship, e.g. damage, the owner must find another ship to maintain the service. Her sister ship B is located far away from the traded area of ship A. It would involve high mobilization costs, long, non-operational time, loss of income and possible breach of contract, if ship B is to be employed. A plausible solution is to take another ship, say ship C, having less similar characteristics, located in the vicinity of the traded route. She can be put into service within shorter time. Ship C is more compatible to ship A to serve the purposes (due to her shorter mobilization time in maintaining the existing service).

The above showed the application of the concept to an entity of a complex structure such as a ship. The concept applies as well for an object of a simple structure; that is an object which can sufficiently be described using one variable only, such as time, deadweight, or length. For example: length of port stay of 5.05 days and 5 days are regarded as similar or even equivalent in practice.

Entity compatibility can be viewed as an entity similarity measurement. This can be either numerical, textual, graphical or of other form. The fuzzy set theory may accommodate this matter well, by viewing the entity compatibility as proximity relations.

Examples of problems which are viewed to belong to the entity compatibility are:

1. "Is this ship suitable to replace that one?"
2. "Does this ship belong to the so-called standard handy size bulkcarrier according this J.E. Hyde Index?"
3. "Shall we consider the inquiries from this broker/ charterer?"

The following example is an implementation of the concept of entity compatibility in chartering [15]. Egon Oldendorff offers Finora, the Charterer, MV GRETKE OLDENDORFF. The vessel will carry 20,700 ton of cargo from Vancouver to Mumbai.

MV GRETKE OLDENDORFF (OR SUB) /FINORA

CPDD VANCOUVER BC 05 JULY 2000

20,700 MT/100 MOLCO

VANCOUVER / MUMBAI FOR 25 JULY/ 05 AUGUST

In case MV GRETKE OLDENDORFF has been fixed earlier for another Charter Party, he will be offered another ship which more or less comparable

[15]E-Mail Viveka Mansukhani, dated 10 July 2004

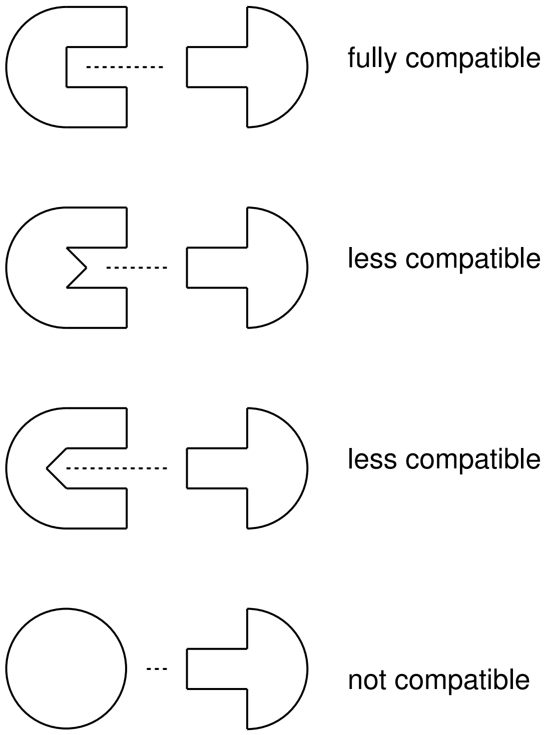


Figure 4.28: Relation compatibility

to MV GRETKE OLDENDORFF, denoted as *'sub'* meaning a substitute. A ship compatible with MV GRETKE OLDENDORFF is viewed as a possible substitute of MV GRETKE OLDENDORFF.

4.5.3 Relation compatibility

The relation compatibility concerns with the fitness between entities of *different functionalities* or *roles* for accomplishing a certain task or to serve a certain purpose, see Figure 4.28. It represents the concept of *matching*, such as between ship and route, ship and company, or ship and a charter hire. In a more general term it may be viewed as a matching between problem and solution. It address the fitness of a problem to its (proposed) solution. Therefore the relation compatibility concept can be viewed as a way to solve problems.

Examples of situations or problems belonging to the relation compatibility are:

1. "This ship B is approximately US$ 5000/day worth".
2. "I believe the prevailing rate for this trade would be about US$ 6500 per day"

Figure 4.29: Recycling

3. "This ship A is currently operating in South East Asian waters, and it has more or less the same size as that of that ship B. I believe this ship A would be an ideal ship to replace that ship B, which has to be docked soon"
4. "Based on our past experience with our previous C/P, we should put additional clause on the matter X when the ship is to trade to port Y".

Elaborating the first example, the above is a result of a problem-solving situation:

> *"Charter hire of ship A (deadweight is 30,000 ton) is \$ 5,000/day. The deadweight of ship B is 31,000 ton. Today's charter hire of ship B will* likely *be* close *to \$ 5000/day".*

The above implies this: if the problems are similar (ship's sizes are similar), their solutions (their charter hires) are likely to be similar too.

4.5.4 Properties

The concept of compatibility involves the capability of *seeing* the relationships between elements. The following aspects mark the concept:

(a) Compatibility may change over time.

The suitability of, e.g. a ship, to serve a certain purpose may change over time. Her compatibility depends on trade and on the ship owners too, see Figure 4.30.

(b) Compatibility involves vagueness. It is a simple fact that is no longer sufficient to describe things in a black-or-white fashion. The definition of, e.g. a good ship and a poor ship, is a matter of degree. The boundary of 'a good ship' is vague, unsharp, see Figure 4.31. To be noted here, that when it comes to the final decision, decisions are usually sharply defined: either yes or not. This involves a defuzzification process.

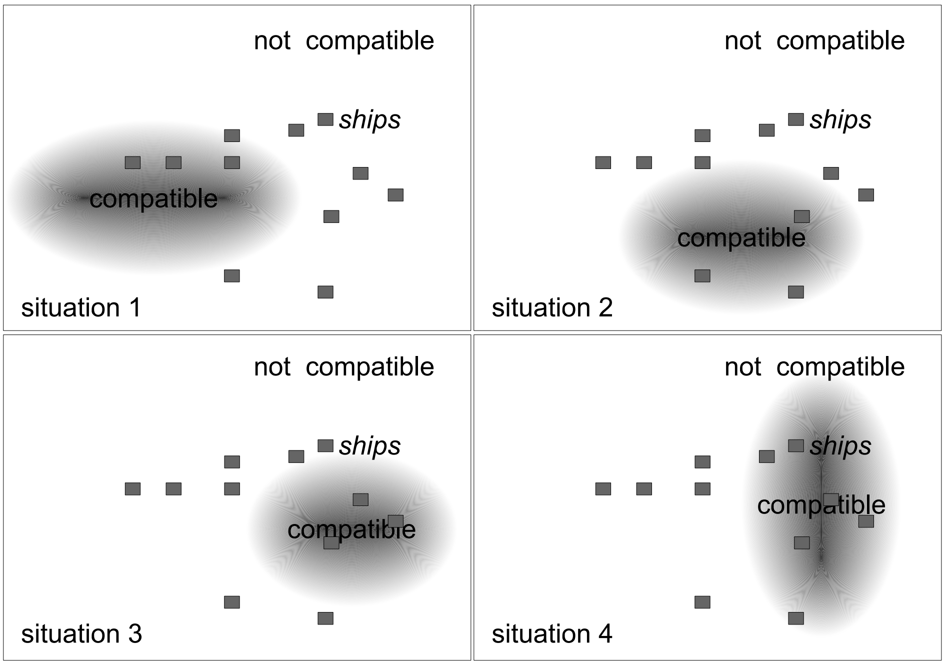


Figure 4.30: Changing compatibilities

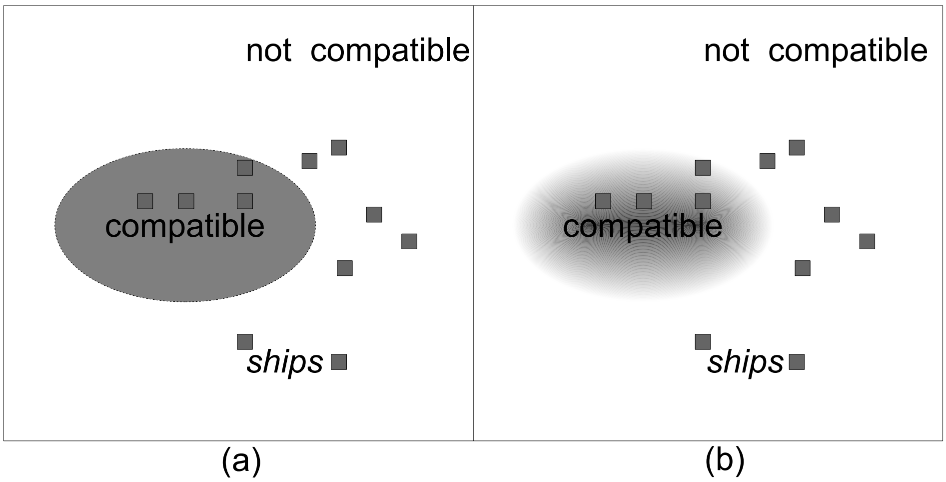


Figure 4.31: Crisp and fuzzy compatibilities

(c) The concept of compatibility is an outcome of a learning process. The capability of ship practitioners to recognize things is extremely valuable. This capability is largely from experience. It is the experience to handle similar tasks in the past. The capability to recognize groups and relations, for example between ship and its value, enables a practitioner to conduct his job efficiently and fast. This process is called an intuitive process, see Kahneman in sub-section 4.2.4. This process is effortless and fast. The capability of using the intuition marks the difference between a novice and and an expert.

(d) It involves reusing past experiences. It asserts the role of experience. 'Reinventing the wheel' is expensive and effortful. An experienced practitioner *recognizes* the compatibilities as he has faced numerous cases in the past. As he faces a new task or problem, he tries to look up, if it reminds him of similar cases in the past. One or more cases are perhaps quite similar to the actual one. It takes a lot time and energy, if one has always to solve things from a scratch. In many occasions, one can reuse his own, his friend's or his superior's experiences. One can borrow the way things were solve. Figure 4.29[16], taken from a waste recycling campaign, symbolizes this idea. Past stowage plans or past solutions are not useless. Those can be 'recycled' and 'reused'. Remembering similar problems and their solutions may help us solving a new problem.

(e) The concept can be of a great use, especially in case of incomplete knowledge. Formal knowledge only is not adequate to conduct shipping business well. Some type of knowledge is hard, when possible, to express. There are some codes, which are simply inexpressible. Expressing as a rule, or a hint has an tentative character. It is vague, it can be subject to interpretation. And it can be inconsistent too. Time and context play an important role. Even key ideas of someone else's experience may guide us toward a solution [25].

(f) It is an attempt to alleviate the difficulty of defining things precisely. It implements the assertions of Wittgenstein, that it is hardly possible to define objects precisely. Even for physical objects it is hardly possible to define precisely and objectively what we understand under ' a good ship' or 'a good stowage plan'. Comparing objects alleviates the burden to define things precisely and objectively.

(g) It is task-oriented. A successful practitioner does not have to know the exact size of the world fleet before he puts a newbuilding order. Nor he needs someone to make a market model before he make a decision. But he can do complex tasks, such as assessing value of ships, intuitively. It is a straightforward and an efficient way, considering the limited capability of a human to address complex problems, see Simon in sub-section 4.2.1. Ex-

[16]adapted from http://www.mygeo.info/cliparts_umwelt.php?startimage=90, snapshot of 18 December 2004

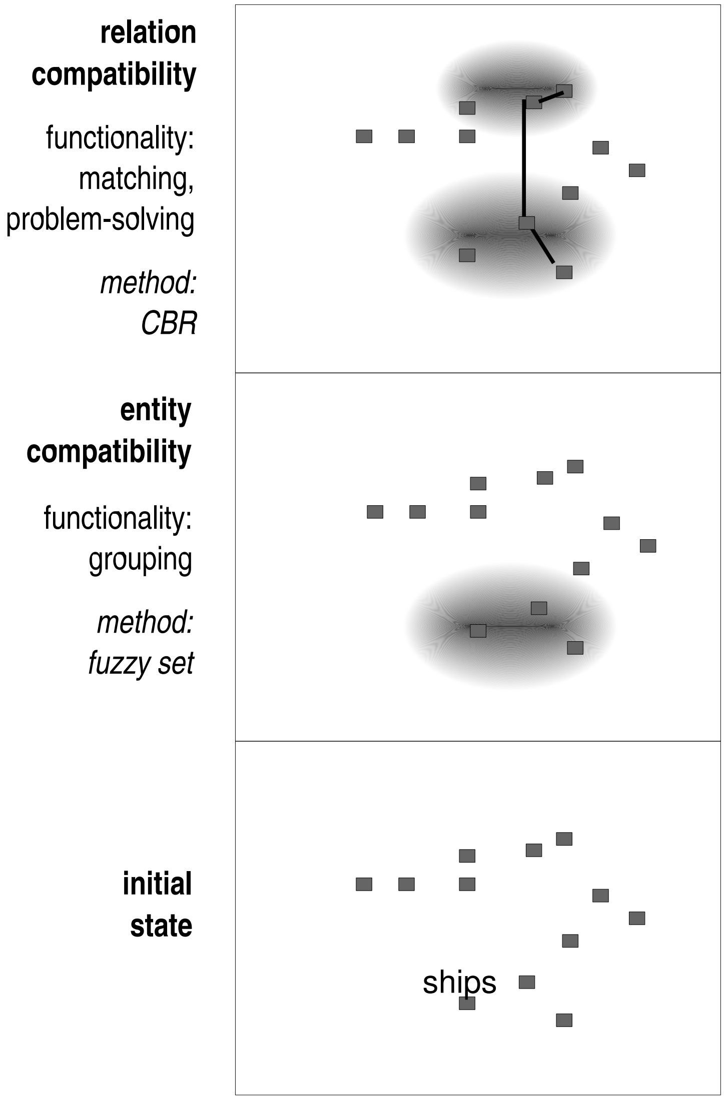


Figure 4.32: Concept of compatibility: an overview

tracting the knowledge on the mechanism or the process of the functioning of a system is laborious, not easy and not always possible.

4.5.5 Choice of methods

The entity compatibility deals with grouping of entities. This involves vagueness. The fuzzy set theory would be an ideal method to address it. In the frame of similarity measurements or other calculations, the fuzzy set theory can be of a great use.

The relation compatibility is marked with the notion of problem-solving. Rule-based expert systems are less practicable to be applied widely in shipping practice. It is difficult to obtain expert's knowledge, which is complete and consistent. Nevertheless, for a specific and narrowly defined task, applying expert system can be worthwhile. To circumvent the knowledge acquisition problems, case-based reasoning is regarded as a good option for addressing problem-solving tasks.

4.6 Conclusions of the chapter

1. Theory of bounded rationality suggests that the human capability to address complex problems is limited. Fully rational decision making is hardly possible, since a human has never a complete knowledge and a full and reliable access to information.

2. The concept of compatibility is a framework aiming at better elaborating the way a shipping practitioner conducts his daily tasks. The concept serves two purposes: a. aiming to explain the phenomenon of compatibility in shipping b. aiming at laying a foundation for solving problems in shipping. The capability of addressing imprecision, recognizing similar events and learning marks this concept of compatibility in shipping. Adopting the concept of compatibility, it will provide a foundation for addressing the shipping problems in a more natural way.

3. As the real world of shipping practice involve aspects such as vagueness, complexity, intuition, knowledge intensity, we may need a new way of how to look at and to treat the problem. The Artificial Intelligence concerning with understanding the notion of human intelligence and aiming at building intelligent systems, can viewed as an opening gate towards understanding and appreciating the above aspects.

4. Expert systems are programs which aimed at mimicking expert knowledge. The heuristic knowledge is captured and expressed as if-then

rules. This method of solving problem can be very efficient for a limited scope of problems. Real problems grow in size in the course of time. It is the source of difficulty. The program is not getting smarter because of having solved more problems. The program must be fed manually with new rules. Modification and maintenance of rules is laborious and difficult.

5. Fuzzy set theory is a superset of the crisp set theory. The fuzzy set theory aims at addressing the notion of imprecision marking the shipping system. This fuzzy set theory, in combination with other methods when necessary, may contribute to address the entity compatibility problem.

6. Case-based reasoning methodology solves a problem by remembering how similar problems in the past were solved. It relies on specific knowledge contained in a case. The CBR is capable of learning.

7. Fuzzy set theory and case-based reasoning, in combination or separately, are proposed methods to implement the concept of compatibility.

Chapter 5

Proposed Implementations

5.1 Fuzzy arithmetic-based voyage estimation[1]

5.1.1 Motivation

Conducting voyage estimation is laborious. A chartering staff spends considerable time on voyage estimation [81]. It is necessary to have an idea or a 'control' on the likely profitability of the voyage charter party he is negotiating for. Given the high pressure to handle few negotiations in parallel and to act timely, therefore he must be able to estimate speedily and accurately [23].

Chartering staff has long been supported with voyage estimation programs. To address the uncertainty of, say ship's speeds, he uses the concept of interval, called sensitivity analysis. The sensitivity analysis performs calculation through varying the values of a variable. The staff analyzes it, if the ship will still generate a certain profitability in the worst situations or vice versa.

The sensitivity analysis can easily be performed. In practice sensitivity analysis is usually conducted by varying only one variable. Varying the values of more variables can also be done easily. In this case, the number of scenarios will explode. Suppose s_i is the number of scenarios of variable i and v is the number of variables. The number of scenarios (=n) will be $n = s_1 \times s_2 \times s_3 \times ... s_v$. If the number of scenarios are the same for each of all variables, then $n = s^v$. For s=3, the scenarios can be expressed as low, mid and high. If the number of variables is 4, then the number of scenarios produced is $3^4 = 81$.

The problem does not lie in the effort of conducting the sensitivity analysis. The problem lies now in the difficulty to use the result of the sensitivity analysis. The abundance of information produced does not ease the decision maker to interpret the increased complexity of result of the sensitivity

[1]This section is adapted from [57]

analysis.

To address the interpretation complexity, it would be of use to loose the intention of using high precision. One may cut down the complexity using approximation, see Simon et al in sub-section 4.2.2. If the precision is higher, the complexity increases exponentially [Ross1996].

5.1.2 Interpretation problem

No. variables (v)	Total number of scenarios (n)		
	s=2	s=3	s=4
1	2	3	4
2	4	9	16
3	8	27	108
4	16	81	432
5	32	243	2160

Table 5.2: Calculation sessions

The following voyage estimation example is taken from Evans and Marlow [23], with some necessary additional information and modifications for demonstration purpose. MV UNIVERSE CARDIFF, a bulk carrier, is to carry 25,500 $\pm$5%ton scrap from New Orleans to Yokohama. The freight rate is US$ 25.00/ton fio[2], loading and discharging speeds are 3,750 ton/day average, 7 day respectively, SHEX[3].

The above statement has legal and operational consequences. From operational viewpoints, the above can expressed as approximations, as follows:

1. The vessel will carry *approximately* 25,000 ton, ranging between 24,225 and 26,775 ton of scrap.

2. The loading and discharging speeds are *about* 3,750 ton/day. In practice these speeds may deviate from this value due to weather, availability of cargo and performance of cargo gears. This value of about 3,750 is interpreted as 3,750 $\pm$5%, meaning all values ranging from 3,563 - 3,938 ton/day.

3. Speed of the vessel will be *about* 14.5 knots. Weather play an important role for the deviation of speed. A speed of *about* 14.5 knots

[2] free in/out
[3] Sunday Holiday Excluded

is interpreted as 14.5 $\pm$5%, meaning all values ranging from 13.77 - 15.22 knots.

A classical sensitivity analysis is by varying the values of the variables each in, say, three variations for simplicity. The sensitivity analysis is performed according to one of the following fashions:

1. Only amount of cargo varies
2. Only cargo handling speed varies
3. Only the vessel's speed varies
4. Amount of cargo and cargo handling speed vary
5. Amount of cargo and the vessel's speed vary
6. Cargo handling and the vessel's speeds vary
7. All variables vary

This sub-section concerns with the last point 7, as it covers all previous sensitivity calculations. Figures 5.1, 5.2 and 5.3 show the input of amount of cargo to be transported, vessel's speed and cargo handling speed for all 27 scenarios.

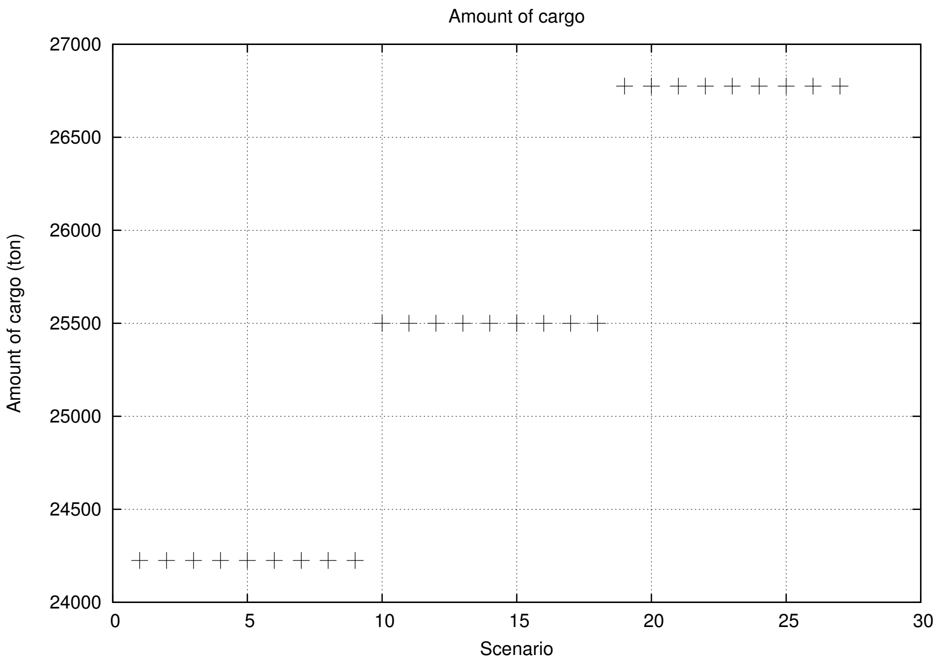


Figure 5.1: Current procedure's input: Amount of cargo

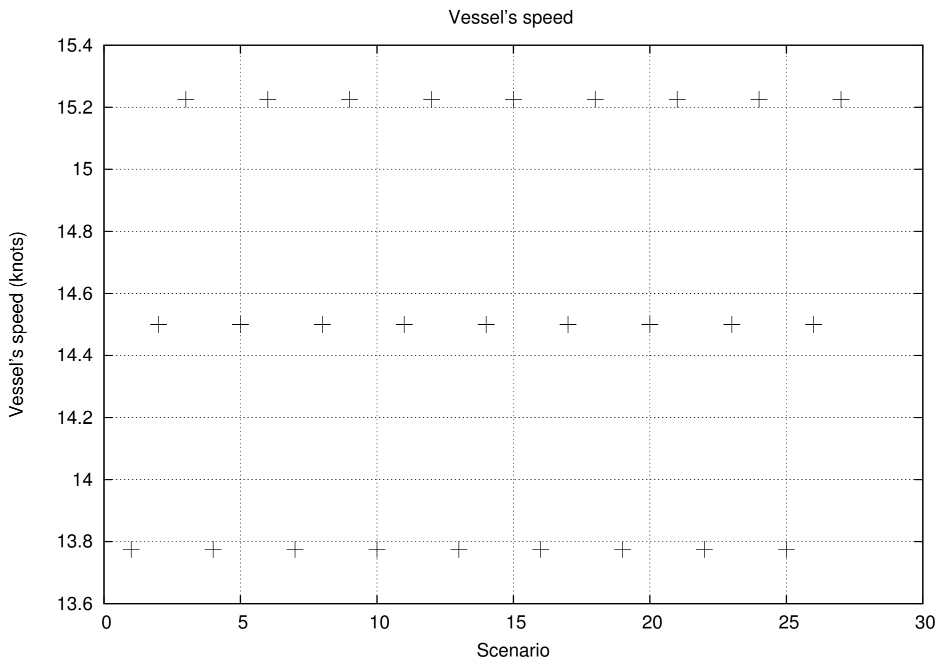


Figure 5.2: Current procedure's input: Vessel speed

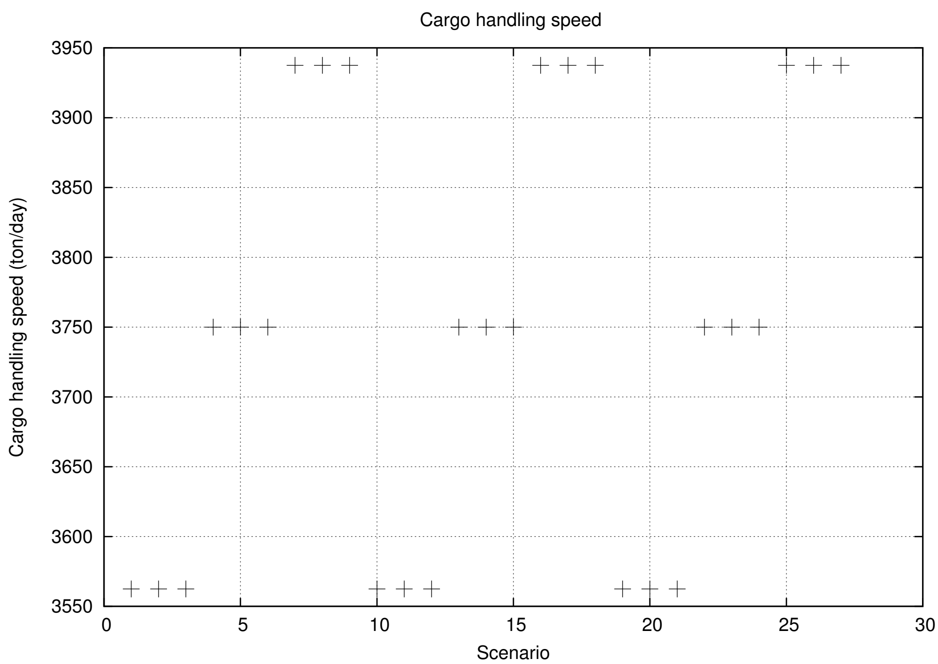


Figure 5.3: Current procedure's input: Cargo handling speed

It becomes soon evident that the abundance of information becomes a problem. Figure 5.4 shows the duration of the voyage in the scenarios. Figures 5.5 and 5.6 show possible the gross profit and time charter equivalent values of the intended voyage charter party. It is difficult to recognize which scenario is likely to happen. A shipping practitioner reduces the complexity of sensitivity analysis by using one one variable varied and keeping other variables constant.

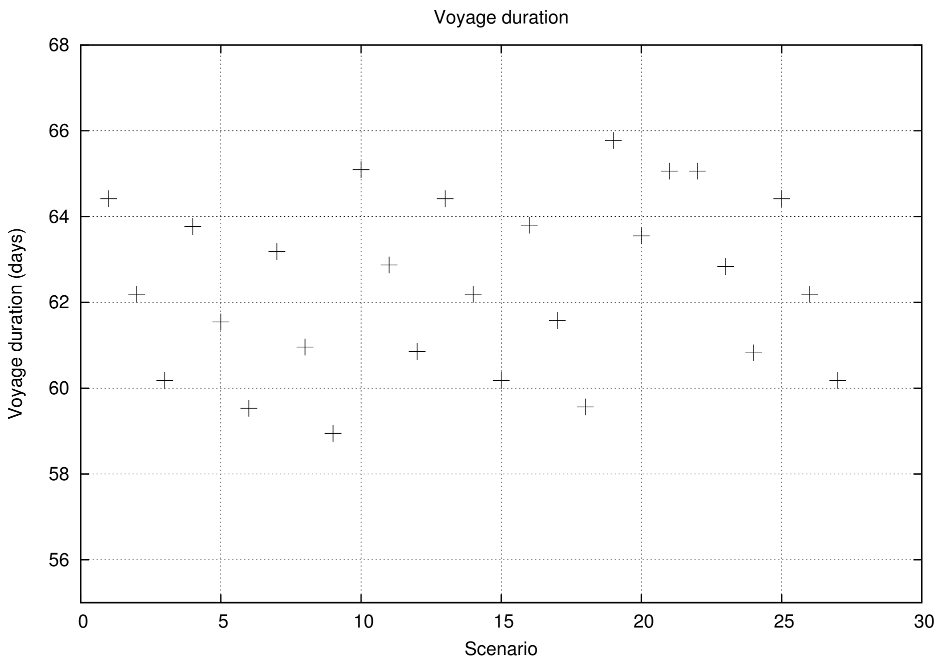


Figure 5.4: Current procedure's output: voyage duration

5.1.3 Fuzzy voyage estimation model

A fuzzy arithmetic - based voyage estimation model, named F-Voyage, has been developed to demonstrate its use in assisting decision making in chartering. The idea is to capture the imprecision by employing fuzzy numbers. Figure 5.7 shows the flowchart of this model.

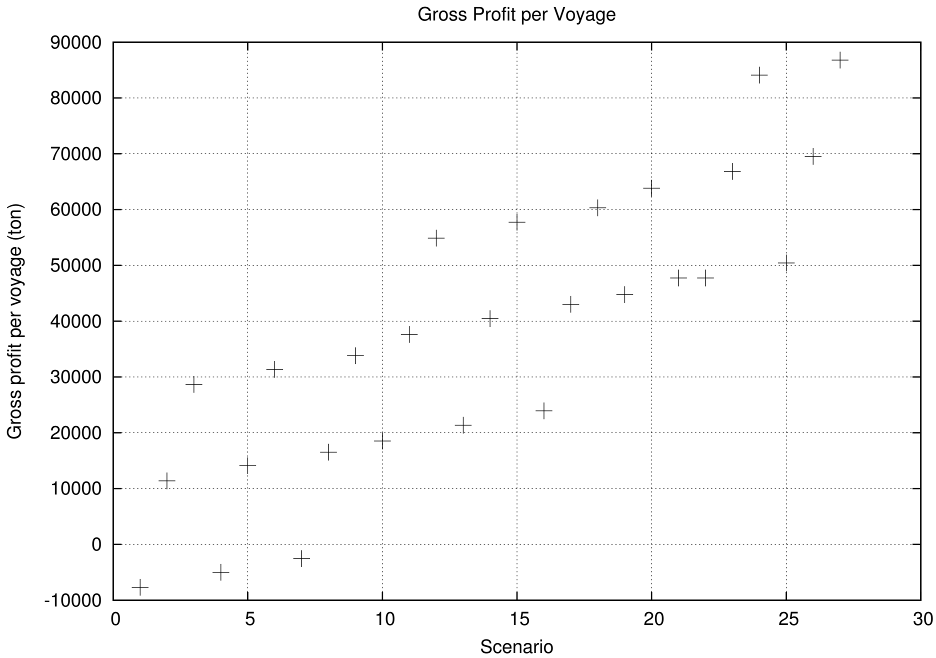


Figure 5.5: Current procedure's output: gross profit per voyage

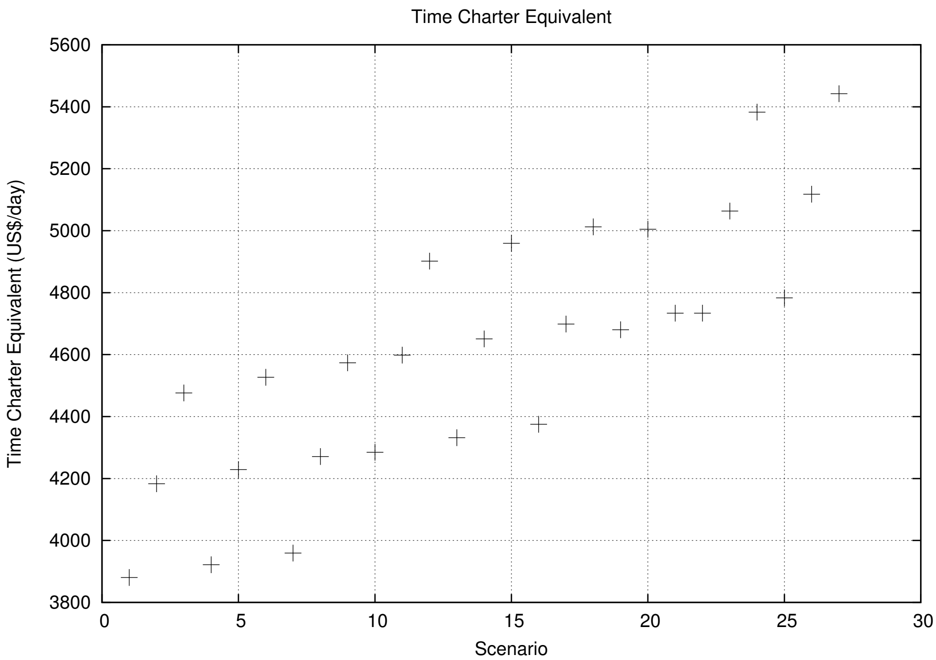


Figure 5.6: Current procedure's output: time charter equivalent

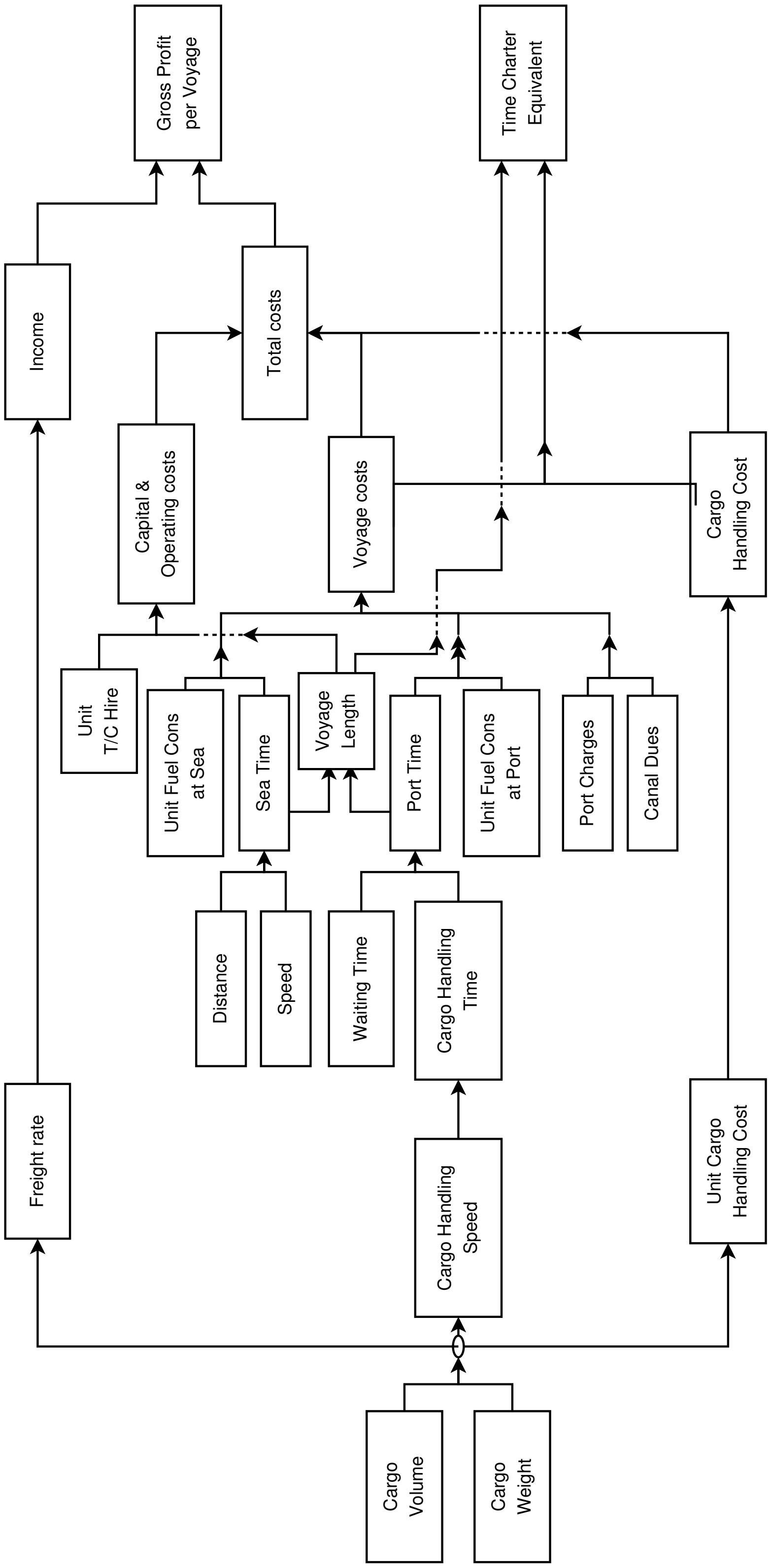


Figure 5.7: Voyage estimation model

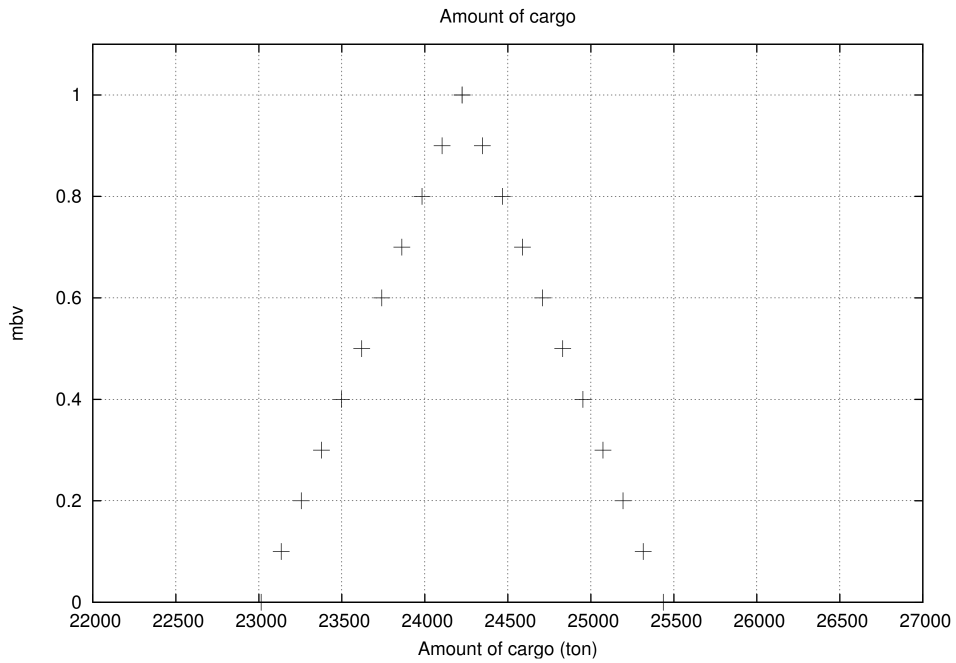


Figure 5.8: Fuzzy input: amount of cargo

Figures 5.8, 5.9 and 5.10 show the amount of cargo, vessel's speed and cargo handling speed represented as fuzzy numbers using a triangular fuzzy membership function. The approximative values are represented by these fuzzy numbers.

Figures 5.11, 5.12 and 5.13 show the likely voyage duration, total costs and income of the charter party. Finally, Figures 5.14 and 5.15 show the results, i.e. gross profit and time charter equivalent. In words the gross profit will likely be *about* US$ 40,000 and its time charter equivalent *approximately* US$ 4,650/day.

5.1.4 Discussion

The problem of sensitivity analysis is caused by the difficulty of interpreting the abundance of calculation results. The above is an attempt to reduce the complexity of interpretation by capturing the notion of imprecision, using fuzzy numbers.

Information significance is a feature of the model. It presents the user the idea that some numbers are more significant than the other. Values of high membership function can be interpreted as more likely to happen than those of the lower ones.

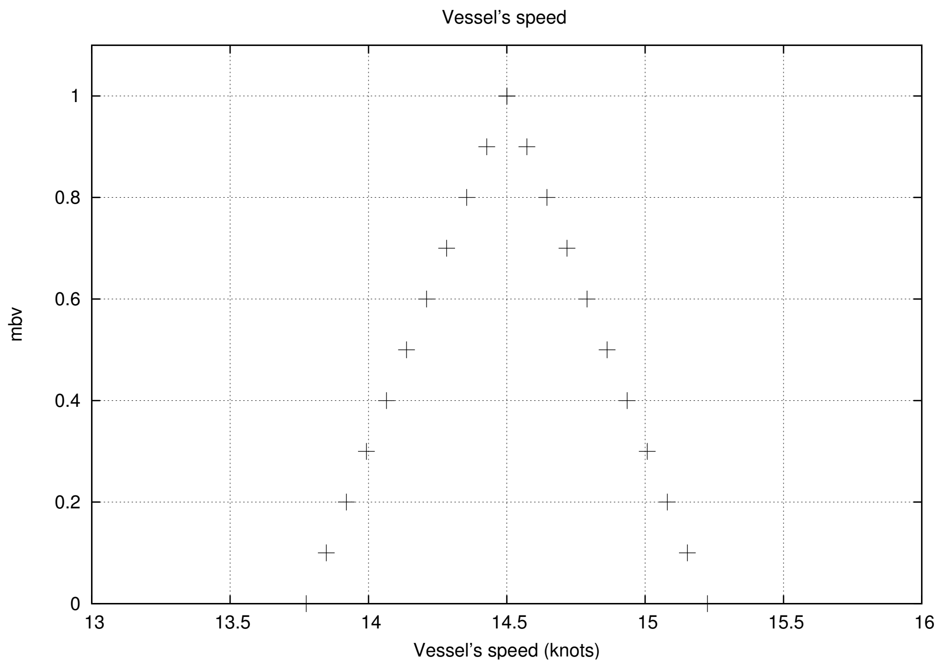


Figure 5.9: Fuzzy input: vessel's speed

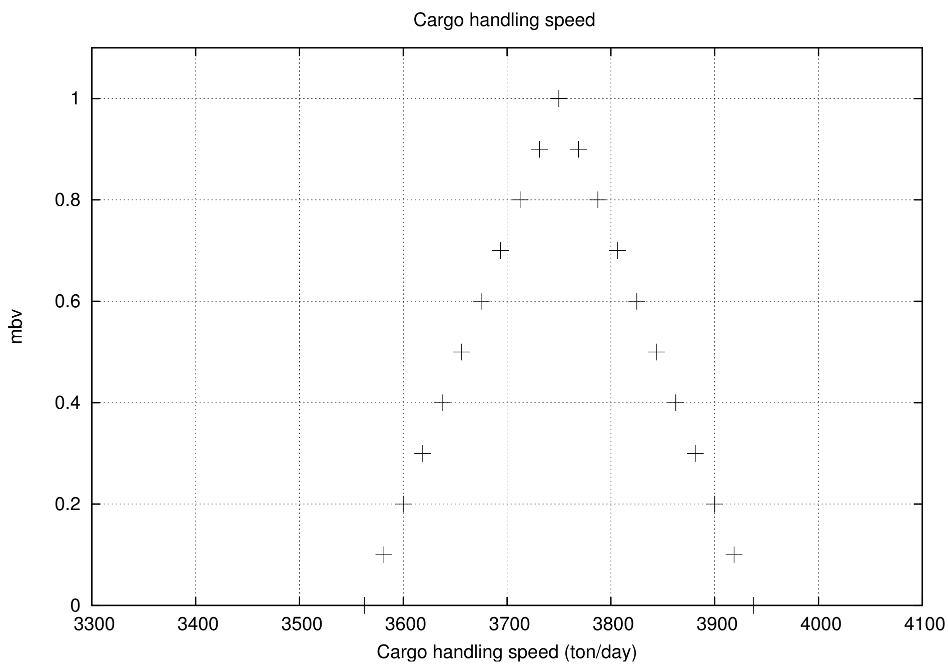


Figure 5.10: Fuzzy input: cargo handling speed

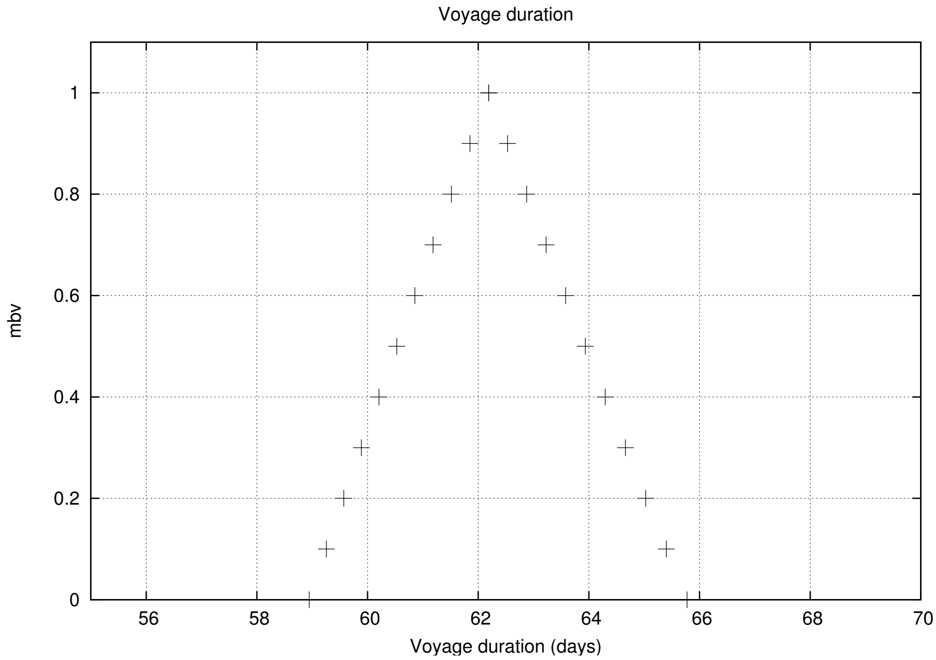


Figure 5.11: Fuzzy output: voyage duration

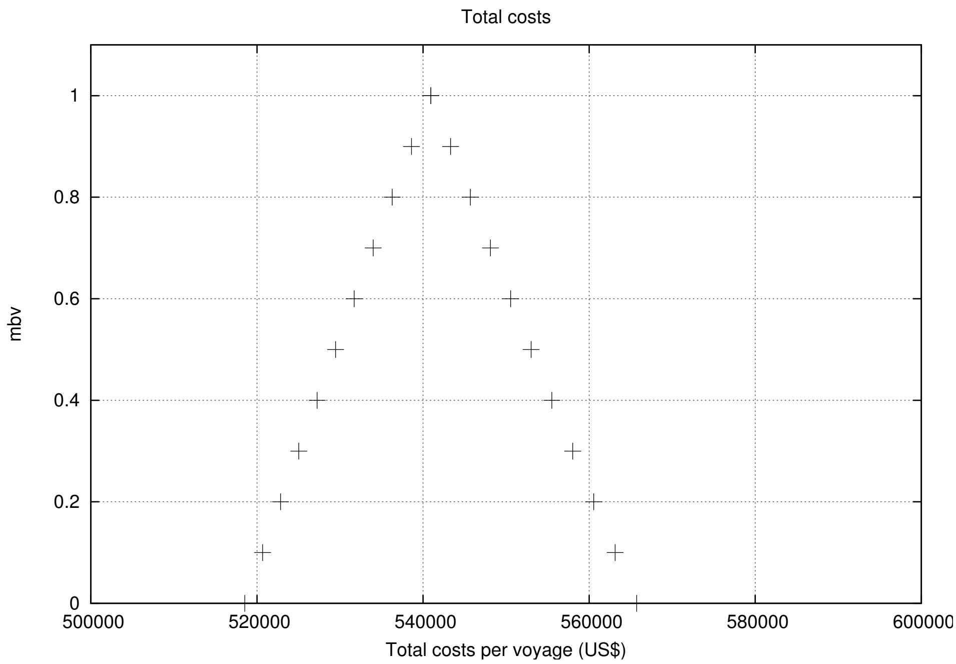


Figure 5.12: Fuzzy output: total costs per voyage

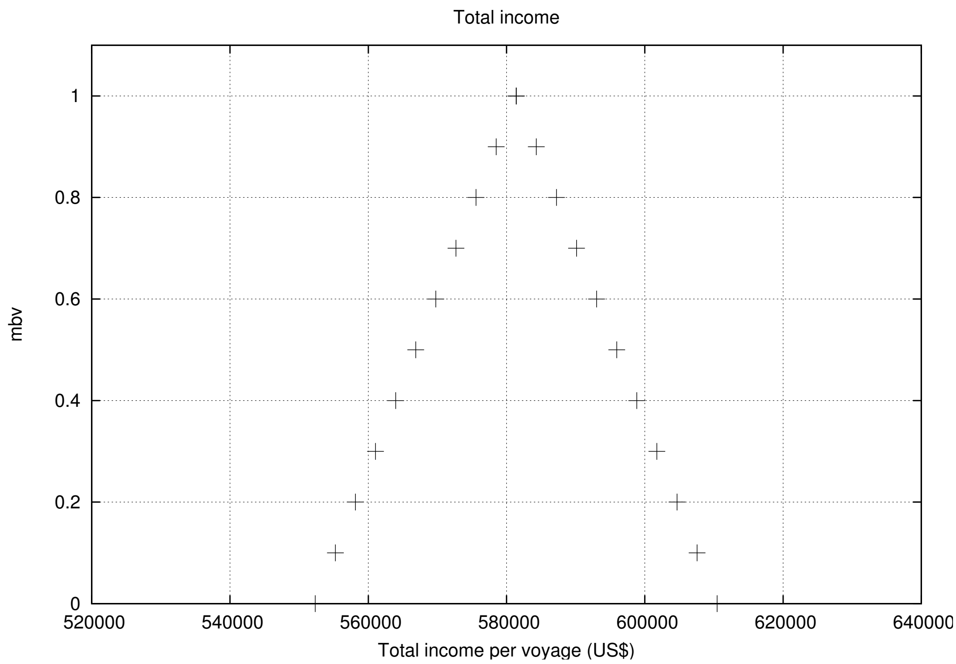


Figure 5.13: Fuzzy output: total income per voyage

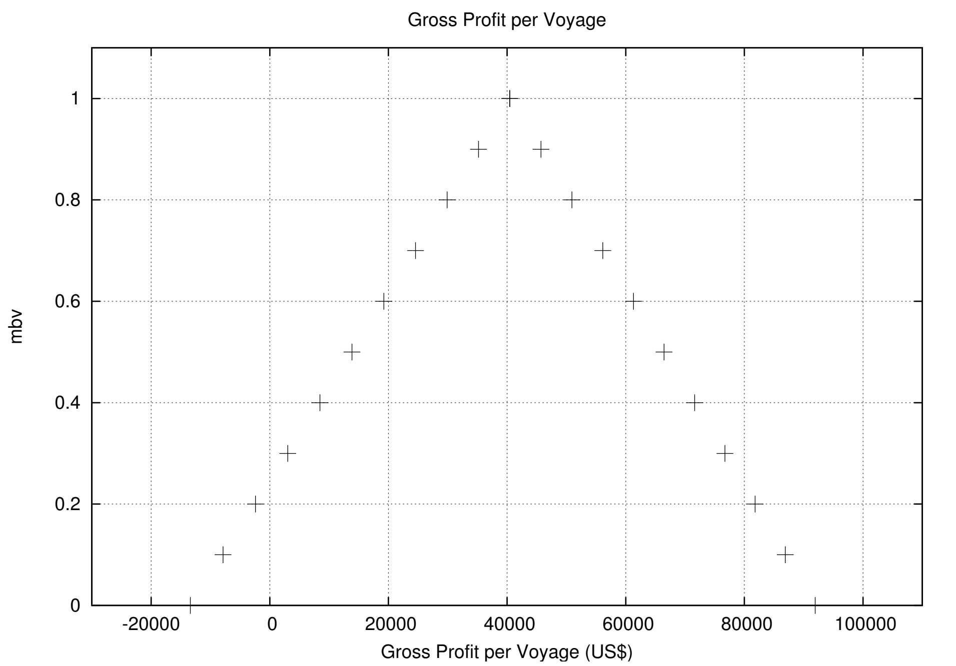


Figure 5.14: Fuzzy output: gross profit per voyage

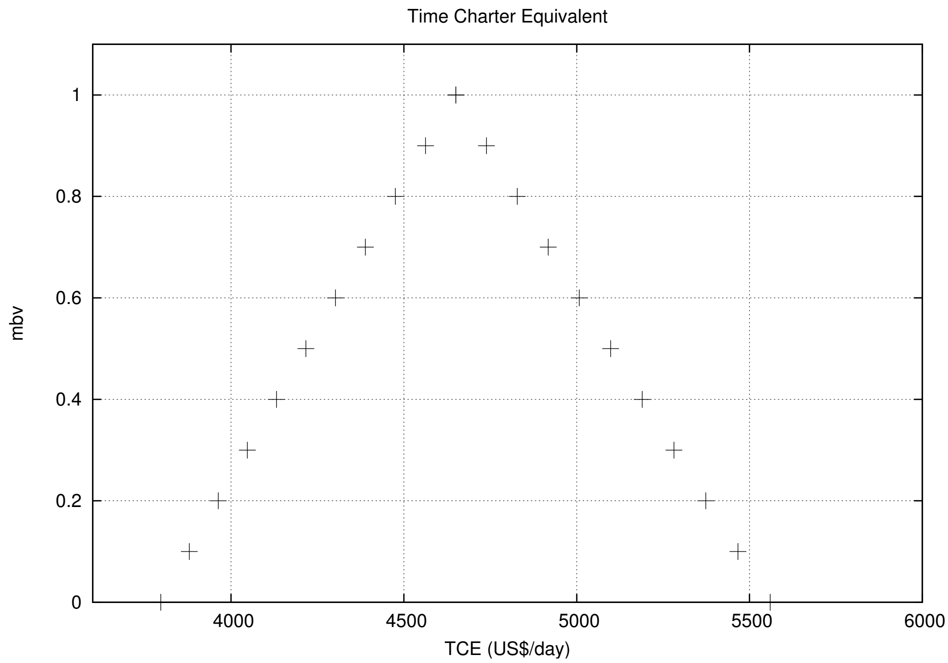


Figure 5.15: Fuzzy output: time charter equivalent

5.2 Tailor-made shipping index

5.2.1 Coverage problem of shipping index

Chapter 2 and 3 have shown that shipping indices are not adequate to assist shipping practitioners to conduct their daily job in chartering. Using the Time Charter fixtures used in Chapter 2, a quick glimpse on the coverage of the J.E. Hyde Index can be made. Using a trapezoidal fuzzy membership function, ships having similar deadweight to a route of J.E. Hyde Index is determined. Furthermore the Index describes that the index is appropriate for 'modern ships'. The definition of modern ships is usually based on age. More precise definition on ship's characteristics are not available. Another important property of an index is the route. The charter fixtures record the delivery and redelivery ports. Since no port database is available, determining the 'route compatibility' using the charter fixtures used in Chapter 2 is impossible.

The coverage of the J.E. Hyde Index is measured on two variables, size and age. For Route 1, the ship's size is defined as (a=25,000 b=27,000 c=43,000 d=50,000 dwt) using a trapezoidal membership function, see subsection 4.3.2.The age of ship is defined a=0 b=0 c=5 d=12 years.

From 7719 fixtures having complete information on ship's deadweight and age, 7377 having membership value (mbv) of 0.0, meaning that the fixtures are not covered by the Index at all. 342 fixtures (4.6%) having an mbv $\geq$ 0.0, 315 fixtures (4.2%) with an mbv $\geq$0.25, 226 fixtures (3.0%) having an mbv$\geq$ 0.50 and 103 fixtures (1.3%) $\geq$>=0.75. Only 47 fixtures (0.6%) have an mbv =1.00, meaning that only 47 fixtures are well covered by the Index. Some of them are illustrated in Figures 5.16 and 5.17.

The fixtures contain important geographical aspects which affect the charter hire very much, namely the delivery and redelivery ports of the ship. Measuring the geographical similarity is ideally based on the sailing distances, and not based on the straight line distances. Due to the size of the data and the unavailability of complete sailing distances, geographical similarity calculations cannot be performed. Therefore the coverage figures mentioned above are still a too optimistic figure since other criteria, such as the geographical criterion (trade route), are not included. Therefore adding other ten indexes of J.E. Hyde would not affect the conclusion on the coverage of the index, as confirmed by findings in shipping practice, see also 3.1.2.

5.2.2 Tailor made shipping index

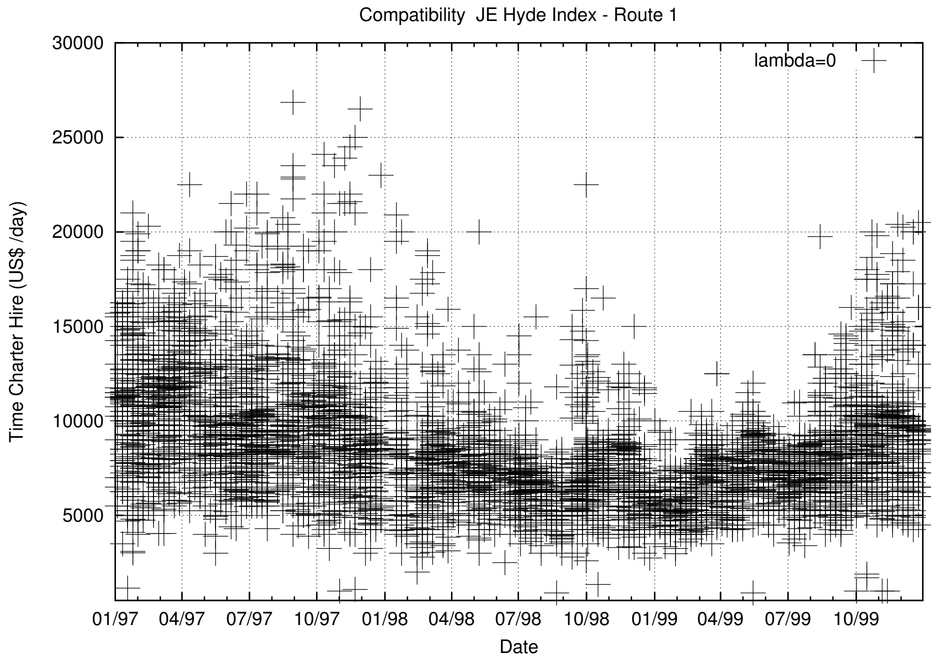
Given the fact that the shipping indexes do not serve shipping practitioners well, it would be of use if a company has the opportunity to make its own index. That is an index specific for *any particular* ship, route or cargo. The so-called tailor-made shipping index. This new index is made, based on the existing indices published.

Ships trade all over the world. They transport almost any kind of cargoes, connect all ports worldwide, use all currencies. The sector has has always an international character from the very beginning. Any event affects the sector considerably. A changing trend of one route may affect other routes as well.

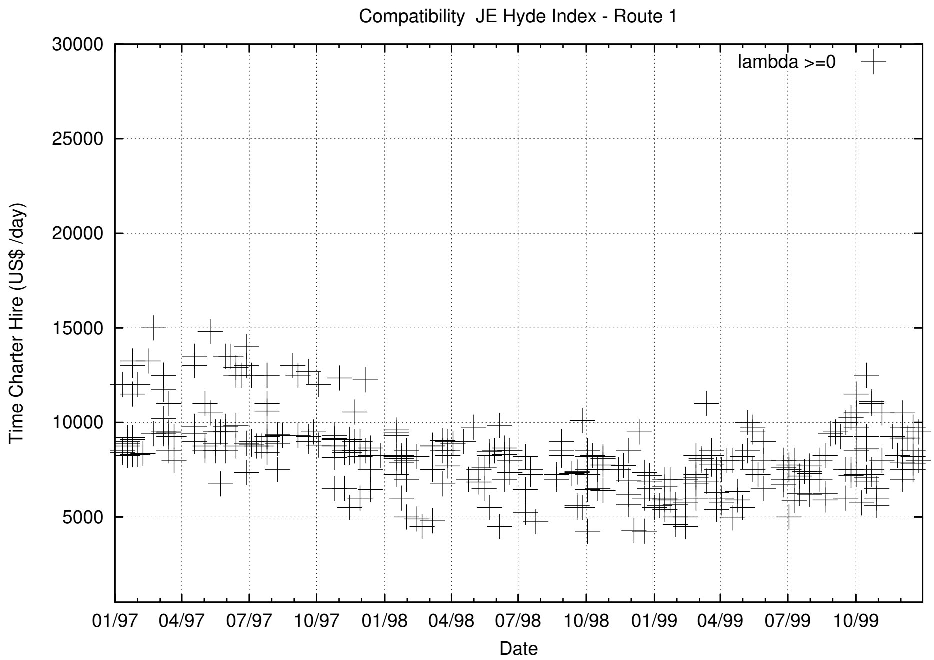
The idea is that an index, representing a route, is always in *connection* with other routes. This route must have a certain degree of similarity with one or more routes. By considering 'the distances' with other known routes, the index can be determined.

In this experiment a new index is calculated based upon three known indexes, Routes 1 till 3 of J.E. Hyde Index, using the Case-Based Reasoning methodology. The fourth index resembles the Route 4 of the J.E. Hyde Index, for evaluation purposes. The new tailor-made index is assume to resemble the Route 4 of the J.E. Hyde Index. The procedure is as follows:

1. The values of the known indexes are normalized.
2. The similarity between the new index and the three known indexes are measured using a bell-shaped fuzzy membership function.

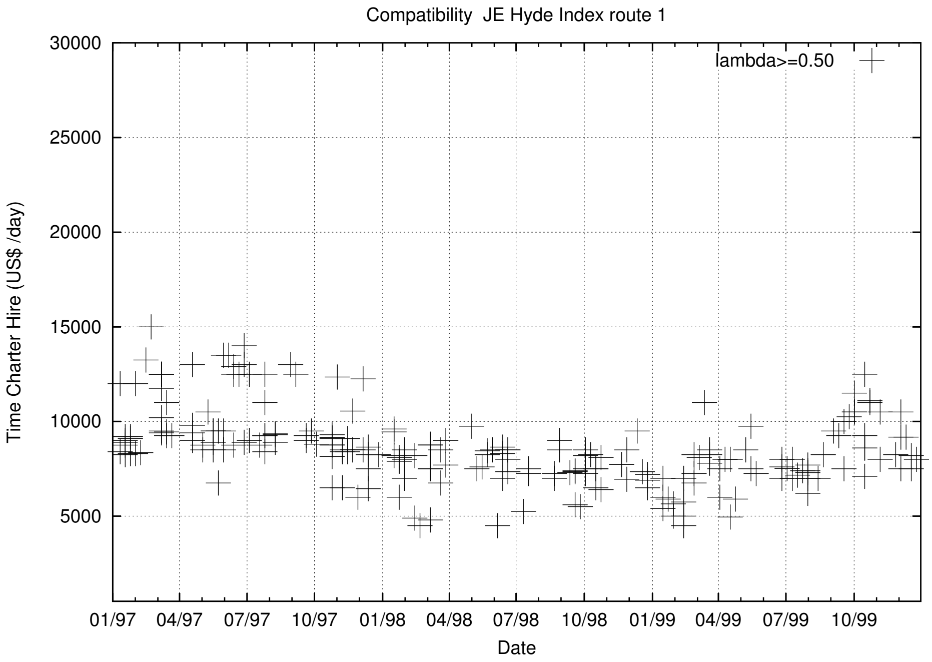


(a)

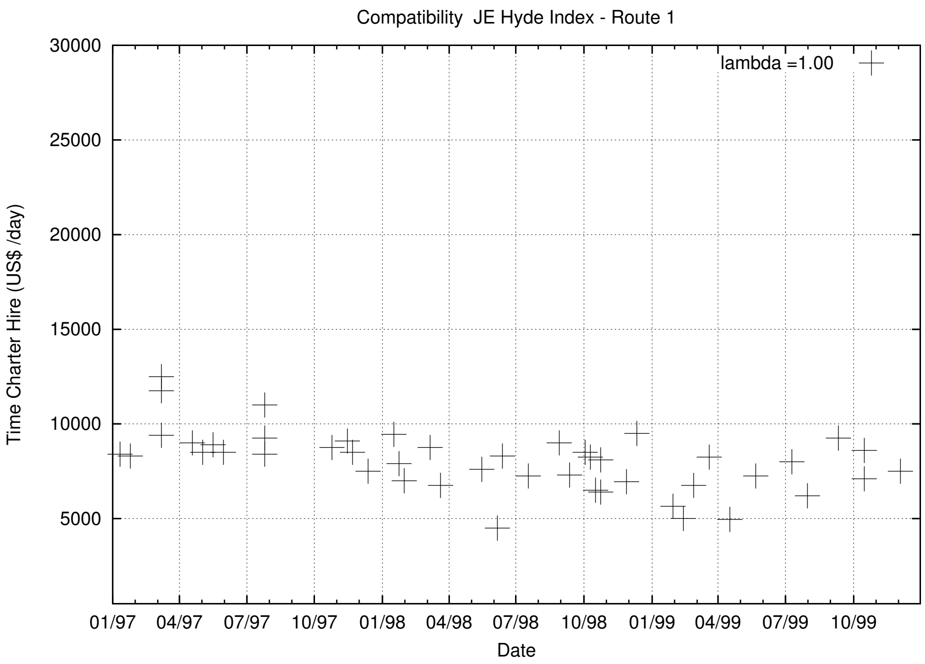


(b)

Figure 5.16: Coverage measurement of J.E. Hyde Index - Route 1



(c)



(d)

Figure 5.17: Coverage measurement of J.E. Hyde Index - Route 1 (continued)

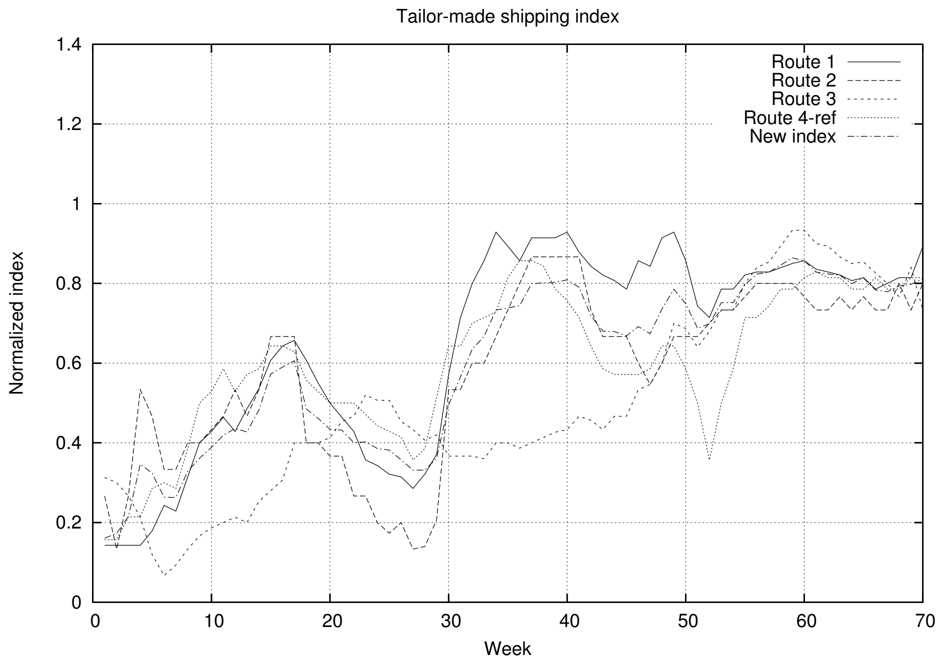


Figure 5.18: Tailor-made shipping index (normalized)

3. Then the weights are determined based on: (a) the similarities between indexes, see previous points, and (b) the recency of the transactions. The recency of the transactions measures the relevance of a transaction, i.e. older transactions are to be forgotten.
4. Then using weighted sum method, the value of the new index is calculated using weighted sum method.

Figure 5.18 shows the normalized indexes. The performance of the new index is compared with its reference, i.e. Route 4 of J.E. Hyde Shipping Index, is shown in Figure 5.19.

5.2.3 Discussion

The above tailor-made index shown above produces an error of approximately 10%. When the difference between the peaks and troughs is small, the values match well. If it is not the case, the estimated value misses the reality. The method probably still does not match the capability of an *experienced* shipping practitioner. Nevertheless the usage of the method is far cheaper than the usage of an experienced estimator. Therefore for the usage in normal situations, which are believed to be dominating, is still of advantage.

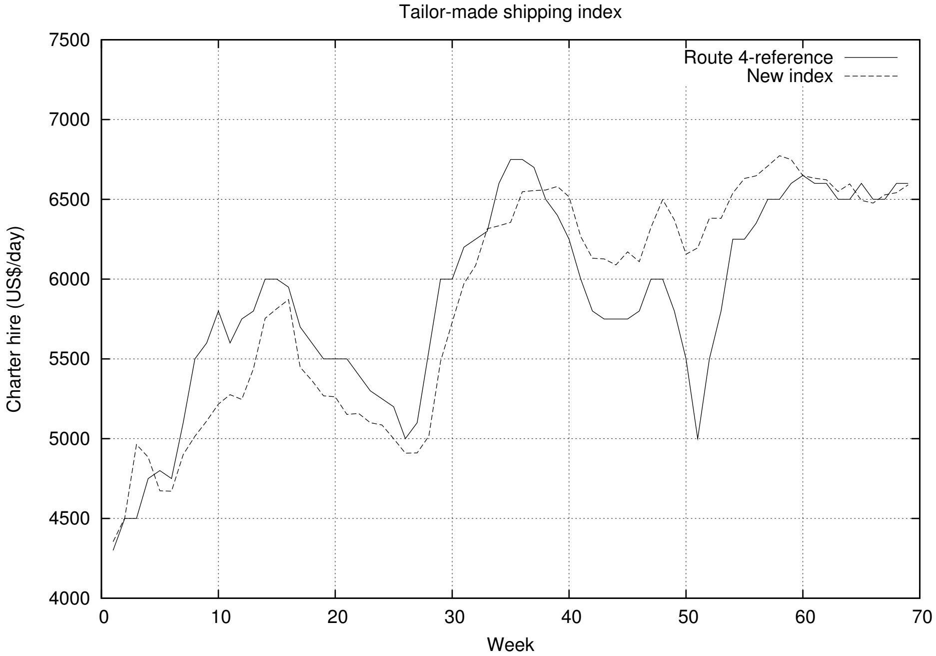


Figure 5.19: Tailor-made shipping index performance

This tool can also be of use to roughly reconstruct the *past*, meaning to assess for example the charter rate of the past. This can be useful in case of insurance claims. Secondly, this tool can be useful, for educational purposes, for trainees, less-experienced junior managers or experienced managers just moved in from other business sectors.

5.3 Case-based stowage planning

5.3.1 Introduction[4] [5] [6]

Tasks in shipping, especially in chartering and operations departments, involve synthesis tasks, such planning, routing or scheduling. A synthesis task is marked with the activities of shaping, designing, composing or building an object. These tasks are conducted daily. Those tasks in bulk ship-

[4]The development of the Case-Based Stowage Planning method (CASESTOW) was initiated within the COMSTAU (Computer-aided stowage planning for container ships) project, a joint-research project with TU Hamburg-Harburg and Müller+Blanck, sponsored by the German Ministry for Education and Research (BMBF), August 2001-June 2004.

[5]This section is mainly adapted from [59].

[6]The method was filed at the German Patent Office (Deustches Patent- und Markenamt) Berlin, 25 June 2004.

ping are generally quite similar to those in other shipping sectors, such as container shipping.

This section elaborates an implementation of the concept of compatibility in addressing stowage planning problems in container shipping, as mentioned briefly in sub-section 4.2.4. Stowage planning problems are as old as the history of the ship itself. It is the task to allocate containers to be loaded to slots on board the ship. The product of a stowage planning task is called stowage plan, that is a two-dimensional diagram showing the positions of containers stowed into a container ship. Increasing efficiency of terminal and ship operations and increasing size of container ships become a pressure to stowage planners. Those make the task prone to human error.

Before the arrival of a container ship, the planning department receives a container loading list (CLL) and the expected arrival conditions of the ship. A fundamental problem is the inaccuracy and imprecision of the CLL. It is not unusual that the CLL is still changing until very short, two hours or even shorter, before the departure of the ship. That means during the discharging and loading, new containers can still be added or some other containers are cancelled.

In spite of the advancement of the information technology, and computers have become indispensable to conduct daily planning tasks, the core process of planning, namely creating the plan itself is still performed manually. The planner still has to create the plan himself, then when the plan is finished he checks, if the criteria are met or not. Figure 5.20 shows the way the stowage planning task is performed today.

Today stowage planning software provides powerful modules which enable the planner to obtain information on the state of the ship and its cargoes concerning stability, strength, dangerous cargoes, crane split, draught, trim and visibility check. Those modules expedite the calculation tasks. If the plan shows that the ship does not have a sufficient static stability, for example, the user is not assisted with any help as to what to do, which containers have to be moved and to which slots. A number of efforts to automate the stowage planning have been undertaken over the past three decades, see Figure 5.21.

5.3.2 Foundation

In view of the slow research progress made in the last decades, it is of necessity to take few steps back, to rethink what we understand under stowage planning. Stowage planning is a search problem and a constraint satisfaction problem [53]. It is a chained process too, a modification in a stowage plan of a loading port will change all plans of the following ports. And stowage planning covers more than the technical aspects of planning, it involves some aspects of authority with the decision making process in the company. It is not unusual that important clients want that their cargoes are stowed in specific slots. At this point, technical stowage planning considerations alone are not adequate to address the problem. Commercial considerations play a more important role. Therefore the sales or marketing department's decisions will contribute in determining the end look of the stowage plan.

Every ship, every route is specific. Each has its own typicality. Even sister ships trading the same route under different ship operators, may have different stowage plans. Furthermore situations may change, some are predictable, some other are not. Therefore we believe it hardly possible to formalize the knowledge contained in the stowage planning objectively in terms of mathematical formulas or if-then rules. We should find an alternative direction to address the problem effectively.

Creating a stowage plan means also accepting a fact that the container loading list (CLL) is less correct and less precise. The loading list may change during loading and until short before the departure of the ship, the degree of precision and correctness improve in the course of time. The knowledge for creating a stowage plan is not stored centrally. It is spread among many, i.e. books (concerning the technical aspects of planning such as stability, strength or dangerous cargoes), human (stowage planning, sales and operations departments) and past stowage plans. The type of knowledge can be formal, such as stability, or informal, such as subjective preferences or rules of thumb. It is hardly possible to define desirable properties of a stowage plan precisely and consistently. In daily practices one knows if a stowage plan is favorable or less favorable, after seeing it and comparing with his expectations. But a planner cannot define precisely what we understand under a good stowage plan[7].

As we have learned form the history of technology advancement, the nature has been our great inspiration for solving various problems. In stowage planning, the success story is not far away out of reach. A human planner solves planning problems everyday. He succeeds addressing planning problems satisfactorily. Planning is in fact an easy task for a human planner, but it is still difficult to automate [56]. Viewing the stowage planning as a search process, a planner does not apply a brute search force, exploring all possible combinations of slots. He does not need reinvent the wheel. From experience he has collected numerous problem-solving sessions. Therefore he is in position now to use this knowledge effectively. He can select only one or a few planning concepts which may likely lead to an acceptable solution. In fact he reuses old solution concepts, with few modifications or improvements when necessary.

The strategy must be pragmatic, in order to make it useful and appli-

[7]Survey at a Hamburg-based shipping company and two container terminals in Hamburg and Bremerhaven, 2001.

cable in practice. A new method must be capable to assist the planner accordingly, in the stages of planning [24]. The method is not designed to generate a fully finished plan in the first place. The final goal is the duration of planning will be shorter, and the input data (CLL) will be more accurate.

5.3.3 CASESTOW procedure

We can safely assume that all planning problems are unique; they are different from each other. Taking a closer look at it, it is easy to recognize that a majority of problems show a certain degree of resemblance. That explains why an experienced planner knows instantly, how to approximately solve a majority of problems. Case-Based Reasoning (CBR) methodology rests on the idea that if two problems are similar, its solution is perhaps similar too. CBR solves a problem by remembering how a known similar problem was solved.

The usage of the Case-Based Reasoning approach is inspired by the success of Clavier addressing autoclave planning problems of in the aircraft industry, where approaches such as rule-based expert system, thermodynamic modelling and inductive learning were considered impractical [54, 78], see also Chapter 4 Sub-section 4.4.3. The Case-Based Stowage Planning system, called CASESTOW, solves a new planning problem by remembering how a similar planning problem was solved. Its way of solving the planning problem is borrowed or even copied to solve the new planning problem.

Procedure

Every stowage plan contains information how a planning problem is solved. In CASESTOW it is not attempted to extract the knowledge of planning from the plans in the form of mathematical formulas or if-then rules. The planning sessions are stored systematically in the casebase.

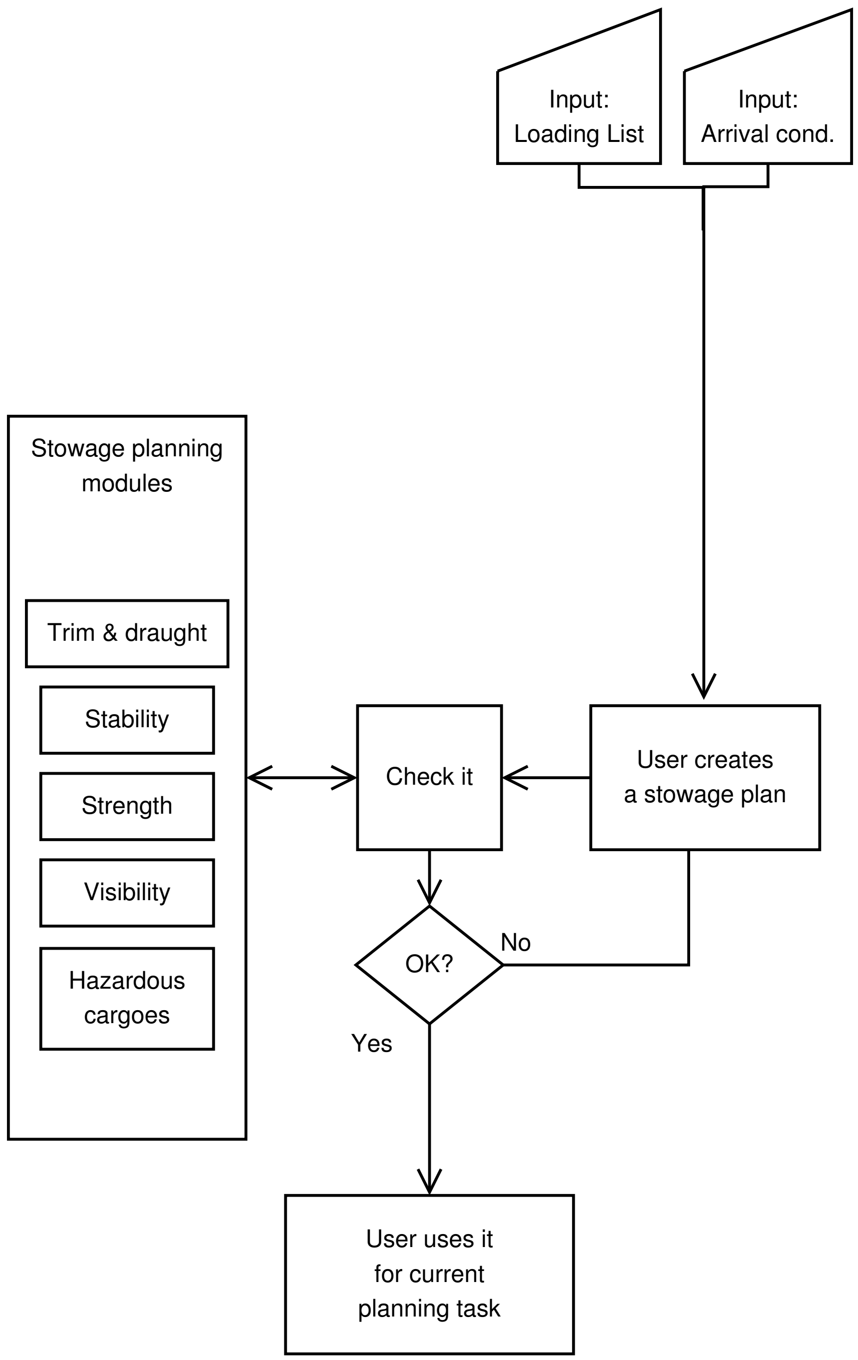


Figure 5.20: Current stowage planning procedure [58]

probability-based simulation
- Shields (1984)

heuristic modelling
- Pape (1980)
- Lang (1985)
- Sansen (1985)
- Martin, Randhawa & McDowell (1988)
- Saginaw & Perakis (1989)

mathematical modelling
- Webster, van Dyke & Cojeen (1969)
- Pape, Bohm & Rieger(1979)
- Jarke (1980)
- Ernst (1982)
- Arndt (1984)
- Cho (1984)
- Shields (1984)
- Tholen, Meade, Scott (1984)
- Weber, Heine & Oberbeck (1985)
- Schott (1989)
- Botter & Brinati (1992)
- Kujath (1996)
- Wilson (2001)
- Imai, Nishimura, Papadimitriou & Sasaki (2002)
- Ambrosino, Sciomachen & Tanfani (2004)
- Vogeley, Laue, Wiechmann & Killat (2004)

rule-based expert system
- Dillingham & Perakis (1986)
- Perakis & Dillingham (1987)
- Sato, Itoh & Awashima (1992)
- Wilson (1997, 1997, 1999)

genetic algorithm
- Hajime, Tatsuya, Jiichi & Nobuyuki (1996)
- Penn, Mordecai, Shpirer & Witteboon (1998)
- Davidor & Avihail (1998)
- Dubrovsky, Levitin & Penn (1999)

case-based reasoning
- Nugroho (2004)

Figure 5.21: Methods applied in stowage planning system developments [7, 17, 32, 41, 58, 69, 77, 82]

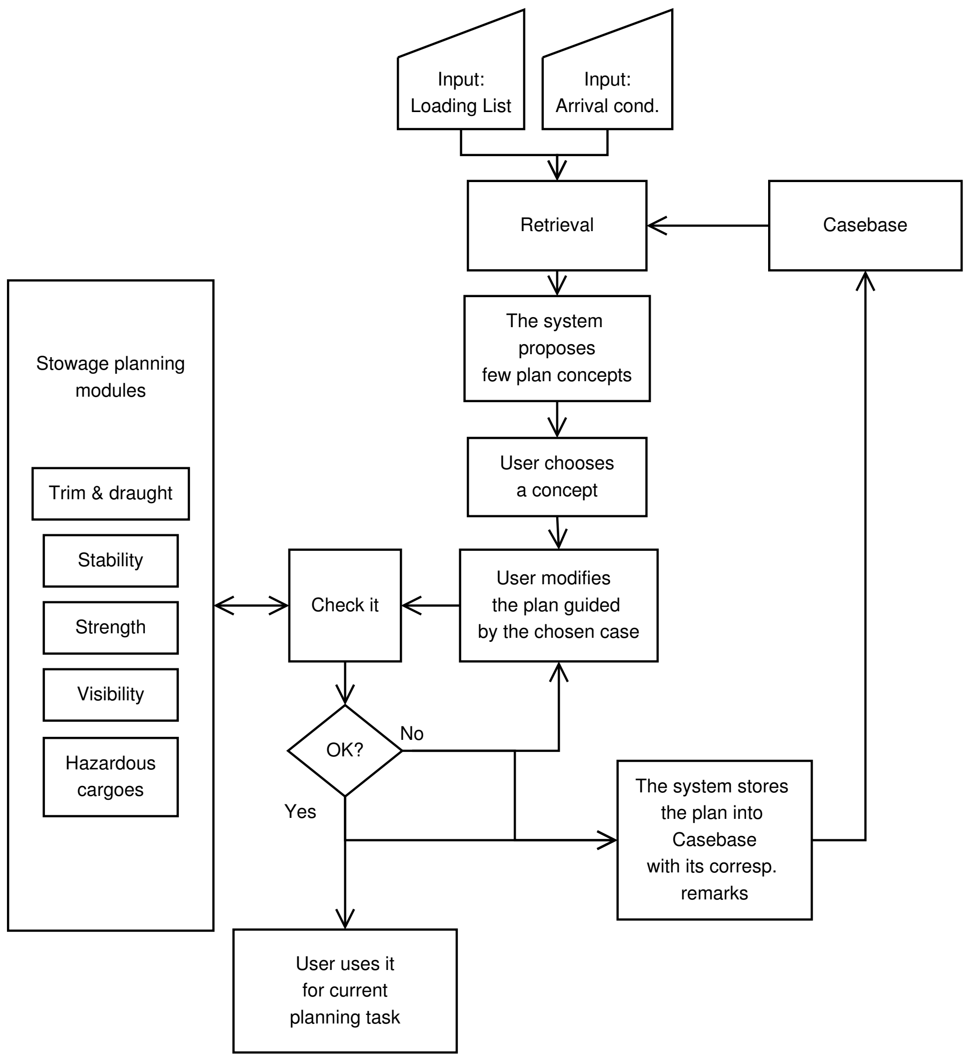


Figure 5.22: Procedure of CASESTOW [58]

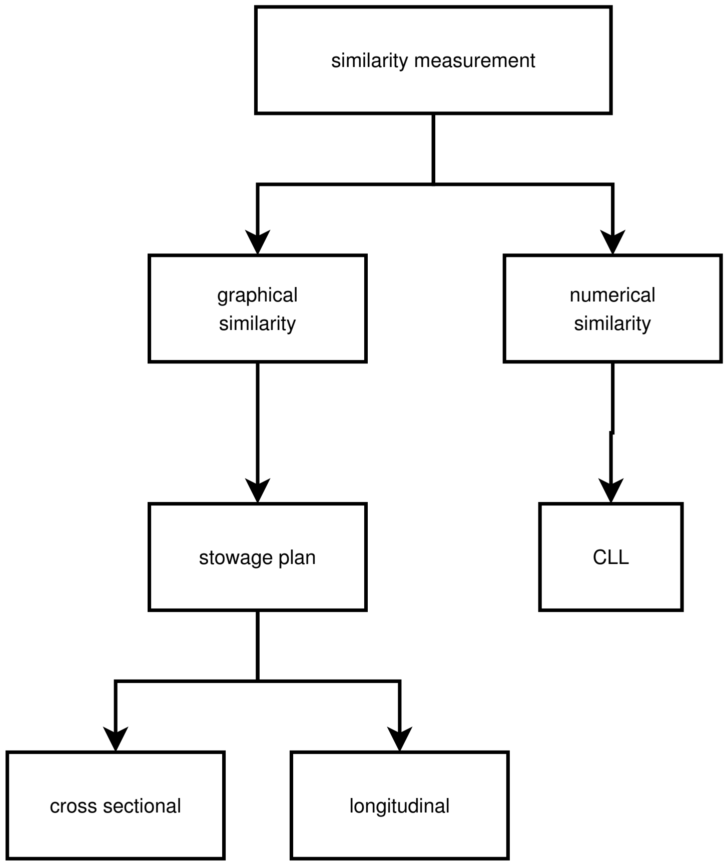


Figure 5.23: Similarity measurement

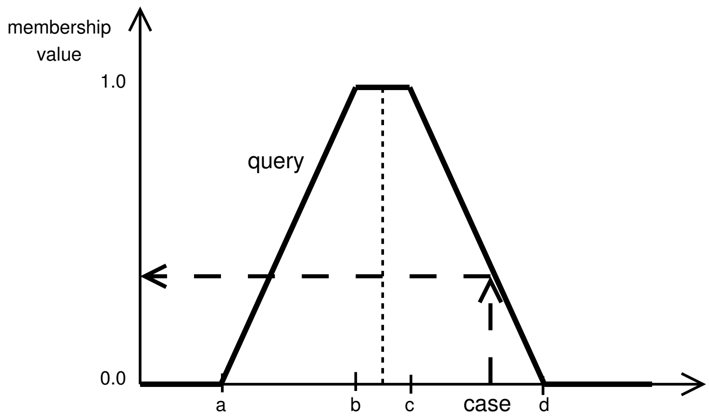


Figure 5.24: Trapezoidal fuzzy membership function

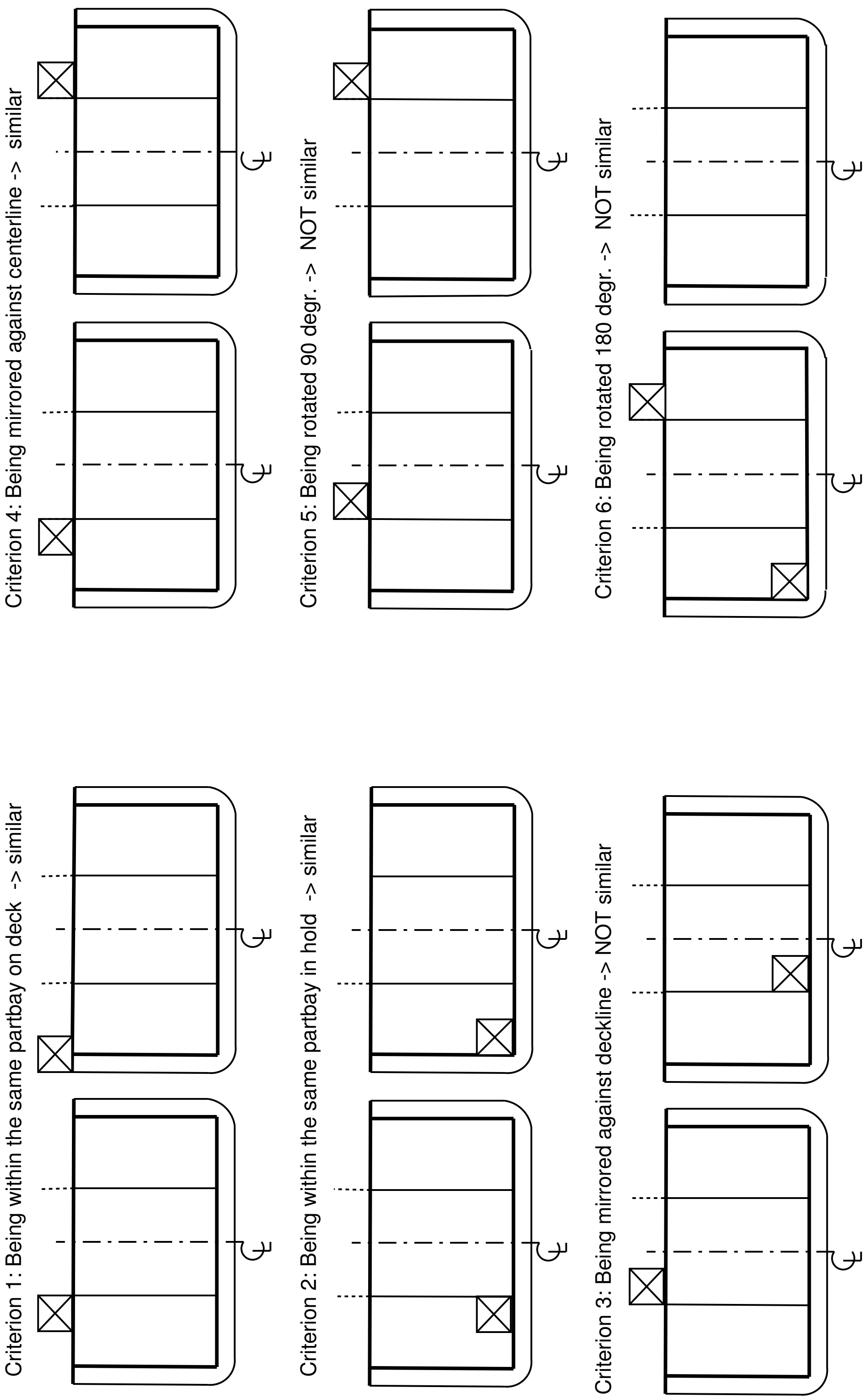


Figure 5.25: Cross sectional similarity criteria

The procedure of CASESTOW is shown in Figure 5.22. After receiving the input, means that the problem is there. The planner is in position to draw a stowage plan of a port of loading (POL) now. The input consists of the arrival plan The arrival plan itself can be derived from the departure stowage plan at the previous port of loading (PPOL) and its container discharging list (CDL). and the container loading list. Its solution is the departure stowage plan. The above definitions can briefly be expressed as tuples as follows:

problem = < arrival stowage plan prior to loading, CLL >

solution = < departure stowage plan >

remark = < quality or comments on the plan >

A case is a finished planning session consisting of a stored problem, its solution and its remark. The actual stowage planning task is called query consisting only one element: the actual problem.

case = < stored problem, stored solution, stored remark >

query = < actual problem >

The new problem is compared with all problems stored in the casebase. There are two types of data to be compared: numerical (CLL) and graphical data (stowage plan). The numerical similarity value is computed using a trapezoidal fuzzy membership function, see Figure 5.24.

To calculate the graphical similarity value the graphical properties of the plan must be taken into account, longitudinally and transversally. The cross section of the ship, the bay, is sub-divided into a few partbays. Containers placed with the same partbays are considered equivalent or its similarity value is 1.0. Containers stowed symmetrically along the center line are considered equivalent. Figure 5.25 shows the graphical similarity criteria. Longitudinally, the vicinity criterion plays a role, i.e. containers stowed close to each other in longitudinal direction are considered equivalent or similar, see Figure 5.26.

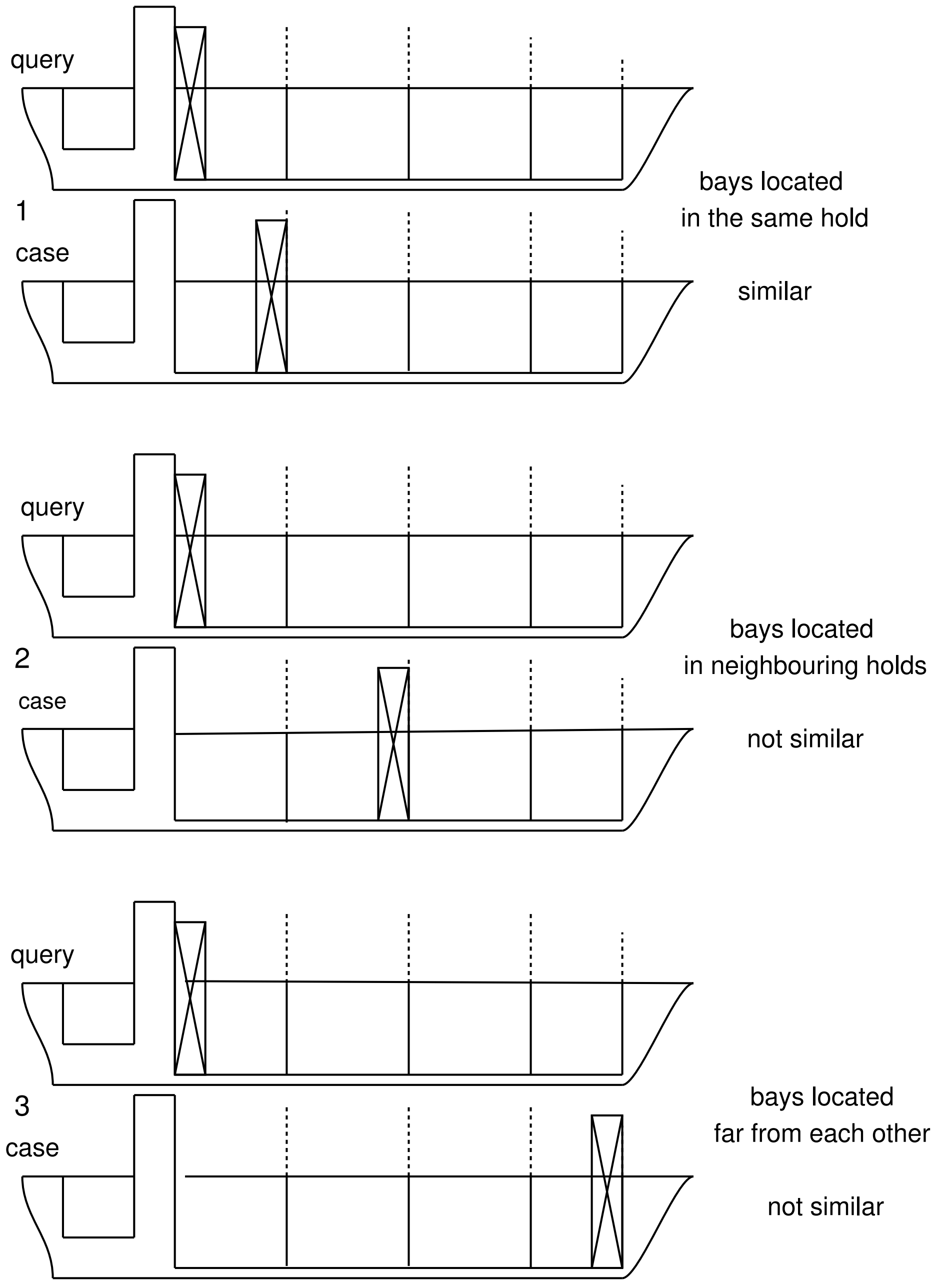


Figure 5.26: Longitudinal similarity criteria

```
Output

Rank   Voy      Plan     Sim1     Sim2     Remarks
------------------------------------------------------------------------------
  1     5        1      0.8186   0.8691      1
  2     3        2      0.6692   0.7449      5
  3     4        2      0.6120   0.6878      0
  4     1        1      0.5706   0.6615      1
  5     1        2      0.5554   0.5792     -5

------------------------------------
Note
-5  : poor  (means warning)
 0  : neutral
 5  : excellent
-------------------------------------

Enter rank number of your most favourable stowage plan: 1
```

Figure 5.27: Retrieval session

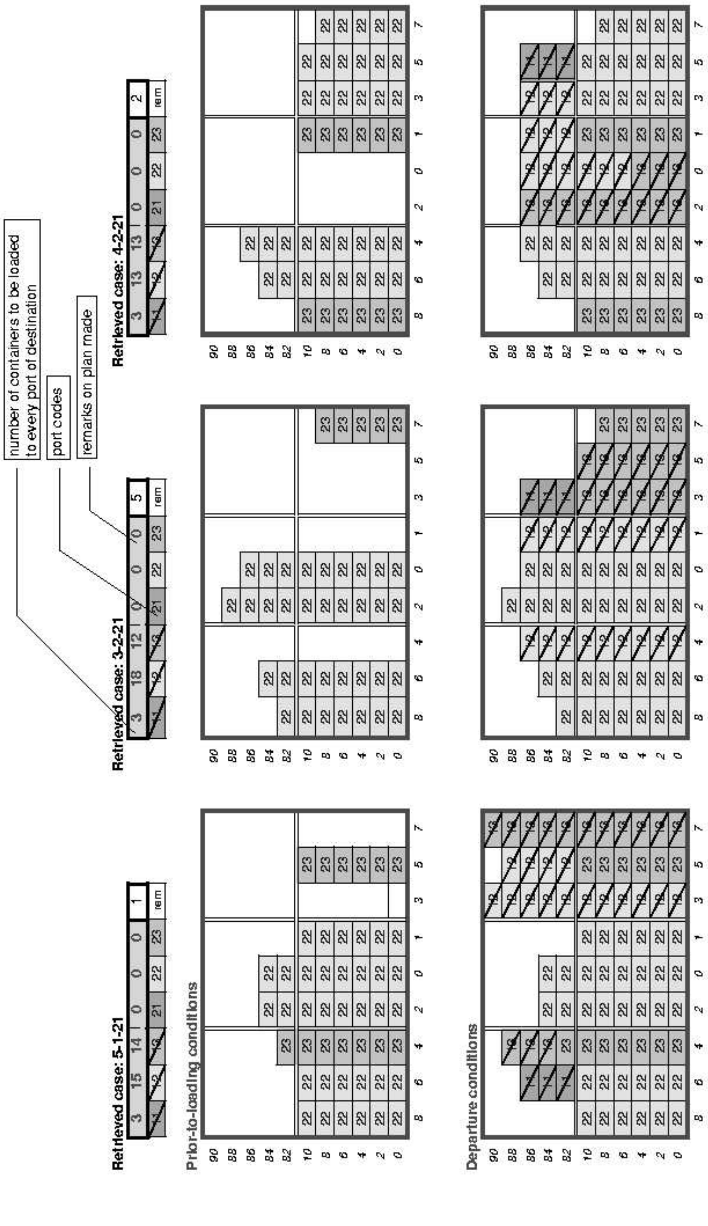


Figure 5.28: Retrieved cases

After computing the combined similarity values, the cases are then indexed and ranked according to the similarity values. Few most similar cases are proposed to the user. Now the user has the opportunity to choose the solution concept which he find the most desirable or favorable one. The chosen case will act as a guide to modify the arrival plan to the departure plan. Its way of solving the problem can be applied, i.e. borrowed or even copied, to solve the new planning problem.

Figure 5.29 shows the usage of the chosen stowage planning concept to help solve the new planning problem. The upper row is the chosen case consisting of three elements, from left to right, (a) the arrival plan prior to loading (b) CLL and (c) the departure stowage plan. The lower rows are of the new problem, (d) the arrival plan and (e) CLL. To create the departure plan, the way of allocating containers, modifying an arrival plan into a departure plan (c) can be reused, imitated or copied. A planning problem may have more solutions; a stowage planning task may also have more than one solutions (f) and (g).

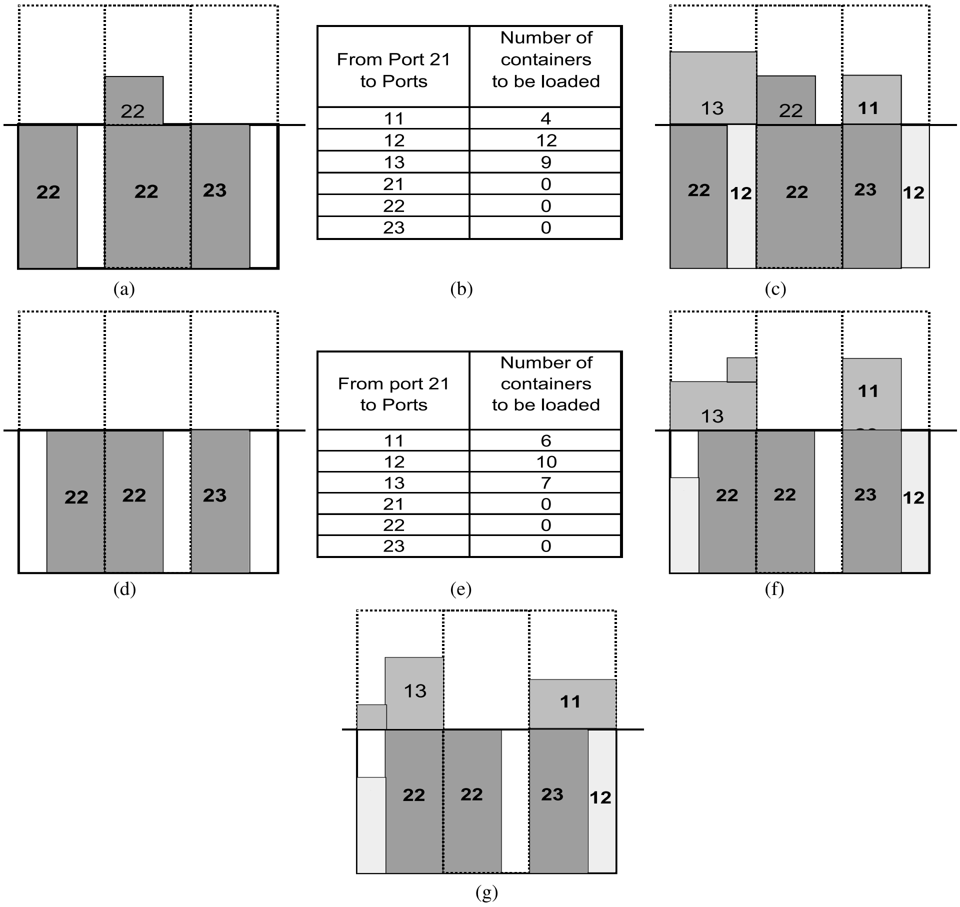
The finished plan is then checked using available modules, e.g. stability, strength etc, if it meets all those criteria. Both favorable and less favorable plans can be useful for future planning sessions. All information concerning the stability, strength etc can be included in to the remarks. In general remark contains information on the quality of the plan either favorable, less favorable or neutral, textually or numerically. The newly created plan is then stored into the casebase, and it is immediately available for use in the next planning session. This last part is the learning mechanism of the system.

The CLL is usually changing over time. It is usual too that for a particular voyage more planning sessions are performed. The produced departure plans may be of various qualities. Those all may contribute in enhancing the richness of the casebase's contents, see Figure 5.30.

5.3.4 Properties

The system is scalable. It can be applied to any sizes of vessels and for any routes with a minimum adaptation effort. The system has the capability of learning. Every newly created stowage plan is stored into the casebase. This increases automatically the capability of the system to propose solution concepts to the user. This approach assists the human planner in a natural way. It enhances the remembering capability of a human, by storing and retrieving cases accordingly whenever required. The system respects subjective preferences which mark the daily stowage planning tasks by providing the planner to choose a solution concept which best suits him.

The system is applicable for addressing stowage planning problems of the whole ship or a part of it, for example for refrigerated containers. A central aspect of the method is its capability to recognize and retrieve similar problems stored in the casebase.



From Port 21 to Ports	Number of containers to be loaded
11	4
12	12
13	9
21	0
22	0
23	0

From port 21 to Ports	Number of containers to be loaded
11	6
12	10
13	7
21	0
22	0
23	0

Figure 5.29: Transforming arrival plan into departure plan

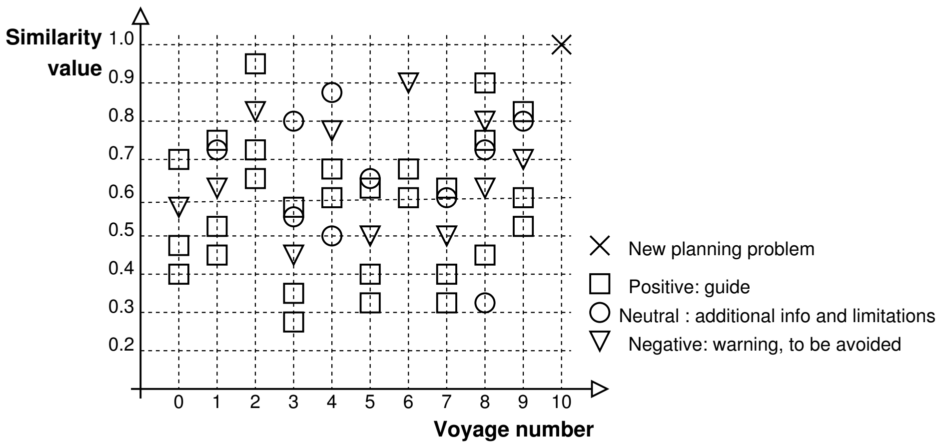


Figure 5.30: Contents of the casebase

CASESTOW solves a new planning problem by remembering how a similar problem was solved. The approach enables the planner to produce a stowage plan faster and of the same quality. The quality improvement is achieved as the duration of planning becomes shorter, and the CLL accuracy improves. Existing stowage planning modules can seamlessly be integrated into the CASESTOW architecture.

Chapter 6

Conclusion

Shipping is a complex system. Shipping involves aspects such as imprecision, influence of exogenous factors and incomplete information. Forecasts and indexes are provided for few main shipping routes and of few standard sizes. A huge majority of transactions are not covered by forecasts and indexes. Local events and weather affect the result of the charter party very much. probabilities and size of those events are hardly available. Many involve also qualitative factors and are subject to subjective interpretation.

Information is available in abundance. But the useful one is still scarce and expensive. The uncertainty can partly be alleviated by obtaining more useful and accurate information, which is expensive.

The way to address complex problems is by cutting down its complexity. Higher precision causes much higher complexity. Applying approximation is a way to alleviate the complexity problem.

Defining and comparing. Defining is not always an implementable task. It is hardly possible to define " a good ship" or "a good stowage plan" precisely. Our understanding on a concept or an object is contextual. It proves to be much easier and practicable to compare objects than to define them.

Practitioners can solve complex problems. In spite of the complexity of the shipping practice, an experienced practitioner can solve difficult tasks well. Reoccurrence of similar events contribute very much in enhancing a human problem-solving capability. Problem-solving is viewed as a process of reminding of past similar cases. It explains the fact that an experienced practitioner can estimate values without calculating, he simply knows it. A similar scene is shown in addressing planning tasks.

Compatibility is a concept of grouping and matching. The capability of grouping entities, such as "similar ships", involves the level of information or knowledge. Analogously is the capability of solving problems, such as "This is ship is approximately US$ 5,000/day worth". The later is viewed as a matching problem between two entities having different roles, i.e. a problem and its solution. The more experienced a practitioner, the more knowledgeable he is, and the more capable he is to apply grouping and matching tasks, i.e. to perform tasks. This confirms the first hypothesis.

The concept of compatibility is implementable. The implementation of this concept involves methods capable of addressing the concepts of imprecision and learning. Fuzzy set theory and case-based reasoning methodologies are appropriate for implementing this concept. The implementations may range from value assessment till planning tasks. This confirms the second hypothesis.

Outlook

Forgotten research agenda. The result of this research may concern three areas: shipping research, industry and education. The findings show us that shipping practice involves aspects, such as imprecision, intuition, experience and task-orientedness, which seem to be *forgotten* by today's research agenda in shipping. Today's research agenda seems to be marked with its preference for addressing macro-oriented problems and its preference for having process-oriented views on addressing problems.

More research addressing living problems in daily shipping practice is necessary. It is also of use for having a wider methodological horizon. Learning from nature proves to have contributed very much to solve many of our problems. This includes learning from failures and successes, and from ourselves, as a human. Having an eye on Artificial Intelligence in research agenda may contribute towards better developing useful tools for shipping.

Towards implementation. The concept of compatibility can be implemented in addressing various tasks in shipping and related areas, such as ship design or fleet scheduling. In areas where knowledge can not be obtained and formulated satisfactorily, recycling (reusing) past solution concepts and modifying them where necessary are usually an effective way to address problems.

AI in shipping education. Better understanding soft aspects such as imprecision and intuition is not something taken for granted in the education of shipping, logistic, traffic engineering and marine technology. Introducing the AI views to them, beside mathematics, statistics and operation research, would contribute very much for understanding the complexity of real problems.

Bibliography

[1] *Webster's Revised Unabridged Dictionary*. 1913. On-line dictionary.

[2] Free On-line Dictionary of Computing, 27 2003.

[3] *WordNet - An Online Lexical Database for the English Language*. Princeton University, 2003. On-line dictionary.

[4] Agnar Aamodt and Enric Plaza. Case-based reasoning: foundational issues, methodological variations, and system approaches. *AI Communications*, 7(1):39–59, 1994.

[5] Roar Os Adland. Theoretical Vessel Valuation and Asset Play in Bulk Shipping. Master's thesis, Department of Ocean Engineering, Massachusetts Institute of Technology, June 2000.

[6] Amir H. Alizadeh and Nikos K. Nomikos. The price-volume relationship in the sale and purchase market for dry bulk vessels. *Maritime Policy and Management*, 30(4):321–337, October- December 2003.

[7] Daniela Ambrosino, Anna Sciomachen, and Elena Tanfani. Stowing a containership: the master bay plan problem. *Transportation Research Part A*, February 2004.

[8] Michael Beenstock and Andreas Vergottis. *Econometric Modelling of World Shipping*. International Studies in Economic Modelling 16. Chapman & Hall, 1993.

[9] James C. Bezdek. *Analysis of Fuzzy Information*, volume III, chapter Partition structure: A Tutorial, pages 82–108. CRC Press, Inc., 1987.

[10] Piero P. Bonissone and William Cheetam. Fuzzy Case-Based Reasoning for Residential Property Valuation. In *Proceedings of the 1997 IEEE Conference on Fuzzy Systems (FUZZ-IEEE'97)*, Barcelona, Spain, July 1997.

[11] Bruce G. Buchanan and Edward H. Shortliffe. *Rule-Based Expert Systems - The MYCIN Experiments of the Stanford Heuristic Programming Project*, chapter The Context of the MYCIN Experiments, pages 3–19. AAAI Publications, March 1984.

[12] Bruce G. Buchanan and Edward H. Shortliffe. *Rule-Based Expert Systems - The MYCIN Experiments of the Stanford Heuristic Programming Project*, chapter Knowledge Engineering, pages 149–158. AAAI Publications, March 1984.

[13] Clarkson Research Studies. Shipping's Profits of Doom. *Shipping Intelligence Weekly*, May 2000.

[14] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. *Introduction to algorithms*. MIT Press, Cambridge, Massachusetts, 2002. iindexCormen, T. H.iindexLeiserson, C. E.iindexRivest, R.

[15] Bernard Dardner, Mohamed Naim, Bernardo Obando-Rojas, and Stephen Pettit. Maintaining the maritime skills base: does the government have a realistic strategy? *Maritime Policy and Management*, 28(4):347–360, 2001.

[16] I. M. Datz. *Planning Tools for Ocean Transportation*. Cornell Maritime Press, Inc., 1971.

[17] Yuval Davidor and Moshav Avihail. Method for Determining a Stowage Plan. page 11, 15 1998. US Patent number 6809 489.

[18] H. L. Dreyfus and S. E. Dreyfus. *Künstliche Intelligenz - von der Denkmaschine und dem Wert der Intuition*. Rheinbek, Rowohlt, 1986.

[19] Hubert L. Dreyfus and Stuart L. Dreyfus. *Mind over Machine - The Power of Human Intuition and Expertise in the Era of Computer*. Basil Blackwell, 1986.

[20] Mary-Lynn Dubray. Fundamentals of Management. 1999. http://www.busn.ucok.edu/mdubray/ downloaded 30 September 2004.

[21] Egon Oldendorff. *75 Years - The ships of Egon Oldendorff*. Egon Oldendorff, February 1996.

[22] J. J. Evans. An Analysis of Efficiency of the Bulk Shipping Markets. *Maritime Policy and Management*, 21(4):311–329, 1994.

[23] J. J. Evans and P. B. Marlow. *Quantitative Methods of Maritime Economics*. Fairplay Publications, 1990.

[24] Joseph Fiksel and Frederick Hayes-Roth. Knowledge Systems for Planning Supports. *IEEE Expert*, 1989.

[25] Frankfurter Allgemeine Sonntagszeitung. Interview mit Peter Dussmann. 24 2002.

[26] Arthur M. Glenberg. *Learning from Data : An Introduction to Statistical reasoning*. Harcourt Brace Jovanovich, 1988.

[27] Franklin de Oliviera Goncalves. *Optimal Chartering and Investment Policies for Bulk Shipping*. PhD thesis, Department of Ocean Engineering, Massachusetts Institute of Technology, September 1992.

[28] Bjarne Hansen and Denis Riordan. Fuzzy Case-Based Prediction of Ceiling and Visibility. In *First Americal Meteorogical Society Conference on Artificial Intelligence*, pages 118–123, 1998.

[29] Bjarne H. Hansen. Weather Prediction Using Case-Based Reasoning and Fuzzy Set Theory. Master's thesis, Dalhousie University, 17 2000.

[30] Frederick S. Hillier and Gerald J. Lieberman. *Introduction to Operations Research*. McGraw-Hill Book Company, 1989.

[31] A. S. Hornby and A. P Cowie, editors. *Oxford Advanced Learner's Dictionary of Current English*. Oxford University Press, 1974.

[32] Akio Imai, Etsuko Nishimura, Stratos Papadimitriou, and Kazuya Sasaki. The Containership Loading Problem. *International Journal of Maritime Economics*, (4):126–148, 2002.

[33] International Institute for Management Development (IMD), Lausanne, Switzerland. *Corporate Venture Capital: Does Experience Matter?*, May 2002. Sixth International Conference on Competence-Based Management.

[34] Ken Irons. *Managing Service Companies - Strategies for Success*. The Economist Intelligence Unit Series. Addison-Wesley Publising Company, 1994.

[35] Daniel Kahneman. Maps of Bounded Rationality: A Perspective on Intuitive Judgment and Choice. *Nobel Prize Lecture*, pages 449–489, 8 December 2002. Nobel Laureate in Economic Sciences 2002.

[36] George J. Klir. Some Applications of the Principle of Uncertainty Invariance. In T. Terano, M. Sugeno, M. Mukaidono, and K. Shigemasu, editors, *Fuzzy Engineering toward Human Friendly Systems*. IOS Press, 1992.

[37] George J. Klir, Ute H. St.Clair, and Bo Yuan. *Fuzzy Set Theory - Foundations and Applications*. Prentice-Hall International, 1997.

[38] Janet L. Kolodner. *Case-Based Reasoning*. Morgan Kaufmann, 1993.

[39] Janet L. Kolodner and David B. Leake. *Case-Based Reasoning: Experiences, Lessons & Future Directions*, chapter A Tutorial Introduction to Case-Based Reasoning, pages 31–66. MIT Press, 1996.

[40] Erhard Konrad. Wissensbasierte Systeme - Stand und Perspektive. In *Informationsgewinnung und Informationsverarbeitung in der Agrarforschung und Agragtechnik - Datenbanken und künstliche Intelligenz*. Institut für Agrartechnik Bornim e.V. (ATB), Bornim bei Potsdam, 23 November 2000.

[41] Sabine Kujath. Entwicklung eines Objektorientierten Systems zur Stauplanung. Master's thesis, Arbeitsgruppe Diskrete Mathematik, Fachbereich Mathematik, TU Berlin, 1996.

[42] David B. Leake. *Case-Based Reasoning: Experiences, Lessons & Future Directions*, chapter CBR in Context: The Present and Future, pages 3–30. AAAI Press/ MIT Press, 1996.

[43] David B. Leake. *Case-Based Reasoning: Experiences, Lessons & Future Directions*, chapter CBR in Context: The Present and Future, pages 31–66. MIT Press, 1996.

[44] David B. Leake. Artificial Intelligence. *Van Nostrand Scientific Encyclopedia. New York: Wiley*, 9th edition, 2002.

[45] Horst Linde. *Strukturen des Welt-Seegüterverkehrs*, volume ISM-Bericht 97/10. Fachgebiet Seeverkehr, Institut für Schiffs- und Meerestechnik, Technische Universität Berlin, 2 edition, December 1997.

[46] Horst Linde. *Seeverkehr*. Technische Universität Berlin, Institut für Land- und Severkehr, Fachgebiet Seeverkehr, 2000.

[47] Horst Linde. *Typologie der Welt-Handelsflotte*. Fahgebiet Seeverkehr, Institut für Schiffs- und Meerestechnik, Technische Universität Berlin, 2000.

[48] George F. Luger. *Artificial inteligence - Structures and Strategies for Complex Problem Solving*. Pearson Education Limited, 2002.

[49] George F. Luger and William A. Stubblefield. *Artificial Inteligence - and the Design of Expert Systems*. Benjamin/Cummings Publishings Company Inc., 1989.

[50] New Jersey Maritime Research Inc. *Chartering Annual 1997*. Maritime Research Inc., New Jersey, 1998.

[51] New Jersey Maritime Research Inc. *Chartering Annual 1998*. Maritime Research Inc., New Jersey, 1999.

[52] New Jersey Maritime Research Inc. *Chartering Annual 1999*. Maritime Research Inc., New Jersey, 2000.

[53] William Mark. *Machine Learning Methods for Planning*, chapter Adapting Plan Architectures, pages 435 – 465. Morgan Kauffmann, 1993.

[54] William Mark, Evangelos Simoudis, and David Hinkle. *Case-Based Reasoning: Experiences, Lessond & Future Directions*, chapter Case-Based Reasoning: Expectations and Results, pages 269–294. AAAI Press / MIT Press.

[55] Marvin Minsky. Negative Expertise. *International Journal of Expert Systems*, 7(1):13–19, 4 January 1994.

[56] Steve Minton and Monte Zweben. *Machine Learning Methods for Planning*, chapter Learning, Planning and Scheduling: An Overview, pages 1–27. Morgan Kaufmann, 1993.

[57] Setyo Nugroho. Addressing Management of Uncertainties in Ship Chartering - A Fuzzy Logic Approach. X Spanish Conference on Fuzzy Logic and Technologies, 22 September 2000.

[58] Setyo Nugroho. Case-Based Stowage Planning for Container Ships. In *International Logistics Congress 2004*, pages 609–618. Dokuz Eylül University, Turkey, Dokuz Eylül Publications, 3 December 2004.

[59] Setyo Nugroho. Case-Based Stowage Planning System. In J. Olivella, C.A. Trebbia, and R. Macet, editors, *Maritime Engineering and Ports III*, volume 80 of *WIT Transactions on the Built Environment*. Wessex Institute of Technology, WIT Press, Southampton, April 2005. PORTS 2005, Barcelona, ISSN 1743-3509.

[60] Malcolm H. Pace. *Determination of Ocean Freight Rates - Towards a New Formula*. Institute of Shipping Economics, Bremen, 1979.

[61] Wiliam V. Packard. *Voyage Estimating*. Fairplay Publications, 1985.

[62] Photis M. Panayides. *Professional Ship Management: Marketing and Strategy*. Plymouth studies in contemporary shipping and logistics. Ashgate Publishing Ltd., 2001.

[63] Kaj Pineus. *Ship's Value*. Lloyd's of London Press Ltd, 1986.

[64] Christoph Relius, Catzemeier, Matthias, Denis Sertcan, and Kathleen Wünscher. *Geschichte der Philosophie*. Könemann Verlaggesellschaft mbH, 2000.

[65] Michael M. Richter. *Case-Based Reasoning Technology - From Foundations to Applications*, chapter Introduction, pages 1–15. Springer Verlag, 1998.

[66] Christopher K. Riesbeck and Roger C. Schank. *Inside Case-Based Reasoning*. Lawrence Erlbaum Associates, Inc., 1989.

[67] Denis Riordan and Bjarne K. Hansen. A Fuzy Case-Based System for Weather Prediction. *Engineering Intelligent Systems*, 10(3):139–146, September 2002.

[68] Timothy Ross. *Fuzzy Logic and Its Engineering Applications*. McGraw-Hill Inc., 1995.

[69] Rainer Schott. *Stauplanung für Containerschiffe*. Verkehrswisssenschaftilchen Studien aus dem Institut für Verkehrswissenschaft der Universität Hamburg. Vandenhoeck & Ruprecht, Göttingen, 1989.

[70] Herbert A. Simon. Rational Decision Making in Business Organizations. 8 December 1978. Nobel Memorial Lecture.

[71] Herbert A. Simon. *The sciences of the artificial*. MIT Press, Cambridge, Massachusetts, second edition, 1981. iindexSimon, H. A.

[72] Herbert A. Simon. Decision Making and Problem Solving. Technical report, National Academiy Press, Washington, D.C., 1986.

[73] Martin Stopford. *Maritime Economics*. Unwin Hyman Ltd, 1988.

[74] Josepth M. Sussman. Introduction to Intelligent Transportation Systems - Basic Concepts. Open course ware - MIT, 5 February 2003.

[75] Liang Tang. *Modellierung der Konjunkturzyklen des Frachschiffahrtsmarktes mittels ökonometrischer Verfahren und rationaler Erwartungstheorie - am Beispiel der Bedarfsschiffahrt*. PhD thesis, Institut für Land- und Seeverkehr, Technische Universität Berlin, 2002.

[76] Jostein Tvedt. A New Perspective on Price Dynamics of the Dry Bulk Market. *Maritime Policy and Management*, 30(3):221–230, July-September 2003.

[77] Heike Vogeley, Peter Horstkorte, Haidi Qiu, and Frank Laue. Optimierung der gewichtsverteilung zur Minimierung der globalen Längsfestigkeitsbelastung. 26 2003.

[78] Ian Watson. *Applying Case-Based Reasoning: Techniques for Enterprise Systems*. Morgan Kaufmann, 1997.

[79] Niko Wijnolst and M. Bartelds. *Analysis of the Panamax Bulkcarrier Chartermarket 1989-1994*. Delft University Press, 1995.

[80] Niko Wijnolst and Frans Waals. *Shipping Industry Structure*. Delft University Press, 1999.

[81] Niko Wijnolst and Tor Wergeland. *Shipping*. Delft University Press, 1996.

[82] I.D. Wilson, P.A. Roach, and J.A. Ware. Container stowage pre-planning: using search to generate solutions, a case study. *Knowledge-Based Systems*, (14):137–145, 2001.

[83] Manfred Zachcial, editor. *Shipping Statistics Yearbook*. Institute of Shipping Economics and Logistics, Bremen, 2003.

[84] H. J. Zimmermann. *Fuzzy Sets Theeory and Its Applications*. Kluwer Academy Publishers, 2nd. edition, 1991.

APPENDICES

Appendix A

MV Lucy Oldendorff

Liberian flag, call sign ELPA2, Reg.-No. 9705
owners: Halfmoon Shipping Corporation, Monrovia
singledeck bulkcarrier, grainfitted and logs fitted incl stanchions
built 5/1992 at Onomichi Dockyard Co. Ltd., Japan,
first class American Bureau of Shipping (+ A1 E Bulkcarrier + AMS)

loa 157,50 m, lpp 148,00 m, breadth 25,00 m,
international grt 13.696 nrt 7.791
Suez Canal grt 13.920,01 nrt 12.245,30
Panama Canal grt 14.407,55 nrt 11.366,55

immersion abt 33 mts per cm
22.160 mts dwat (21.811 lgts) on abt 9,115 m ssw draft
(21.537 mts dwat on winter loadline abt 8,925 m)
(timber 23.028 mts dwat on abt 9,378 m ssw)

1.034.766 cbft/999.354 cbft grain/bale available for cargo
43.323 m^3 lumber loading capacity

4 holds and 4 hatches:
No.1: 20,00 m x 11,68/17,52 m fore/aft
No.2: 20,80 m x 17,52 m
No.3: 20,80 m x 17,52 m
No.4: 20,80 m x 17,52 m

capacities (cbm)	grain	bale
No. 1:	221.890	213.626
No. 2:	278.025	268.189
No. 3:	278.422	268.371
No. 4:	256.429	249.168

one twostroke singleacting diesel engine Mitsubishi 6UEC45LA,
6 cylinders, turbocharged, of abt 7.200 bhp at abt 158 rpm,

speed/consumption:
abt 14 kn on abt 19,5 mts heavy fuel oil (180 cst RME25) plus abt 1,5 mts MDO (DMB), (DMB),
vessel burns MDO with main engine whilst on roads, rivers, anchorages, in ports, canals etc.
port consumption:
abt 2,6 mts MDO with cranes working,
abt 1,5 mts MDO without cranes working

gear:
4 x Mitsubishi electro hydraulic deck cranes of
30 mts each (max jib radius 3 x 24 m + 1 x 22 m)
hoisting speed 30 mts x 18,5 m/min,
12 mts x 37,0 m/min,

bunker capacity abt 725 mts (96 %) IFO/abt 253 mts (96 %) MDO,
water ballast abt 7.458 mts, freshwater evaporator (abt 15 mts/day),

grainfitted, CO^2 fitted, Australian hold ladder fitted, natural ventilation, all modern nautical aids incl 2 radars with one Arpa, weather fax, navtex, global positioning system, doppler log, gmdss-satcom "A" incl fax, Suez/Panama Canal fitted, logs fitted, incl lashing material and collapsible steel stanchions

stanchion heights:
hold 1: abt 7,00 m
holds 2-4: abt 8,00 m

maximum permissible uniform loading:
tank top: 17 mts/m2
weather deck: 3.67 mts/m2
weather deck hatches covers: 3.00 mts/m2

Inmarsat B: phone-no. 363625810 fax-no. 363625820
Inmarsat C telex no. 463674390

P& I Club: The United Kingdom Mutual Steamship Assurance Association (Bermuda) Ltd

all details "about"

Appendix B

Glossary

- *Algorithm*: (1) a sequence of computational steps for solving a well-specified computational problem [14]. (2) a procedure that is guaranteed either to find a correct solution to a problem in a finite time or to tell you thee is no so solution [11]
- *Approach*: ideas or actions intended to deal with a problem or situation[3]
- *Artificial Intelligence*: (1) a branch of computer that studies the computational requirements for tasks such as perception, reasoning, and learning, and develops systems to perform those tasks [44]. (2) a program that mimics human intelligence, when exhibited by devices and applications such as robots or computers with voice recognition and language processing ability.This human-like intelligence implies the ability to learn or adapt through experience.*http://www.computeruser.com/resources/dictionary/definition.html?lookup=296.* (3) a part of computer science concerned with designing intelligent computer systems, i.e. systems that exhibit the characteristics that we associate with intelligence in human behavior - understanding language, learning, reasoning, solving problems etc (Barr and Feigenbaum*). http://www.doc.mmu.ac.uk/STAFF/J.Gray/kbsnotes/intro/lecture1.htm.* (4) a branch of computer science that is concerned with the automation of intelligent behavior [49]. (5) a branch of computer science dealing with symbolic, non-algorithmic methods of problem solving [11].
- *Bounded Rationality:* Herbert Simons's theory arguing that capacity of a human is too small to address the complexity of the real world rationally, .
- *Case*: a set consisting of a problem, solution and their corresponding effect, i.e case = <problem, solution, effect>
- *Case-base*: a database containing cases.

- *Case-Based Reasoning*: a method for solving a problem by remembering the way how similar past problems were solved.

- *Crisp number*: exact number, a number having exactly one value, see also fuzzy number.

- *Compatible*: (1) capable of existing in harmony; congruous; suitable; not repugnant; – usually followed by with [1]. (2) having similar disposition and tastes[3]. (4) capable of being used with or connected to other devices or components without modification[3]. (5) able to exist and perform in harmonious or agreeable combination; "a compatible married couple"; "her deeds were compatible with her ideology". (6) having similar disposition and tastes; "a compatible married couple"; "with their many similar tastes, he found her a most sympathetic companion". (7) capable of being used with or connected to other devices or components without modification. (8) (of a couple) existing together harmoniously [syn: well-matched] (9) capable of forming a homogeneous mixture that neither separates nor is altered by chemical interaction [3]. (10) different systems (e.g., programs, file formats, protocols, even programming languages) that can work together or exchange data are said to be compatible[2]. (11) suited to, in accord with, able to exist together with (ideas, arguments, principles etc)[31].

- *Compatibility*: (1) the quality or power of being compatible or congruous; congruity; as, a compatibility of tempers; a compatibility of properties.[1]. (2) capability of existing or performing in harmonious or congenial combination [3].

- *Concept*: (1) an abstract general conception; a notion; a universal [1], (2) an abstract or general idea inferred or derived from specific instances [syn: conception, construct] [3]

- *Data:* (1) a collection of facts from which conclusions may be drawn; [3] data on its own has no meaning, only when interpreted by some kind of data processing system does it take on meaning and become information [2].

- *Data extraction*: summarizing or transforming data into a useful form in line with requirements.

- Expert system: a program which uses the heuristic expert knowledge for analysis, or synthesis purposes [48].

- *Effect*: additional information regarding the qualities of a case, such as *'good'*, *'misleading'*, *'important'*, *'don't do this in rainy season'* or '*a hypothetical case*'. Its purpose is to guide the planner during the retrieval of cases and in the following modification steps, i.e. REUSE and REVISE.

- *Fuzzy logic*: a formal system of logic in which numbers on a scale from 0 to 1 are used instead of the values "true" and "false" as absolutes, to accurately represent the fact that some questions do not have a simple yes or no answer. Fuzzy logic was developed by Lotfi Zadeh of the University of California, Berkeley. http://www.computeruser.com/resources/dictionary/definition.html?lookup=2095

- *Fuzzy number*: a set of numbers to describe imprecision attributed to an object, e.g. *approximately 30,000 dwt*

- Heuristic: a procedure that is not guaranteed to work, but will often find solutions in much shorter times than exhaustive trial and error and other algorithms [11]

- *Hypothesis:* (1) a tentative theory or supposition provisionally adopted to explain certain facts, and to guide in the investigation of others[1] (2) A proposal intended to explain certain facts or observations[3] (3) a tentative theory about the natural world; a concept that is not yet verified but that if true would explain certain facts or phenomena [3].

- *Information:* (1) a message received and understood. (2) a collection of facts from which conclusions may be drawn; "statistical data" [syn: data]. (3) knowledge acquired through study or experience or instruction. (4) (communication theory) a numerical measure of the uncertainty of an outcome; "the signal contained thousands of bits of information" [3]

- *Intuition*: Direct apprehension or cognition; immediate knowledge, as in perception or consciousness; – distinguished from "mediate" knowledge, as in reasoning; quick or ready insight or apprehension[1].

- *Knowledge*: an informal notion describing something that a human, a formal system or a machine can possibly use in order to perform a certain task of functionality [65].

- *Knowledge base*: a program's part which stores facts and associations it 'knows' about a subject area such as medicine [11].

- *Knowledge engineering*: the process of mapping expert knowledge into a program's knowledge base [11].

- *Knowledge-Based System (KBS)*: (1) a computer system that is programmed to imitate human problem-solving by means of artificial intelligence and reference to a database of knowledge on a particular subject `http://www.computeruser.com/resources/dictionary/definition.html?lookup=3775`. (2) A computer system in which some symbolic representation of human knowledge is applied, usually in a way resembling human. `http://www.doc.mmu.ac.uk/STAFF/J.Gray/kbsnotes/intro/lecture1.htm`.

- *Logic*: (1) the science or art of exact reasoning, or of pure and formal thought, or of the laws according to which the processes of pure thinking should be conducted; the science of the formation and application of general notions; the science of generalization, judgment, classification, reasoning, and systematic arrangement; correct reasoning [1]. (2) the branch of philosophy that analyzes inference. (3) reasoned and reasonable judgment; "it made a certain kind of logic". (3) the principles that guide reasoning within a given field or situation. (4) a system of reasoning [3]

- *Logical*: (1) capable of or reflecting the capability for correct and valid reasoning (2) in accordance with reason or logic; "a logical conclusion"[3]

- *Membership function*: a function showing the membership values of a fuzzy number; a fuzzy number's degree of truth to a particular definition.

- *Method*: (1) an orderly procedure or process; regular manner of doing anything; hence, manner; way; mode; as, a method of teaching languages; a method of improving the mind[1]. (2) Orderly arrangement, elucidation, development, or classification; clear and lucid exhibition; systematic arrangement peculiar to an individual[1].

- *Methodology*: (1) the science of method or arrangement; a treatise on method[1]. (2) the branch of philosophy that analyzes the principles and procedures of inquiry in a particular discipline[3]. (3) a pretentious way of saying "method" [2].

- *Indexing*: ordering similar cases to ease retrieval.

- *Learning*: a process of adding new cases and managing them.

- *Query*: a current/ new problem

- *Rational*: (1) relating to reason; not physical; mental. (2) Having reason, or the faculty of reasoning; endowed with reason or understanding; reasoning. (3) Agreeable to reason; not absurd, preposterous, extravagant, foolish, fanciful, or the like; wise; judicious; as, rational conduct; a rational man [1]. (4) consistent with or based on or using reason; "rational behavior"; "a process of rational inference"; "rational thought". (5) of or associated with or requiring the use of the mind; "intellectual problems". (3) having its source in or being guided by the intellect (distinguished from experience or emotion); "a rational analysis" [3].

- *Similarity*: (1) the quality or state of being similar; likeness; resemblance; as, a similarity of features [1]. (2) the quality of being similar. (3) a *Gestalt* principle of organization holding that (other things being equal) parts of a stimulus field that are similar to each other tend to be perceived as belonging together as a unit[3].

Appendix C

Shipping terms and abbreviations

[1]AA	Always Afloat
AAAA	Always Accessible Always Afloat
AAOSA	Always Afloat or Safe Aground. Condition for a vessel whilst in port
AARA	Amsterdam-Antwerp-Rotterdam Area
ABAFT	Toward the rear (stern) of the ship. Behind.
ABOARD	On or within the ship
ABOVE DECK	On the deck (not over it - see ALOFT)
ABT	About
ADCOM	Address Commission
ADDENDUM	Additional chartering terms at the end of a charter party
AFSPS	Arrival First Sea Pilot Station (Norway)
AFFREIGHTMENT	The hiring of a ship in whole or part
AFT	At or towards the stern or rear of a ship
AGROUND	Touching or fast to the bottom

[1]http://www.uq.net.au/~zzksteph/, downloaded 11 January 2005 and http://www.m-i-link.com/dictionary/acronym_IJK.asp, downloaded on 16 January 2005

AGW	All Going Well
AHL	Australian Hold Ladders
AIDS TO NAVIGATION	Artificial objects to supplement natural landmarks indicating safe and unsafe waters
ALOFT	Above the deck of the ship
AMIDSHIPS	In or toward the centre of the ship
ANCHORAGE	A place suitable for anchorage in relation to the wind, seas and bottom
ANTHAM	Antwerp-Hamburg Range
APS	Arrival Pilot Station
ARAG	Amsterdam-Rotterdam–Antwerp-Gent Range
ARBITRATION	Method of settling disputes which is usually binding on parties. A clause usually in a charter party
A/S	Alongside
ASBA	American Shipbrokers Association
ASPW	Any Safe Port in the World
ASTERN	In the back of the ship, opposite of ahead
ATDNSHINC	Any Time Day/Night Sundays and Holidays Included
ATHWARTSHIPS	At right angles to the centreline of the ship
ATUTC	Actual Times Used to Count
BACKLETTER	Where a seller/shipper issues a 'letter of indemnity' in favour of the carrier in exchange for a clean bill of lading
BAF	Bunker Adjustment Factor. A Fuel Surcharge expressed as a percentage added or subtracted from the freight amount, reflecting the movement in the market place price for bunkers.
BALE CAP.	Cubic capacity of a vessels holds to carry packaged dry cargo such as bales/pallets
BALLAST	Heavy weight, often sea water, necessary for the stability and safety of a ship which is not carrying cargo
BALLAST BONUS	Compensation for relatively long ballast voyage
BAREBOAT CHTR.	Bareboat Charter - Owners lease a specific ship and control its technical management and commercial operations only. Charterers take over all responsibility for the operation of the vessel and expenses for the duration.
BBB	Before Breaking Bulk. Refers to freight payments that must be received before discharge of a vessel commences
BDI	Both Dates Inclusive
BEAM	The maximum breadth or the greatest width of a ship
BELOW	Beneath the deck
BENDS	Both Ends (Load & Discharge Ports)

BI	Both Inclusive
BIMCO	The Baltic and International Maritime Council
BL	Bale
BL	(Bill of Lading) A document signed by the carrier which acts as a Contract of Affreightment, a receipt and evidence of title to the cargo.
BM	Beam
BN	Booking Note
BOB	Bunker on Board
BOFFER	Best Offer
BOW	The forward part of a ship
BROB	Bunkers Remaining on Board
BROKERAGE	Percentage of freight payable to broker (by owners in c/p's) or applicable to sale or purchase
BSS	Basis
BSS 1/1	Basis 1 Port to 1 Port
BT	Berth Terms
BULKHEAD	A vertical partition separating compartments
BUNDLING	This is the assembly of pieces of cargo, secured into one manageable unit. As a rule of thumb it is to present cargo at a size easily handled by a large (20 tonne) fork lift.
BUNKERS	Name given for vessels Fuel and Diesel Oil supplies (Originates from coal bunkers)
BUOY	An anchored float used for marking a position on the water or a hazard or a shoal and for mooring
BWAD	Brackish Water Arrival Draft
CAF	Currency Adjustment Factor
CBM	Cubic Metres
CBFT (or CFT)	Cubic Feet
CFR (or C&F)	Cost and Freight
CHART	A map used by navigators
CHOPT	Charterers Option
CHTRS	Charterers
CIF	Cost, Insurance & Freight. Seller pays all these costs to a nominated port or place of discharge.
CKD	Completely knocked down
COA	Contract of Affreightment - Owners agree to accept a cost per revenue tonne for cargo carried on a specific number of voyages.
CIP	Carriage and Insurance paid to...
COACP	Contract of Affreightment Charter Party
COB	Closing of Business
COBLDN	Closing of Business London

COD	Cash On Delivery
COGSA	Carriage of Goods by Sea Act
CONGESTION	Port/berth delays
CONS	Consumption
C/SNEE	CONSIGNEE. Name of agent, company or person receiving consignment
COP	Custom Of Port
CP (or C/P)	Charter Party
CPD	Charterers Pay Dues
CPT	Carriage Paid To
CQD	Customary Quick Despatch
CR	Current Rate
CROB	Cargo Remaining on Board
CRN	Crane
CRT	Cargo Retention Clauses, introduced by charterers based on shortage of delivered cargo because of increased oil prices
CST	Centistoke
CTR	Container Fitted
DA	Disbursement Account
DAF	Deliver At Frontier
DAPS	Days all Purposes (Total days for loading & discharging)
DAMFORDET	Damages for Detention. Penalty if cargo is not ready when ship arrives for working (1st day of Laycan). This is not detention which is charged for ships time on delay. If the cargo is ready there is no DAMFORDET.
DDU	Delivered Duty unpaid.
DDP	Delivered Duty Paid.
DECK	A permanent covering over a compartment, hull or any part thereof
DEM	Demurrage (Quay Rent). Money paid by the shipper for the occupying port space beyond a specified "Free Time" period.
DEQ	Delivered Ex Quay
DES	Delivered Ex Ship
DESP	Despatch. Time saved, reward for quick turnaround-in dry cargo only
DET	Detention (See DAMFORDET)
DEV	Deviation. Vessel departure from specified voyage course
DFRT	Deadfreight. Space booked by shipper or charterer on a vessel but not used

DHDATSBE	Despatch Half Demurrage on All Time Saved Both Ends
DHDWTSBE	Despatch Half Demurrage on Working Time Saved Both Ends
DISCH	Discharge
DK	Deck
DLOSP	Dropping Last Outwards Sea Pilot (Norway)
DO	Diesel Oil
DOLSP	Dropping Off Last Sea Pilot (Norway)
DOP	Dropping Outward Pilot
DOT	Department of Transport
DNRCAOSLONL	Discountless and Non-Returnable Cargo and/or Ship Lost or Not Lost
DRAUGHT (or DRAFT)	Depth to which a ship is immersed in water.
DRK	Derrick
DUNNAGE	Materials of various types, often timber or matting, placed among the cargo for separation, and hence protection from damage, for ventilation and, in the case of certain cargoes, to provide space in which the tynes of a fork lift truck may be inserted.
DWAT (or DWT)	Deadweight. Weight of cargo, stores and water, i.e. the difference between lightship and loaded displacement.
EBB	A receeding current
EC	East Coast
EIU	Even If Used
ELVENT	Electric Ventilation
ETA	Estimated Time of Arrival
ETC	Estimated Time of Completion
ETD	Estimated Time of Departure
ETS	Estimated Time of Sailing
EXW	Ex Works
FAC	Fast as can
FAS	Free Alongside Ship. Seller delivers goods to appropriate dock or terminal at port of embarkation and buyer covers costs and risks of loading
FCA	Free to Carrier. A modern equivalent of FAS used in intermodal transport where goods are transferred at a nominated forwarders premises, depot or terminal but not actually on board vessel.
FD (FDIS)	Free Discharge
FDD	Freight Demurrage Deadfreight
FDESP	Free Despatch

FDEDANRSAO-CLONL	Freight Deemed Earned, Discountless And Non-Returnable (Refundable) Ship And Or Cargo Lost Or Not Lost
FENDER	A cushion, placed between ships, or between a ship and a pier, to prevent damage
FEU	Standard 40? Container
FEU	Standard 40? Container
FHEX	Fridays/Holidays Excluded
FHINC	Fridays/Holidays Included
FILO	Free In/Liner Out. Seafreight with which the shipper pays load costs and the carrier pays for discharge costs.
FIO	Free In/Out. Freight booked FIO includes the seafreight, but no loading/discharging costs, i.e. the charterer pays for cost of loading/discharging cargo.
FIOS	Free In/Out Stowed. As per FIO, but excludes stowage costs.
FIOST	Free In/Out and Trimmed. Charterer pays for cost of loading/discharging cargo, including stowage and trimming.
FIOT	Free In/Out and Trimmed. As per FIOS but includes trimming, e.g. the levelling of bulk cargoes. FIOS includes seafreight, but excludes loading/discharging and stowage costs.
FIT	Free In Trimmed
FIW	Free In Wagon
FIXING	Chartering a Vessel
FIXTURE	Conclusion of shipbrokers negotiations to charter a ship - an agreement
FLATPACKING	Cargo to be presented stacked and secured as an integral unit.
FLT	Full Liner Terms
FMC	Federal Maritime Commission
FME	Force Majeure Excepted
FMS	Fathoms
FO	For Orders
FO (IFO)	Fuel Oil/Intermediate FO
FO	Free Out
FOB	Free on Board. Seller sees the goods "over the ship?s rail" on to the ship which is arranged and paid for by the buyer
FOFFER	Firm Offer

FOB	Free on Board. Seller sees the goods "over the ship?s rail" on to the ship which is arranged and paid for by the buyer
FOFFER	Firm Offer
FOG	For Our Guidance
FOQ	Free On Quay
FOR	Free On Rail
FORCE MAJEURE	Clause limiting responsibilities of the charterers, shippers and receivers of cargo.
FORE-AND-AFT	In a line parallel to the keel
FORWARD	Toward the bow of the ship
FOT	Free On Truck
FOW	First Open Water
FOW	Free On Wharf
FP	Free Pratique. Clearance by the Health Authorities
FR	First Refusal. First attempt at best offer that can be matched
FREEBOARD	The minimum vertical distance from the surface of the water to the gunwale
FRT	Freight. Money payable on delivery of cargo in a mercantile condition
FREE DESPATCH	If loading/discharging achieved sooner than agreed, there will be no freight money returned.
FREE EXINS	Free of any Extra Insurance (Owners)
FREE OUT	Free of discharge costs to owners. Includes seafreight only.
FRUSTRATION	Charterers when cancelling agreement sometimes quote ’doctrine of frustration’ i.e. vessel is lost, extensive delays.
FWAD	Fresh Water Arrival Draft
FWDD	Fresh Water Departure Draft
FYG	For Your Guidance
FYI	For Your Information
GA	General Average
GEAR	A general term for ropes, blocks, tackle and other equipment
GLS (GLESS)	Gearless
GNCN	Gencon (GENERAL CONDITIONS)
GN (or GR)	Grain (Capacity)
GO	Gas Oil
GP	Grain Capacity. Cubic capacity in ’grain’
GR	Geographical Rotation. Ports in order of calling
GRD	Geared
GRT	Gross Registered Tonnage

HAGUE RULES	Code of minimum conditions for the carriage of cargo under a Bill of Lading
HATCH	An opening in a ship's deck fitted with a watertight cover
HBF	Harmless Bulk Fertilizer
HDLTSBENDS	Half Despatch Lay Time Saved Both Ends
HDWTS	Half Despatch Working (or Weather) Time Saved
HHDW	Handy Heavy d.w. (Scrap)
HIRE	T/C Remuneration
HMS	Heavy Metal Scraps
HO	Hold
HOLD	A compartment below deck in a large vessel, used solely for carrying cargo
HULL	The main body of a ship
HW	High Water
ICW	Intercoastal Waterway : bays, rivers, and canals along the coasts (such as the Atlantic and Gulf of Mexico coasts), connected so that vessels may travel without going into the sea
ILOHC	In Lieu Of Hold Cleaning
IMDG	International Maritime Dangerous Goods Code
IMO	International Maritime Organisation
IN &/ OR OVER	Goods carried below and/or on deck
IND	Indication
INTERMODAL	Carriage of a commodity by different modes of transport, i.e. sea, road, rail and air within a single journey
ITF	International Transport Workers Federation (Trade Unions). Complies on crewing
ITINERARY	Route.Schedule
IU	If Used
IUHTAUTC	If Used, Half Time Actually To Count
IWL	Institute Warranty Limits
KEEL	The centreline of a ship running fore and aft; the backbone of a vessel
KNOT	A measurement of speed equal to one nautical mile (6,076 feet) per hour
LANE METER	A method of measuring the space capacity of Ro/Ro ships whereby each unit of space (Linear Meter) is represented by an area of deck 1.0 meter in length x 2.0 meters in width.
LASH	To hold goods in position by use of Ropes, Wires, Chains or Straps etc.
LAT	Latitude. The distance north or south of the equat
LAYCAN	Laycan (Layday Cancelling Date)

LAYTIME	Time at Charterers disposal for purpose of loading/discharging
L/C	Letter of Credit
LCR	Lowest Current Rate
LEE	The side sheltered from the wind
LEEWARD	The direction away from the wind. Opposite of windward
LEEWAY	The sideways movement of the ship caused by either wind or current
LF	Load Factor. Percentage of cargo or passengers carries e.g. 4,000 tons carried on a vessel of 10,000 capacity has a load factor of 40%
LIEN	Retention of property until outstanding debt is paid
LNG	Liquefied Natural Gas
LOA	Length Overall of the vessel
LOAD LINE	SEE PLIMSOLL LINE
LOF	Lloyds Open Form
LOG	A record of courses or operation. Also, a device to measure speed
LOI	Letter of Indemnity
LONGITUDE	The distance in degrees east or west of the meridian at Greenwich, England
LOW	Last Open Water
LS (or LUMPS)	Lumpsum Freight. Money paid to Shipper for a charter of a ship (or portion) up to stated limit irrespective of quantity of cargo
LSD	Lashed Secured Dunnaged
LSD	Lashed Secured Dunnaged
LT	Liner Terms
LT	Long Ton = 1,016.05 kilogram (2,240 lbs)
LTHH	Liner Terms Hook/Hook
LW	Low Water
LYCN	Laycan (Layday Cancelling Date)
MANIFEST	Inventory of cargo on board
MB	Merchant Broker
MB	Merchant Broker
MDO (DO)	Marine Diesel Oil
MIDSHIP	Approximately in the location equally distant from the bow and stern
MIN/MAX	Minimum/Maximum (cargo quantity)
MOA	Memorandum of Agreement
MOLCHOPT	More or Less Charterers Option
MOLOO	More or Less Owners Option

MOORING	An arrangement for securing a ship to a mooring buoy or pier
MT	Mertic Tonne (i.e. 1,000 kilos)
M/V	Motor Vessel / Merchant Vessel
NAABSA	Not Always Afloat But Safely Aground
NM	Nautical Mile. One minute of latitude; approximately 6,076 feet - about 1/8 longer than the statute mile of 5,280 feet
NAVIGATION	The art and science of conducting a ship safely from one point to another
NCB	National Cargo Bureau
NESTING	Implies that cargo is presented stacked in the contour of similarly shaped cargo, it may be likened to a stack of plates. This is particularly relevant in the presentation of tankage strakes for transport
NON-REVERSIBLE	(Detention). If loading completed sooner than expected, then saved days will not be added to discharge time allowed
NOR	Notice of Readiness
NRT	Net Restricted Tonnage
NYPE	New York Produce Exchange
OO	Owners Option
OBO	Ore/Bulk/Oil Vessel
OSH	Open Shelter Deck
OVERBOARD	Over the side or out of the ship
OWS	Owners
P&I	Protection and Indemnity Insurance
PASTUS	Past Us
PC	Period of Charter
PCGO	Part Cargo
PCT	Percent
PDPR	Per Day Pro Rata
PERDIEM	By the Day
PER SE	By Itself
PHPD	Per Hatch Per Day
PLIMSOLL MARK	plimsoll_mark An internationally recognised line painted on the side of merchant ships. When a ship is loaded, the water level is not supposed to go above the line. Water can reach different parts of the line as its temperature and saltiness varies with the season and location. From where Plimsoll Shipping derived its name.
PORT	The left side of a ship looking forward. A harbour.
PRATIQUE	Licence or permission to use a port

PREAMBLE	Introduction to a charter party
PROFORMA	Estimated Account
PUS	Plus Us
PWWD	Per Weather Working Day
RCVR	Receiver
RECAP	Recapitulation of the terms and conditions agreed
REVERSIBLE	(Detention). If loading completed sooner than expected at load port, then days saved can be added to discharge operations.
ROB	Remaining On Board
RT	Revenue Tonne (i.e. 1.0 metric tonne or 1.0 cubic meter, whichever greater). The overall RT is calculated on a line by line basis of the Packing List using the largest amount. The overall freight liability is calculated on the total RT amount, multiplied by the freight rate.
SATPM	Saturday P.M.
SB	Safe Berth
SD (or SID)	Single Decker
SEAFREIGHT	Costs charged for transporting goods over the sea. This does not cover haulage or loading/discharging costs but the sea transport only
SEAWORTHINESS	Statement of condition of the vessel (valid certificates, fully equipped and manned etc.)
SELFD	Self Discharging
SEMI-TRAILERS	Are usually 12.0 meter flat bed road trailers
SF	Stowage Factor. Cubic space (measurement tonne) occupied by one tonne (2,240 lbs/1,000 kgs) of cargo
SHINC	Sundays/Holidays Included
SHEX	Sundays/Holidays Excluded
SKIDS	Are bearers (timber or steel) positioned under the cargo to enable forklift handling at port, and for ease of rigging and lashing on board ship.
SN	Satellite Navigation - A form of position finding using radio transmissions from satellites with sophisticated on-board automatic equipment
SOC	Shipper Owned Container
SOF	Statement of Facts
SP	Safe Port
SPIDERING	Is the strengthening of circular tanks for transport, this prevents the tanks from becoming warped. The tanks are strengthened with steel or wood cross-beams giving a "spider" appearance

SRBL	Signing and Releasing Bill of Lading
SSHEX	Saturdays, Sundays, Holidays Excluded
SSHINC (or SATSHINC)	Saturdays, Sundays, Holidays Included
STABILITY	It is paramount that a vessel is stable in all aspects at all times. When cargo is loaded/discharged, the stability is monitored by a computer, which takes into account the weight and position of cargo within the vessel.
STARBOARD	Right side of a ship when facing the front or forward end.
STEM	Subject to Enough Merchandise (Availability of cargo). Also, the forward most part of the bow.
STERN	The aformost or after part of a ship
SUB	Subject (to). Depending upon as a condition
SUPERCARGO	Person employed by a ship owner, shipping company, charterer of a ship or shipper of goods to supervise cargo handling operations. Often called a port captain.
SWAD	Salt Water Arrival Draft
SWDD	Salt Water Departure Draft
THWARTSHIPS	At right angles to the centreline of the ship
TIDE	The periodic rise and fall of water level in the oceans
TIME BAR	Time after which legal claims will not be entered
TBN	To Be Named / To Be Nominated
TC	Time Charter - Owners agree to hire a particular ship for a set length of time and provide technical management, crewing etc.
TCP	Time Charter Party
TEU	Standard 20’ Container
TOPSIDES	The sides of a ship between the waterline and the deck; sometimes referring to onto or above the deck
TRIM	Fore and aft balance of a ship
TTL	Total
TW	Tween Decker
USC	Unless Sooner Commenced
UU	Unless Used
UUIWCTAUTC	Unless Used In Which Case Time Actually Used To Count
VPD	Vessel Pays Dues
WATERLINE	A line painted on a hull which shows the point to which a ship sinks when it is properly trimmed
WAY	Movement of a ship through water such as headway, sternway or leeway

WCCON	Whether Customs Cleared Or Not
WIBON	Whether In Berth Or Not
WIFPON	Whether In Free Pratique Or Not
WINDWARD	Toward the direction from which the wind is coming
WIPON	Whether In Port Or Not
WLTOHC	Water Line-To-Hatch Coaming
WOG	Without Guarantee
WP	Weather Permitting. That time during which weather prevents working shall not count as laytime
WPD	Weather Permitting Day
WWD	Weather Working Day
WRIC	Wire Rods In Collis
WWR	When, Where Ready
WWWW	Wibon, Wccon, Wifpon, Wipon
YAR	York Antwerp Rules
YAW	To swing or steer off course, as when running with a quartering sea
Z	UTC = GMT

Appendix D

Lebenslauf

Name	Setyo Nugroho
Nationalität	indonesisch
Familienstand	verheiratet, 2 Kinder
Adresse	Peter-Vischer-Strasse 42 12157 Berlin
Geburtsdatum/-ort	20.10.1965 in Tuban, Indonesien
E-mail	snugroho@gmx.de

AUSBILDUNG

1984-1985	Studium Schiffs- und Meerestechnik an der Technischen Universität Sepuluh Nopember in Surabaya.
1985-1986	Sprachkurs Niederländisch in Jakarta und Utrecht. Stipendium von der NUFFIC /Niederlande.
1986-1993	Studium Seeverkehr an der Technischen Universität Delft, Niederlande, Abschluß: ir. / MSc. Stipendium von der NUFFIC/Niederlande und von der BAPPENAS/Indonesien
1999	Sprachkurs Deutsch in Surabaya und in Dresden.
1999-2005	Promotion am Fachgebiet Seeverkehr an der Technischen Universität Berlin. Stipendium vom DAAD (1999-2001).

BERUFSERFAHRUNG

1993	Mitarbeiter, Wijsmuller Engineering, IJmuiden, Niederlande. Projekt: “Kohletransport in Ostkalimantan mit Bargen”.

1994-1997	Mitarbeiter, Meratus Shipping, Surabaya. Aufgaben: (a) Planung und Operation von Container- und Stückgutschiffen (b) Chartering (c) Agentur (d) Logistikprojekt: "Distribution von Melamin". DKM-Kaltim Melamine, Bontang, Ostkalimantan.
1994-1999	Wissenschaftlicher Mitarbeiter mit Lehraufgaben, Fachgebiet Seeverkehr, an der Technischen Universität Sepuluh Nopember (ITS), Surabaya. Lehre: (a) Computerprogrammierung (b) Seeverkehr. Mitarbeit an den folgenden Projekten:
1995	"Planung des Kohltransports Kalimantan-Java mit Barge", Beratung, PT PANSAAB, Jakarta.
1996-1997	"Effizienz und Produktivität der Häfen in Kalimantan und Sumatra", Forschung in Zusammenarbeit mit Indonesian Port Corporation II (Pelindo II) Jakarta.
1997-1998	"Entwurf eines Palmölhafens in Südkalimantan", Indonesian Port Corporation III (Pelindo III) Surabaya, Beratung.
1998	"Passagiertransport Malaysia-Surabaya", Beratung, Primaju-Bekalan Sdn.Bhd., Kuala Lumpur.
1998	"Entwurf des Chemikalien-Terminal im Tanjung Perak", Beratung, Aneka Kimia Raya, Surabaya.
2001-2004	Wissenschaftlicher Mitarbeiter, Fachgebiet Seeverkehr an der Technischen Universität Berlin, "Computerunterstützte Stauplanung für Containerschiffe", vom BMBF gefördertes Forschungprojekt in Zusammenarbeit mit der TU Hamburg-Harburg und Müller+Blanck Softwarefirma.

DIVERSES

EDV	Matlab, Pascal, Postgresql, Qt, C++, Python.
Sprachen	Javanisch (Muttersprache), Indonesisch, Englisch, Deutsch, Niederländisch.
Interessen	(a) Seeverkehr: Planung, Management und Innovation (b) Anwendungen der künstlichen Intelligenz, vor allem aus den Bereichen Fuzzy Logik und Fallbasiertem Schließen.
Freizeit	Spielen mit Kindern, Debian Linux, Jogging und Tischtennis.

PATENT

Patentanmeldung "Verfahren zur Erstellung eines Stauplanes für Containerschiffe" am 25. Juni 2004 beim Deutschen Patent- und Markenamt, Berlin.

WISSENSCHAFTLICHE ARBEITEN

1	Setyo Nugroho. Addressing Management of Uncertainties in Ship Chartering - A Fuzzy Logic Approach. X Spanish Conference on Fuzzy Logic and Technologies, 20-22.September 2000, Sevilla.
2	Setyo Nugroho, Jens Heyer and Peter Horstkorte. Conceptual Design of Box-Type Barges. Technische Universität Berlin, 2002. Unveröffenlichter COMSTAU-Projektbericht.
3	Setyo Nugroho. Voyage Scenario. Technische Universität Berlin, 2002. Unveröffenlichter COMSTAU-Projektbericht.
4	Csaba Piller and Setyo Nugroho. Stauung von Gefahrgut. Technische Universität Berlin, 2002. Unveröffenlichter COMSTAU-Projektbericht.
5	Horst Linde and Setyo Nugroho. Assessing A Stowage Plan. Technische Universität Berlin, 2003. Unveröffenlichter COMSTAU-Projektbericht.
6	Setyo Nugroho. Case-Based Stowage Planning: A Proposal. Technische Universität Berlin, 2003. Unveröffenlichter COMSTAU-Projektbericht.
7	Setyo Nugroho. Preliminary Experiments with A Case-Based Stowage Planning System. Technical report, Technische Universität of Berlin, 2003. Unveröffenlichter COMSTAU-Projektbericht.
8	Setyo Nugroho. Case Representation of a Round Voyage in a Case-Based Stowage Planning System. Presentation at the Technische Universität Hamburg-Harburg. June 11, 2003. Unveröffenlichter COMSTAU-Projektbericht.
9	Setyo Nugroho. Case-Based Stowage Planning for Container Ships: An Outline. Technical report, Technische Universität Berlin, 23 February 2004. Unveröffenlichter COMSTAU-Projektbericht.
10	Setyo Nugroho. Case-Based Stowage Planning for Container Ships. International Logistics Conference, 2-3.Dezember 2004, Izmir, Turkey.
11	Setyo Nugroho. Case-Based Stowage Planning System. PORTS 2005 Conference, 20-22.April 2005, Barcelona, Spain. Maritime Engineering and Ports III, Volume 80 of WIT Transactions on the Built Environment. ISSN 1743-3509. WIT Press.