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Hans-Joachim Schramm

Freight Forwarder's Intermediary Role in Multimodal Transport Chains

A Social Network Approach

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Foreword

This book sums up my research so far concerning the freight forwarding business in multimodal transport chains and was submitted successfully as a Doctoral Thesis at Dresden University of Technology. As research always comes along with at least some external support, acknowledgements are as follows.

First, I express my sincere gratitude to my supervisor Univ.-Prof. Dr. Sebastian Kummer and my local examiner Prof. Dr. Knut Haase for their patience as the finishing of my thesis took unusually long.

Second, thank you to Prof. Michael Browne, Prof. Dr. Herbert Kopfer, Prof. Dr. Herbert Kotzab, Prof. Dr. Wolfgang Stölzle, Prof. Dr. Michael Essig and Prof. Lauri Ojala being among those delivering useful comments during the various stages of my work.

Third, sincere thanks are given to my present and former colleagues from Dresden University of Technology, University of Applied Sciences bfi Vienna and WU Wirtschaftsuniversität Wien, especially Dipl.-Verkwirtsch. Nicole Gülle for raising a sample of Austrian freight forwarding companies engaged in air cargo operations as well as Dr. Dipl.-Verkwirtsch. Mirko Hoppe, MMag. Irene Sudy, Dipl.-Ing. Rainer P. Bogensperger and Dipl.-Buchhandelswirtin (FH) Astrid Fischer for suggestions for improvement while proof-reading the text.

Furthermore, I owe some libraries where I spend hours doing desk research on my topic a debt of gratitude, especially the Dresden State and University Library (SLUB), the University Library at WU Wirtschaftsuniversität Wien and the ISL Information Centre at the Institute of Shipping Economics and Logistics at Bremen. Moreover, electronic resources providers like Karlsruhe Virtual Catalogue (KVK) for monographs and ProQuest, ScienceDirect, EBSCOhost, Springer or JSTOR for articles which allowed easy access to publications from all around the world. And last but not least subito (the document delivery service of research libraries in Germany, Austria and Switzerland) which saved my life many times when I was in need for really scarce sources elsewhere not available. Without them I could not have retrieved such a huge amount of references given in this work.

Moreover, I am in debt with Donald E. Knuth and Leslie Lamport for LaTeX, MacKichan Software for Scientific Work, and Visio Corporation (as the original developer of Microsoft Visio) which allowed me to write this thesis in perfect style than with any other word-processing system available. Referring to statistical analysis, SPSS was used, which recently got part of IBM's Business Analytics and Process Optimization organization.

Finally my thesis (and this book) is dedicated to my grandfather Dipl.-Ing. (FH) Hans Haupter who supported me from the very beginning of my academic carrier but could not see the end of my doctorate studies as he died some time ago and (of course) my little daughter Hanna which was growing up to now with her daddy writing hours and hours on a work that never seemed to get completed.

Hans-Joachim Schramm

Contents

List of Figures

List of Tables

List of Symbols (in order of appearance)

p_i	i^{th} point (or actor) in a network
i, j, k, l	(Index for) points or actors in a network with $i \neq j \neq k \neq l$
N	Total number of points (or actors) in a network
q_m	m^{th} link (or relation) in a network
m	(Index for) lines (or relations) in a network
M	Total number of links (or relations) in a network
z_{ij}	Strength of a link between p_i and p_j, $i \neq j$
a_{ij}	Strength of an adjacent between p_i and p_j, $i \neq j$
d_{ij}	Distance of a path between p_i and p_j, $i \neq j$
g_{ij}	Geodesic (or shortest path) between p_i and p_j; $i \neq j$
h	Home country
f	Foreign country or country abroad
x	(Index for) country at home (h), foreign or abroad (f)
TM_x	Transport middleman with $x \in \{h, f\}$
TP_x	Transport service provider with $x \in \{h, f\}$
LP_x	Logistics service provider $x \in \{h, f\}$
P_x	Primary sector firm with $x \in \{h, f\}$
I_x	Industrial sector firm with $x \in \{h, f\}$
D_x	Distributor with $x \in \{h, f\}$
R_x	Retailer with $x \in \{h, f\}$
C_x	Customer with $x \in \{h, f\}$
$d(p_i)$	Actor's degree of p_i
$d_0(p_i)$	Actor's outdegree of p_i
$d_1(p_i)$	Actor's indegree of p_i
$AD(p_i)$	Actor's density of p_i
$z_{ij}(m)$	Strength of the mth link between p_i and p_j, $i \neq j$
$AM(p_i(m))$	Multiplexity of actor's contacts of p_i

o	(Index for) oth distinct subgroup in a network
O	Total number of distinct subgroups in a network
$z_{ij}(o)$	Strength of a link between p_i and p_j of the same subgroup o, $i \neq j$
$AH(p_i(o))$	Heterogeneity of contacts of p_i as a member of subgroup o
NS	Network size
NS_{ego}	Ego's network size of an ego-centric network
ND	Network density
ND_{alter}	Alter's network density in an ego-centric network
ND'	Standardized measure of network density
NC	Network cohesion
NM	Network multiplexity
$C_D(p_k)$	Degree-based absolute measure of point centrality of p_k
$C'_D(p_k)$	Degree-based relative measure of point centrality of p_k
G_{ij}	Total number of geodesics between p_i and p_j, $i \neq j$
$G_{ij}(p_k)$	Total number of geodesics between p_i and p_j that contain p_k, $i \neq j \neq k$
$C_B(p_k)$	Betweeness-based absolute measure of point centrality of p_k
$C'_B(p_k)$	Betweeness-based relative measure of point centrality of p_k
$C_C(p_k)^{-1}$	Closeness-based absolute measure of point centrality of p_k
$C'_C(p_k)$	Closeness-based relative measure of point centrality of p_k
$C_R(p_k)$	Rank-based measure of centrality or eigenvector centrality of p_k
C	$(N \times 1)$ vector of rank-based centrality measures for each actor
Z	$(N \times N)$ matrix of links between actors in a network
λ	Constant, largest positive eigenvalue of Z
$C_R(p^*)$	Maximum value of all $C_R(p_k)$
X	(Index for) measures of point centrality based on degree (D), closeness (C), betweeness (B) or rank (R)
$C_X(p_k)$	Point centrality measures of p_k for $X \in \{D, C, B, R\}$
$C_X(p^*)$	Maximum value of all $C_X(p_k)$ for $X \in \{D, C, B, R\}$
C_X	Measure of centralization for $X \in \{D, C, B, R\}$
C_D	Degree-based measure of graph centrality
$C_D(p^*)$	Maximum value of all $C_D(p_k)$
C_B	Betweenness-based measure of graph centrality
$C'_B(p^*)$	Maximum value of all $C'_B(p_k)$
C_C	Closeness-based measure of graph centrality
$C'_C(p^*)$	Maximum value of all $C'_C(p_k)$
$C_R(p^*)$	Maximum value of all $C_R(p_k)$
$\overline{C}_D$	Average of actor's degrees
$\overline{C}'_D$	Average standardized degree
S^2_D	Variance of actor's degrees

$\overline{C}_C$	Average of actor's closeness
$\overline{C}'_C$	Average standardized closeness
S_C^2	Variance of actor's closeness
$\overline{C}_B$	Average of actor's betweeness
$\overline{C}'_B$	Average standardized betweeness
S_B^2	Variance of actor's betweeness
$\overline{C}_R$	Average of rank-based point centrality
S_R^2	Variance of rank-based point centrality
$P_D(p_k)$	Degree-based prestige of p_k
$P'_D(p_k)$	Standardized degree prestige of p_k
I_k	Number actors in the influence domain of p_k
$P_P(p_k)$	Proximity-based prestige of p_k
$P_R(p_k)$	Rank-based prestige *of* p_k
P	$(N \times 1)$ vector of rank-based prestige for each actor
Φ	$(N \times N)$ identity matrix
P_Y	Network hierarchization with $Y \in \{D, C, R\}$
Y	(Index for) prestige measures based on degree (D), proximity (P) or rank (R)
$P_Y(p^*)$	Maximum value of all $P_Y(p_k)$
$\overline{P}_Y$	Average of prestige measures with $Y \in \{D, P, R\}$
$S_{P_Y}^2$	Variance of prestige measures with $Y \in \{D, P, R\}$
NS_k	Effective network size of an actor k
p_{kj}	Proportion of k's network time and energy invested in a contact with $j \neq i \neq k$
v_{ji}	Marginal strength of j's relations with contact $i \neq j \neq k$
p_{ki}	Proportion of k's network time and energy invested in a contact with $i \neq j \neq k$
p_{ji}	Proportion of j's network time and energy invested in a contact with $i \neq j \neq k$
c_{ki}	Contact-specific constraint of k engaged in a relationship with $i \neq j \neq k$
NC_k	Network constraint index of an actor p_k
T_k	Total raw brokerage score of an intermediary p_k
w_{1k}	Individual raw within-group brokerage score of p_k of the local broker type
w_{0k}	Individual raw within-group brokerage score of p_k of the itinerant broker type
b_{01k}	Individual raw between-group brokerage score of p_k of the gatekeeper type
b_{10k}	Individual raw between-group brokerage score of p_k of the representative type

b_{0k}	Individual raw between-group brokerage score of p_k of the liaison type
$o(ij)$	Common membership of p_i, p_j and/or p_k in a subgroup o according to brokerage type with $i \neq j \neq k$
$z_{ij}(o)$	Strength of a link between p_i and p_j of the same subgroup o with $i \neq j$
$w_1(ij)$	Within-group brokerage between p_i and p_j of the local broker type with $i \neq j$
$w_0(ij)$	Within-group brokerage between p_i and p_j of the itinerant broker type with $i \neq j$
$b_{01}(ij)$	Between-group brokerage between p_i and p_j of the gatekeeper type with $i \neq j$
$b_{10}(ij)$	Between-group brokerage between p_i and p_j of the representative type with $i \neq j$
$b_0(ij)$	Between-group brokerage between p_i and p_j of the liaison type with $i \neq j$
$p_{ij}(p_k)$	Number of two-step paths with p_k between p_i and p_j with $i \neq j \neq k$
T_k^*	Total partial brokerage score of an intermediary p_k
w_{1k}^*	Individual partial within-group brokerage score of p_k of the local broker type
w_{0k}^*	Individual partial within-group brokerage score of p_k of the itinerant broker type
b_{01k}^*	Individual partial between-group brokerage score of p_k of the gatekeeper type
b_{10k}^*	Individual partial between-group brokerage score of p_k of the representative type
b_{0k}^*	Individual partial between-group brokerage score of p_k of the liaison type
w_k	Total within-group raw brokerage score of an intermediary p_k
w_k^*	Total within-group partial brokerage score of an intermediary p_k
b_k	Total between-group raw brokerage score of an intermediary p_k
b_k^*	Total between-group partial brokerage score of an intermediary p_k
W_1	Global within-group raw brokerage score of the local broker type
W_0	Global within-group raw brokerage score of the itinerant broker type
B_{01}	Global between-group raw brokerage score of the gatekeeper type
B_{10}	Global between-group raw brokerage score of the representative type
B_0	Global between-group raw brokerage score of the liaison type
W	Global within-group raw brokerage score
B	Global between-group raw brokerage score

W_1^*	Global within-group partial brokerage score of the local broker type
W_0^*	Global within-group partial brokerage score of the itinerant broker type
B_{01}^*	Global between-group partial brokerage score of the gatekeeper type
B_{10}^*	Global between-group partial brokerage score of the representative type
B_0^*	Global between-group partial brokerage score of the liaison type
W^*	Global within-group partial brokerage score
B^*	Global between-group partial brokerage score
GD_{hf}	Transport distance between country h and f
GD'_{hf}	Transport time between country h and f
CD_{hf}	Cultural distance index between country h and f based on average scores
c	(Index for) cultural dimensions of power distance (*PDI*), uncertainty avoidance (*UAI*), individualism (*IDV*) and masculinity (*MAS*)
CI_{ch}	Values of cultural dimensions at home with $c \in \{PDI, UAI, IDV, MAS\}$
CI_{cf}	Values of cultural dimensions abroad with $c \in \{PDI, UAI, IDV, MAS\}$
CV_c	Overall variance in the sample of each cultural dimension with $c \in \{PDI, UAI, IDV, MAS\}$
CD'_{hf}	Cultural distance index between country h and f based on Euclidean concept
e	(Index for) country indexes of economic freedom (*IEF*), freedom of the world (*EFW*), corruption perception (*CPI*) and globalization (*GI*)
ED_{hf}	Economic distance index between country h and f based on average scores
EI_{eh}	Values of country indexes at home with $e \in \{IEF, EFW, CPI, GI\}$
EI_{ef}	Values of country indexes abroad with $e \in \{IEF, EFW, CPI, GI\}$
EV_e	Overall variance in the sample of each country index with $e \in \{IEF, EFW, CPI, GI\}$
ED'_{hf}	Economic distance index between country h and f based on Euclidean concept
VI_k	Degree of vertical integration of an intermediary k

List of Abbreviations

3PL	Third-Party Logistics Provider
4PL	Fourth-Party Logistics Provider
ABB	Allgemeine Beförderungsbedingungen
AB-SVV	Allgemeine Bedingungen des Schweizerischen Spediteurs-Verbandes
ACL	Atlantic Container Lines
ACT	Associated Container Transportation
ADHGB	Allgemeines Deutsches Handelsgesetzbuch
ADSp	Allgemeine Deutsche Spediteursbedingungen
AGBSp	Allgemeine Geschäftsbedingungen im österreichischen Speditionsgewerbe
ALFA	Automatisiertes Luftfrachtabwicklungsverfahren
AÖSp	Allgemeine Österreichische Spediteursbedingungen
APM	Arnold Peter Møller
APL-NOL	American President Lines - Neptun Orient Lines
ATLAS	Automatisiertes Tarif- und Lokales Zollabwicklungssystem
AWB	Air waybill
B/L	Bill of Lading
BAX	Burlington Air Express
BGBl	Bundesgesetzblatt
BGL	Bundesverband Güterkraftverkehr, Logistik und Entsorgung
BIFA	British National Freight Association
BLG	Bremer Lagerhaus-Gesellschaft
BPAWG	Business Process Analysis Working Group
BSL	Bundesverband Spedition und Logistik
CAGE	Cultural, Adminstrative, Geographical and Economic Distance
CBL	Combined Bill of Lading

CCS	Cargo community system
CdC	Code de Commerce
CEFACT	Centre for the Facilitation of Procedures and Practices for Administration, Commerce and Transport
CFR	Cost and freight (INCOTERM 2000/2010)
CIF	Cost, insurance and freight (INCOTERM 2000/2010)
CINA	Commission Internationale pour la Navigation Arienne
CIP	Carriage and insurance paid to (INCOTERM 2000/2010)
CMI	Comit Maritime International
COD	Cash on Delivery
CoFR	Code of Federal Regulations
COSCO	China Ocean Shipping Company
CPI	Corruption Perception Index
CPM	Critical Path Method
CPS	Cargo Portal System
CPT	Carriage paid to (INCOTERM 2000/2010)
CTO	Combined transport operator
D/C	Documentary collection
DAF	Delivered at frontier (INCOTERM 2000)
DAKOSY	Daten-Kommunikationssystem
DAP	Delivered at place (INCOTERM 2010)
DAT	Delivered at terminal (INCOTERM 2010)
DB	Deutsche Bahn
DBGB	Deutsches Bürgerliches Gesetzbuch
DBGBl	Deutsches Bundesgesetzblatt
DBH	Datenbank Bremische Häfen
DDP	Delivered duty paid (INCOTERM 2000/2010)
DDU	Delivered duty unpaid (INCOTERM 2000)
DES	Delivered ex ship (INCOTERM 2000)
DEQ	Delivered ex quay duty paid (INCOTERM 2000)
DHL	Dalsey-Hillblom-Lynn
DIN	Deutsches Institut füsr Normung
DPWN	Deutsche Post World Net
DRGBl	Deutsches Reichsgesetzblatt
DSLV	Deutscher Speditions- und Logistikverband
DVB	Deutsche Verkehrsbank
DVZ	Deutsche Verkehrszeitung
EACP	European Air Cargo Programme
EC	European Community
ECAA	European Common Aviation Area
ECT	Europe Combined Terminals

EDI	Electronic Data Interchange
EEC	European Economic Community
EFTA	European Free Trade Association
EFW	Economic Freedom of the World Index
EHK	Euler Hermes Kreditversicherungs AG
EMC	Export management company
ETC	Export trading company
ETI	Enabling Trade Index
EU	European Union
EXW	Ex works (INCOTERM 2000/2010)
FAS	Free alongside ship (INCOTERM 2000/2010)
FBL	FIATA Bill of Lading
FCA	Free carrier (INCOTERM 2000/2010)
FCL	Full-container-load
FCR	FIATA Forwarders Certificate of Receipt
FCT	FIATA Forwarders Certificate of Transport
FedEx	Federal Express
FIATA	Fdration Internationale des Associations de Transitaires et Assimils
FOB	Free on board (INCOTERM 2000/2010)
FTL	Full-truck-load
GAP	German Airfreight Partners
GATT	General Agreement on Tariffs and Trade
GBlÖ	Gesetzblatt der Republik Österreich
GDP	Gross domestic product
GERT	Graphical Evaluation and Review Technique
GF-X	Global Freight Exchange
GI	Globalization Index
GNP	Gross national product
GSA	General sales agent
GSSA	General sales and service agent
GT&C	General terms and conditions
GTC	General trading company
HGB	Handelsgesetzbuch
HMM	Hyundai Merchant Marine
HPH	Hutchison Port Holding
HVertG	Handelsvertretergesetz
IAPH	International Association of Ports and Harbours
IATA	International Air Transport Association
IATA-CASS	IATA Cargo Accounts Settlement System
IBM	International Business Machines Corporation

ICAO	International Civil Aviation Organization
ICC	International Chamber of Commerce
ICH	IATA Clearing House
IDV	Individualism versus collectivism
IEC	Immediate effects centrality
IEF	Index of Economic Freedom
IFF	International freight forwarder
IGLU	Interessensgemeinschaft Luftfracht GmbH
IMD	Institute for Management Development
IMP	Industrial Marketing and Purchasing
INCOTERMs	International Commercial Terms
IOT	Industrial Organization Theory
IOU	I owe you
ISO	International Standardization Organization
ITF	Intermediation Theory of the Firm
ITZ	Internationale Transportzeitung
KLM	Koninklijke Luchtvaart Maatschappij
km	Kilometre
kn	Knots
KVK	Karlsruher Virtueller Katalog
L/C	Letter of Credit
LACES	London Airport Cargo Electronic Data Processing System
LCL	Less-than-container-load
LLP	Lead logistics provider
LPI	Logistics Performance Index
LTL	Less-than-truckload
LTO	Long-term versus short-term orientation
MaklerG	Maklergesetz
MAS	Masculinity versus femininity
MEC	Mediative effects centrality
MISC	Malaysian International Shipping Corp.
MLS	Multiple listing service
MMT	Market Microstructure Theory
MOL	Mitsui Osaka Shoshen Kaisha Line
mph	Miles per hour
MPM	Meta Potential Method
MS	Management Science
MSC	Mediterranean Shipping Company
MTO	Multimodal transport operator
NAFTA	North-American Free Trade Area

NCBFAA	National Customs Brokers and Forwarders Association of the United States
NCE	(Neo)classical Economics
NES	New Economic Sociology
NET	Network Exchange Theory
NIE	New Institutional Economics
nm	Nautical miles
NSAB	Nordisk Speditørforbunds Alminnelige Bestemmelser
NSF	Nordiskt Speditör Förbund
NVO	Non-vessel operator
NVOC	Non-vessel owning carrier
NVOCC	Non-vessel operating common carrier
NYK	Nippon Yushen Kaisha
OCL	Overseas Container Limited
OeKB	Österreichische Kontrollbank AG
OEM	Original Equipment Manufacturer
OG	Obligationenrecht
ÖHGB	Österreichisches Handelsgesetzbuch
OIE	Old Institutional Economics
OOCL	Oriental Overseas Container Line
OR	Operations Research
OTI	Ocean transport intermediary
P&O	Peninsular and Oriental Steam Navigation Company
PAT	Principal Agent Theory
PDI	Power distance
PERT	Programm Evaluation and Review Technique
PRT	Property Rights Theory
PSA	Port of Singapore Authority
RO/RO	Roll-on/roll-off
SABRE	Sales And Business Reservations Electronically
SAS	Scandinavian Airlines System
SET	Social Exchange Theory
SLUB	Staats- und Landesbibliothek
sm	Statute miles
SNA	Social Network Analysis
SOFIA	Systme d'ordinateur du Frt International Arien
STC	Standard Trading Conditions
SWB	Sea waybill
SWIFT	Society of Worldwide Interbank Financial Telecommunication
TACT	The Air Cargo Tariff
TCT	Transaction Cost Theory

TEC	Total effects centrality
TEU	Twenty foot equivalent unit
TLF	Fdration des Entreprises de Transport et Logistique de France
TMWG	Techniques and Methodologies Working Group
TNT	Thomas Nationwide Transport
TPG	The Post Groep
TRAXON	Tracking and Tracing Online
UAI	Uncertainty avoidance
UASC	United Arab Shipping Company
UGB	Unternehmensgesetzbuch
ULD	Unit load device
UN	United Nations Organization
UN/ECE	United Nations Economic Commission for Europe
UNCTAD	United Nations Conference on Trade and Development
UPS	United Parcel Service
US	United States (of America)
VAN	Value Added Network
VAT	Value Added Tax
VBGL	Vertragsbedingungen für den Güterkraftverkehrs- und Logistikunternehmer
VBSp	Verein Bremer Spediteure
VDS	Verein Deutscher Spediteure
VHSp	Verein Hamburger Spediteure
WACO	World Cargo Organization
WIFI	Wirtschaftsförderungsinstitut
WIN	Worldwide Independent Network
WKO	Wirtschaftskammer Österreich
WTO	World Trade Organization

Chapter 1
Introduction

> "A work of this kind is really never finished; one only calls it finished because one has done all that is possible in the time and the circumstances."
>
> (Johann Wolfgang von Goethe (1970 [1786–1788]), Italian Journey, 16/03/1787, translated by W.H. Auden and E. Meyer)

In this book, the business of international freight forwarding is examined both from a theoretical and empirical point of view with a special emphasis on multimodal transport chains including sea or air transport operations - a truly multi-billion dollar business, where international freight forwarders get an ever increasing share of the pie and generate highly attractive returns on capital.[1] There, the freight forwarder is always considered as "The Architect of Transport," but this intermediary role seems not to be well theoretically reflected in research up to now. Therefore, relevant theoretical concepts from economic theory and economic sociology are employed to draw both an intermediary and a network perspective of freight forwarding in order to provide a better understanding of this kind of transportation business. Furthermore, the position of freight forwarder such an inherent network structure of multimodal transport chains is explored by mapping relationship patterns in a stylized model framework which is applied to a questionaire based sample raised among freight forwarders in multimodal transport chains with a leg by sea or air in Germany (especially from Hamburg, Bremen, and Bremerhaven) as well as Austria in 2003.

Writing a book in English about freight forwarding seemed to be very uncommon for most of my German and Austrian colleagues (at least at the beginning), but for me as the author, there are some striking reasons to do this I want to declare briefly. First, since my time as an research and teaching assistant at Dresden University of Technology I got in contact with many colleagues in the field of university education outside German speaking countries being very interested in my focus of research work and so I decided to offer my contribution to a greater audience. Second, over

[1] See e.g. MergeGlobal (2008a,b,c).

H.-J. Schramm, *Freight Forwarder's Intermediary Role in Multimodal Transport Chains*, Contributions to Management Science, DOI 10.1007/978-3-7908-2775-0_1,

the years my assignments came along with more and more lecturing as well as research work in English. Augmenting this experience, I saw that being a citizen of the European Union, there is a need for a more "unifying" approach in writing about German and Austrian freight forwarding issues. Last but no least, some sections of this work are heavily influenced by Anglo-Saxon scholarship, especially in the case of theoretical treatments in New Institutional Economics, Intermediation Theory of the Firm and Social Network Analysis. Writing about these topics in German, there is always a danger to get "lost in translation," because at least some of the wording used cannot be translated in a straightforward way without alternating their original meaning. Therefore, German speaking authors nowadays often "fall in love" to write German texts with a considerable high percentage of Anglicisms and ending up then with a work being neither German nor English but something in between. I definitely did not want to end up with such a piece of work, so I decided to write it down in English as a contemporary "lingua franca."[2]

In the remaining sections, findings from an initial literature review about freight forwarding, container and air cargo operation issues as well as purpose, objectives, methodology, and the structure of this work are outlined.

1.1 Freight Forwarding as a Research Topic So Far

In order to motivate purpose, objectives, methodology, and outline of this work, a rough overview about the status quo of research in freight forwarding (as well as container shipping and air cargo operations) as a research topic will be given first to show clearly to what extent it is theoretically reflected in scientific literature so far. In the following, a focus is set on dissertations (or works on doctoral or PhD level) originating from Germany, Austria and Switzerland before a brief outlook about Anglo-Saxonian literature is given.

Reviewing freight forwarding related literature in German, a considerable number of 97 dissertations from Germany, Austria and Switzerland about the freight forwarding business with mainly non-legal focus could be identified as shown in Fig. 1.1.[3] Whereas these dissertations cover a widespread variety of topics from the

[2]Following Welch et al. (2001, p. 195), "English has evolved as the most commonly used corporate language, reflecting its more general position as a type of *lingua franca* of international business." According to Encyclopædia Britannica (2002), the term "lingua franca" originally means frankish language and is an "auxiliary or compromise language used between groups having no other language in common." It was first applied to a jargon or pidgin based on southern French and Italian, developed in the Middle Ages by crusaders and traders in the eastern Mediterranean.

[3]This review of literature from German speaking countries is mainly based on a bibliography of forwarder-related scientific literature by Müller (1990), a review survey of dissertations in the field of logistics from 1990 to 1997 by Large and Stölzle (1999), the annual bibliographic notes in the Jahrbuch der Logistik from 1990 to 2007 as well as library catalogues of monographs from Deutsche Bibliothek Frankfurt-on-Main, Deutsche Bücherei Leipzig, Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Österreichische and Schweizerische Nationalbibliothek. Fur-

Goerres (1909)*	Vogel (1947)	Schott (1971)	Zöllner (1990)
Heinrich (1913)	Lehmann (1949)	Ringshausen (1971)	Thaler (1990)*
Silberstein (1914)	Kirchner (1950)*	Lösch (1972)	Kleer (1991)
Reinmüller (1919)	Ullmann (1950)*	Diehl (1973)	Niegel (1991)
Kürbs (1920)*	Ehret (1951)	Freese (1975)	Severin (1992)
Vadnai (1921)	Kobelnig (1952)	Matthäi (1979)	Rendez (1992)
Vonnegut (1921)	Fritz (1955)	Seiler (1981)	Gollnick (1992)
Thost (1921)	Meyer (1957)	Offergeld (1984)	Freichel (1992)
Meyer (1922)	Schmitz (1957)	Krass (1984)	Hebert (1992)
Pontow (1922)	Bader (1959)	Quintero (1985)*	Fuhrmann (1993)
Vogler (1924)	Scharl (1963)	Eckstein (1985)	Otto (1993)
Scharlibbe (1925)*	Donndorf (1963)	Seiffert (1986)	Simon (1993)*
Höppel (1925)	Keller (1966)	Schumacher (1987a)	Stahl (1995a)*
Schneider (1925)	Gretzschel (1968)*	Dehn (1987)*	Heierli (1995)
Tiebel (1925)	Lamprecht (1969)	Drechsler (1988)	Lublow (1995)
Grass (1927)	Wecker (1969)	Welker (1988)	Falk (1995)
Dietrich (1929)	Kloetz (1969)*		Wittenbrink (1995)
Hansen (1928)			Jacob (1996)
Blank (1929)			Niebuer (1996)
Böllinger (1930)			Steffen (1996)
Weisel (1934)			Waldenberger (1997)
Dietz (1935)			Rumpf (1997)
Stern (1938)*			Richter (1997)
Eggli (1942)			Wlcek (1998)
Lehrner (1942)			Wolf (1999)
Palmhofer (1944)			Becker (1999)*
			Engelsleben (1999)
			Erdmann (1999)
			Nöcker (2002)
			Pankratz (2002)
			Uhlmann (2004)
			Schmidthöfer (2004)
			Schmitz (2005)
			Helf (2005)
			Lohre (2005)
			Weddewer (2007)
			Krajewska (2007)
			Rieck(2008)
1909 to 1945: 26	1946 to 1969: 17	1970 to 1989: 16	1990 to 2008: 38

Fig. 1.1 Dissertations in German about freight forwarding

freight forwarder business, 14 of them are worth to highlight with an asterix here, because they explicitly coped with the international freight forwarding business. In the very first contribution, Goerres (1909) mainly discussed in depth tariff structure

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ther, a snowball sampling method was applied to all monographs physically available for the author in order to find other works not cited or filed at the above mentioned sources.

and paperwork needed for cross-border railway transports. Kürbs (1920) observed freight forwarding operations between France and Germany, whereas Scharlibbe (1925) and Stern (1938) described thoroughly the freight forwarder's business at seaports. Ullmann (1950) and Kirchner (1950) gave an overview on the freight forwarding business in Austria after World War II, together with a detailed description of historical, legal, functional and organizational issues. Furthermore, Gretzschel (1968), Kloetz (1969) and Quintero (1985) focused on organizational topics in export-import operations of international freight forwarding in socialist countries. Moreover, Dehn (1987) assessed chances of freight forwarding companies offering distribution services in air cargo as well as sea freight operations. Thaler (1990) discussed the economic impacts on European freight forwarding companies borne by the establishment of the European Common Market, followed by Simon (1993) and Stahl (1995a) further investigating freight forwarder transport networks in groupage service on a European level. Finally, Becker (1999) analyzed strategic alliances among freight forwarders in the air cargo industry.

Looking at the literature outside German-speaking countries, freight forwarding seems to be of less scientific interest. Works at a doctoral or PhD level in English language found coping directly with forwarding issues or freight forwarder-related third-party logistics since 1980 are e.g. Okeafor (1982), Westfall (1987) and Rahman (1989) in the United States, Stone (1998) and Ford (2001) in the United Kingdom as well as Hertz (1993), Andersson (1995, 1997), Ludvigsen (2000), Berglund (2000) and Stefansson (2004) in Sweden or Lommelen (2004) in Belgium.[4] Referring to peer reviewed journal articles, early contributions are e.g. Davies (1981) about exporter and freight forwarder relationships in the United Kingdom, Pope and Thomchick (1985) or Sherwood and Burns (1992) about freight forwarders and "non-vessel operating common carriers" (NVOCCs) in the United States. Furthermore, Ozsomer et al. (1993) presented an expert system tool that helps to evaluate and select international freight forwarders and Paul R. Murphy, James M. Daley and Douglas R. Dalenberg published a series of surveys about export management and international freight forwarding issues resulting in contributions like Murphy et al. (1992) and Murphy and Daley (1994, 1995, 1996a,b, 2000, 2001). Yet, other recent contributions are Lu and Dinwoodie (2002) about international freight forwarding services in the People's Republic of China, Lemoine and Dagnæs (2003) dealing with the dynamics of internationalization and globalization of European freight forwarding and logistics service providers, Bowen and Leinbach (2004) examining the air freight forwarding industry with a special focus on South-East Asia as well as Lai and Cheng (2004) with a survey of the freight forwarding business in Hong Kong, Markides and Holweg (2006) about diversification of international freight forwarders in the United Kingdom

[4]See Stock (1988/1989), Stock and Luhrsen (1993), Stock (2001) and Stock and Broadus (2006) for a review and bibliographic notes for dissertations filed at United Microfilms International from 1970 to 2004 or Gubi et al. (2003) with a review of dissertations written in the Scandinavian countries from 1990 to 2001.

			Hinricher (1993)
	Baumöller (1970)		Geuther (1990)
	Wyremba (1970)		Lieb (1990)
	Egert (1970)		Cao (1991)
	Schuh (1971)		Mira (1993)
	Käselau (1971)	Scheibe (1980)	Opatz (1994)
	Walter (1971)	Philipp (1980)	Bortfeld (1995)
	Zinnecker (1972)*	Jehle (1981)	Gürsel (1996)
	Mönch (1972)	Schmitt (1981)	Exler (1996)
	Baumgarten (1972)	Jarke (1981)	Ordemann (1996)
	Ramcke (1973)	CardonneMolina (1981)	Malchow (1996)
	Huch (1973)	Ernst (1982)	Kasprzak (1997)
	Kranz (1973)	Lutze (1982)	Ponta (1997)
	Detrez (1973)	Krieger (1984)*	Alicke (1999)
	Nguyen (1973)	Lasser (1984)	Pumpe (2000)
	Broers (1974)	Moral Garcia (1984)	Hautau (2002)
	Monzel (1974)	Richter (1985)	Kramer (2004)
	Meyer (1975)	Behrens (1986)	Reise (2005)
	Bartscher (1976)	Mester (1986)	Ninnemann (2005)
	Kühnbaum (1976)	Kunzmann (1988)	Hein (2007)
	Bopp (1976)	Shalaby (1988)	Schönknecht (2007)
	Trettin (1977)	Schott (1989)	Hildebrand (2008)
Mathiesen (1969)	Knepper (1978)	Sinnig (1989)	Meier (2008)
Rackwitz (1969)	Gerckens (1978)	Grabellus (1989)	Lauf (2008)
1946 to 1969: 2	1970 to 1979: 23	1980 to 1989: 19	1990 to 2008: 24

Fig. 1.2 Dissertations in German about container shipping

and Neiberger (2008) describing spatial and organizational patterns of European air cargo freight forwarding. Another stream of literature closely related to the freight forwarding business is the booming field of third- and fourth-party logistics with numerous contributions since the 1990s well documented in Razzaque and Sheng (1998), Maloni and Carter (2006), Selviaridis and Spring (2007) and Marasco (2008).

In addition to freight forwarding related contributions, dissertations from German speaking countries related to container shipping and air freight operations were surveyed, too, again with a focus on merely economic issues.[5] In Figs. 1.2 and 1.3, all dissertations originating from Germany, Austria or Switzerland found are summarized with a total of 105 contributions since 1931.[6]

[5]This implies, that dissertations coping solemnly with topics from engineering, polity or law were excluded. As the scope of this work is international freight forwarding, a more rigorous review including works at a doctoral or PhD level of non-German country origin was not conducted but Stock (1988/1989), Stock and Luhrsen (1993), Stock (2001) and Stock and Broadus (2006) list a total of 104 contributions filed at United Microfilms International from 1970 to 2004 covering about the same topics in the field of water and air cargo transportation as in the case of dissertations of German country origin.

[6]Notably, Zinnecker (1972) and Krieger (1984) were dealing both with air cargo operations as well as container shipping, but they are counted once.

			Zimmermann (1992)
			Terhorst (1992)
			Schneider (1993)
			Mengen (1993)
		Seidelmann (1971)	Gompf (1994)
		Bey (1972)	Windisch (1996)
		Zinnecker (1972)*	Klampferer (1996)
		Hoff (1972)	Opgenhoff (1997)
		Krebs (1974)	Reinheimer (1998)
		Blattmann (1977)	Bachmeier (1999)
		Meier (1977)	Gutthal (1999)
		Arndt/Kinkeldei (1978)	Buro (2000)
		Zettl (1979)	Fränkle (2001)
		Krieger (1984)*	Heckmann (2002)
	Wagner (1952)	Weisskopf (1984)	Frye (2003)
	Mollekopf (1956)	Wendorff (1984)	Schüller (2003)
	Heinrich (1966)	Sustrate (1986)	Prinz (2008)
Kreuter (1931)	Snoek (1967)	Wendorff (1986)	Linz (2008)
1909 to 1945: 1	1946 to 1969: 4	1970 to 1989: 14	1990 to 2008: 18

Fig. 1.3 Dissertations in German about air cargo operations

The first dissertations in German language dealing explicitly with container shipping issues can be dated back to 1969, shortly after the first regular intercontinental container shipping services were introduced by Sea-Land Service.[7] In the 1970s and 1980s, contributions mushroomed, covering various aspects of container shipping. Most of them were of merely general interest, describing and discussing en detail container shipping operations or observing the impacts of containerization on shipping companies and/or seaports. Others, like Baumöller (1970), Schuh (1971), Käselau (1971), Bartscher (1976), Schmitt (1981) or Krieger (1984) focused on pricing or controlling issues. Furthermore, authors like Ramcke (1973), Huch (1973), Jehle (1981), Jarke (1981), Ernst (1982), Kunzmann (1988), Schott (1989), Cao (1991), Bortfeld (1995), Gürsel (1996), Ordemann (1996), Kasprzak (1997), Ponta (1997), Alicke (1999), Pumpe (2000), Hein (2007) or Meier (2008) employed mathematical approaches to improve container transport operations.[8]

From the time before 1945, only one dissertation in German language dedicated to air cargo transport operations could be identified. But other authors like Wüst (1927), Stahlberg (1931), Maetz (1937) or Ziegler (1938) raised both passenger and cargo transport issues. After 1945, a steadily increasing stream of contributions from Wagner (1952) to Linz (2008) either commenting actual developments in the air cargo industry or treating special problems in air cargo transport operations

[7] See Sect. 2.2.2.1 with further comments. Moreover at that date, maritime economics was a rather new emerging research field with isolated works before the 1960s, as Goss (2002) noted.

[8] See Sect. 4.1.2 for a more thoroughly treatment of this issue.

can be observed.[9] Among these various special treatments, Seidelmann (1971) or Zinnecker (1972) discussing air cargo unitization issues, Bey (1972), Krebs (1974), Arndt and Kinkeldei (1978), Terhorst (1992) or Frye (2003) surveying ground handling operations and Schneider (1993), Bachmeier (1999) or Gutthal (1999) focusing on integrated air cargo transport chains can be highlighted.

To conclude, the total amount of dissertations about freight forwarding (as well as container shipping and air cargo operations) originating from German speaking countries count up to considerable volume of scientific research work. But especially contributions in the field of multimodal transport chains with a leg by sea or air seems to be rare with only a few exceptions like Scharlibbe (1925), Stern (1938), Gretzschel (1968), Kloetz (1969), Quintero (1985) or Dehn (1987) about international freight forwarding in maritime shipping and Becker (1999) or (again) Dehn (1987) in air cargo operations. Referring to other contributions about international freight forwarding outside German speaking countries, especially Okeafor (1982), Westfall (1987), Rahman (1989), Hertz (1993), Ludvigsen (2000), Ford (2001) and Lommelen (2004) can be mentioned.

1.2 Purpose and Research Objectives

Seeing the rather underdeveloped field of contributions about international freight forwarding in multimodal transport chains with a leg by sea and air, the purpose of this work is to explore international freight forwarding beyond a merely descriptive approach and look on the topic from both a strict theoretical as well as empirical point of view. Accordingly, the research question(s) in short are as follows:

1. What is the intermediary role of freight forwarders in multimodal transport chains including a leg by sea or air?
2. Which body of theory may help to explore its intermediary role theoretically?
3. Which kinds of measures are needed to catch its intermediary role empirically?

The term "role" in the context of this work is derived from its well defined meaning in role theory as covered by anthropologists, sociologists and psychologists, but it can be merely regarded as a classificatory concept than a theory. After first explicit treatments in the 1930s by Mead (1934), Moreno (1934) and Linton (1936), a language of technical terms was developed during the 1950s to 1960s.[10]

Probably the most employed basic definition of role and its relationship to position and status stem from the anthropologist Ralph Linton, who defined a *status* as "[...] a position in a particular pattern. [...] It represents his position in relation

[9]In addition to this, there is a bulk of dissertations dealing with the airline industry as a whole. But in contributions like Berendt (1961), Wolf (1967) or Buchwald (1973), air cargo transport operations are of minor interest.

[10]Cf. Zukin and DiMaggio (1990, p. 11–20), Dahrendorf (1960, p. 12–14), Thomas and Biddle (1966a), Turner (1985) or Biddle (1986).

to the total society" (Linton (1936, p. 113)).[11] Furthermore, a status can be either ascribed or achieved with the first type assigned to individuals from birth without reference to their innate differences or abilities and the second to be acquired through competition and effort.[12] To define the term *role*, he simply asserted that it "[. . .] presents the dynamic aspect of a status. The individual is socially assigned to a status and occupies it with relation to other statuses [. . .] Rôle and status are quite inseparable, and the distinction is only of academic interest. There are no rôles without statuses or statuses without rôles" (Linton (1936, p. 114)).[13] As a status always comes along with a collection of rights and duties (or obligations) associated with a particular position, a role determines an individual's behaviour as a social pattern expected by others (or the society in general).[14] While sharing Linton's (1936) ideas of role and status definition, Merton (1957, p. 110) pointed to the fact that each person in society not only occupies multiple statuses with "each social status involves a single associated role, but an array of roles." He named it *role-set* and defined it as "the work complement of role-relationships in which persons are involved by virtue of occupying a particular social status" (ibid). Accordingly, Merton (1957, p. 111) designated a *status-set* to be a "complement of distinct statuses of a person, each of these in turn having its own role-set." Later on, sociologists like Gross et al. (1958, p. 48), Dahrendorf (1960, p. 45–46) or Thomas and Biddle (1966b, p. 28–29) suggested that *position* rather than *status* is a better term because "status connotes the idea of differential ranking among a set of person or social locations, whereas the more neutral term, position, does not" (Gross et al. (1958, p. 48)). Moreover, Gross et al. (1958, p. 48–69), Dahrendorf (1960, p. 46–52) or Thomas and Biddle (1966b, p. 29–31) showed, how these initial definitions can be further enlarged to a language for role analysis. But without elaborating on further details, it is useful to restate these basic relationships between role, position and status briefly as follows:[15]

- A *position* is defined by the location of a person in a system of social relationships.

[11]See Gross et al. (1958, p. 11–48) or Dahrendorf (1960, p. 40–45) for broad discussion about definitions of the terms role, position and status from other authors.

[12]See Linton (1936, p. 115–131) and other authors like Gross et al. (1958, p. 48–58), Dahrendorf (1960, p. 35–40) or Davis (1966).

[13]Writing "rôle" instead of "role" seems to be a subtle indication that the word itself originates from French, see e.g. Dahrendorf (1960, p. 13–17) or Thomas and Biddle (1966a, p. 5–7) for further discussion.

[14]Gross et al. (1858:58–60) worked out two dimensions of a single expectation, namely direction and intensity with the first reduced either a statement for or against something and the second a continuum from completely permissive (may or may not do) through the preferential (preferably should do) to the mandatory (absolutely must do). Further, Dahrendorf (1960, p. 18–34) added that with deviance from such expectations, positive or negative sanctions must follow in order to secure their compliance.

[15]Referring to Biddle (1986), this set of definitions is in line with the structuralist perspective of role theory.

- A *role* of a person is a set of expectations of others about its behaviour, connected with a particular position.
- A *role-set* is the sum of different roles associated with a particular position.
- A *position-set* is the sum of different positions associated with a person.
- A *status* implies the ranking of a person's position among a set of persons or locations.

Additionally, Blau and Scott (1963, p. 195) and Evan (1965) regarded these role theoretic considerations to be valid on an organisational level, too. As organizations consist of a set of persons with common position called membership, one can speak of an *organization-set*, referring to the various other organizations an particular organization is related. These relationships are mediated by "(a) the role-sets of its boundary personnel, (b) the flow of information, (c) the flow of products or services, and (d) the flow of personnel" (Evan (1965, p. B220)). As in every organization at least some positions are connected with a liaison role *vis-à-vis* other organizations, the occupants of these roles can be regarded as representatives for their organization. This is especially true in the case of the freight forwarding business, a people-driven service industry where most personnel is in direct contact with their companies' clients in the name and on behalf of their company. Therefore throughout this work, the term "role-set" subsumes both role- as well as organization-set as a freight forwarder can be regarded as an individual and a legal entity at the same time without getting different outcomes in this context.

1.3 Research Methodology and Outline

Being a rather exploratory study emphasizing the quest for theories matching to real-world observations, an appropriate research approach for this piece of work may be best described as abductive reasoning (Kovács and Spens (2005) or Spens and Kovács (2006)). Departing from mainstream research processes being either strict deductive or inductive, the abductive research approach implies a creative interactive process (Taylor et al. (2002)) of matching or systematic combining theories to real-world observations made (Dubois and Gadde (2002)) in order to find a matching framework or to extend existing theory (Andreewsky and Bourcier (2000)) for further treatment. Following this research approach, the book is structured in seven Chapters as follows (see Fig. 1.4 for reference):

Starting with Chapters 2, first legal status and functional views of freight forwarder operations are outlined with a special focus set on Germany and Austria. After that, a closer look at multimodal transport chains including a leg by sea or air is made including technological development, functional aspects, institutional environment and market structure. Then inter-organizational interaction and cargo movement in such multimodal transport chains are described thoroughly by identifying actors and showing how they work together. In this context, a freight forwarder can be regarded as some special intermediary, organizing goods movements and

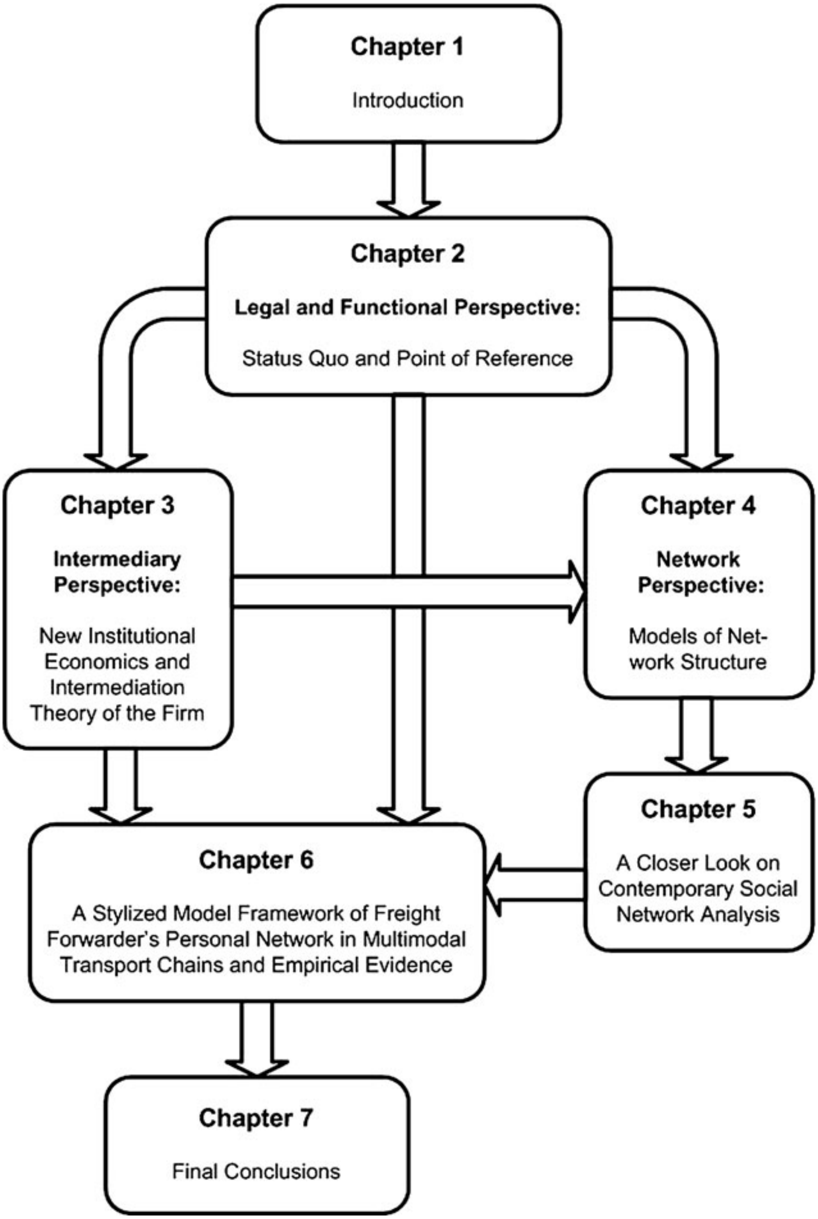

Fig. 1.4 Structure of this Book

providing other related services along a chain of transport and logistics operations. These real-world observations from actual freight forwarding industry practice lead to a legal and functional perspective of freight forwarding which serve as a status quo or point of reference from which more elaborated scientific treatments are conducted.

In Chapter 3, a conceptual framework of a freight forwarder's intermediary perspective based on New Institutional Economics and Intermediation Theory of the Firm will be developed. First, the three basic concepts of *New Institutional Economics*, namely (1) *Property Rights Theory* (discussing forms of contractual relationships and contract enforcement mechanisms), (2) *Transaction Cost Theory* (addressing bounded rationality, opportunism, transaction costs and their impact on governance structure) and (3) *Principal–Agent Theory* (focusing on information asymmetry and their impact on agency costs and contractual design) are reviewed as a starting point for further discussion. Then recent developments in the *Intermediation Theory of the Firm* are addressed where a special focus on several distinct intermediary roles like being (1) a *matchmaker* (broker) in dyadic relationships, (2) a *market maker* (specialist, dealer, merchant or marketer) in triadic relationships, (3) an *information producer*, *guarantor* and/or *certificator* and (4) an *agent* employed *for delegated expertise*, *bargaining, contracting* and/or *monitoring* tasks is offered. After that, a taxonomy of middlemen and service providers in multimodal transport chains is presented, including players for commercial, financial, transport and logistics operations as well as some forms of infomediaries and information service providers. In this framework, the freight forwarders' role-set may be described best as a somehow strange hybrid providing intermediation as well as financial, transport and logistics support to shippers, consignees or consignors. Furthermore, some critical comments on the intermediary perspective are stated that demand a network perspective to catch the inherent network structure of freight forwarding in multimodal transport chains.

Therefore in Chapter 4, these multimodal transport chains in question are considered as specific forms of network structure. There are six distinct models of network structure, which are regarded fruitful in the context of this work: (1) *Network Models in Operations Research and Management Science* mainly coping with problems of network design and flow, (2) *Strategic Networks* focusing on cooperative relationships and strategic alliances around a central actor, (3) *Dynamic Networks* as business communities or temporal virtual companies for specific tasks, (4) *Entrepreneurial Networks* consisting of specialized intermediaries in a hierarchical information structure, (5) *Industrial Networks* with power-dependant exchange relationships in a framework of actors, activities and resources and (6) *Social Networks* with personal interaction, weak and strong ties, structural holes, social capital and embeddedness issues. Comparing these models of network structure and their underlying body of theory with initially made observations as documented in Chapter 2, it can be concluded, that a freight forwarder's intermediary role in multimodal transport chains can at best be described as a focal company in a social network structure.

As social network analysis is a wide prosperous field of research, its roots and levels of analysis are briefly outlined in Chapter 5 before relevant analytical concepts for both personal network structure (e.g. network size and density) and intermediary position (e.g. centrality and prestige) as well as relationships (e.g. brokerage capacity and network constraint) are thoroughly discussed. In addition to this, suggestions are made how to apply these measures to empirical data in order to explore social network structures as well as social capital.

In Chapter 6, a stylized model framework of freight forwarder's personal network in multimodal transport chains is then set up from an ego-centric social network point of view in order to show empirical evidence for the freight forwarder's intermediary role in multimodal transport chains in the case of a small sample of freight forwarder's personal networks in Germany (especially from Hamburg and Bremen-Bremerhaven) as well as Austria.

Finally, in Chapter 7, both theoretical and empirical results as well as contribution to extant research are summarized and some managerial implications are given along with recommendations for further research.

Chapter 2
Legal and Functional Perspective of Freight Forwarding in Multimodal Transport Chains

Following authors like Palmhofer (1944, p. 8–9), Ullmann (1950, p. 18), Murr (1979, p. 1), Matthäi (1979, p. 4), Seiler (1981, p. 33) or Gass (1991, p. 15), freight forwarding as a special business can be traced to the Medieval Age. Up to this time, a merchant principally transported cargo overland by own means or vessels chartered directly from their owners. Of course, since the times of the Roman Empire, usually merchandise cargo in transit was always accompanied by some agent who was obliged to take care for the shipment and to act on behalf of the owning merchant, but such transport operations can be considered merely as being done on own account.[1]

Several trade practices coming up in the late Medieval Age can be regarded as the beginning of the freight forwarding business. First, stand-alone foreign subsidiaries of trading companies called "Accumenda," "Implicita" or "Faktoren" started business on own account, combining commercial trade with freight forwarding.[2] In the sixteenth century, several cities in Central Europe raised regulations, upon each cargo of an extraneous merchant subject to a "Stapelrecht" crossing their territory had to be unloaded there and offered for sale to domestic merchants.[3] As they were not always able to buy all the merchandise offered to them, they took it on commission in order to sell them later or send them to somewhere else under their name.[4] Both tasks are nowadays part of the freight forwarding business: acting as a

[1]See Stamm (1908, p. 1–2), Goerres (1909, pp. 7–8), Securius and Böning (1941, pp. 10–11), Palmhofer (1944, p. 80–86), Ullmann (1950, p. 13–18), Hald (1951, p. 11), Matthäi (1979, p. 4) or Gass (1991, pp. 14–15) with further reference.

[2]See Goerres (1909, pp. 7–8), Vadnai (1921, pp. 29–30), Securius and Böning (1941, pp. 10–11), Ullmann (1950, p. 18), Hald (1951, pp. 11–12) or Gass (1991, pp. 15–16) with further reference.

[3]Cf. Goerres (1909, pp. 9–11), Vadnai (1921, p. 30a-31a), Securius and Böning (1941, p. 10), Palmhofer (1944, p. 8–9), Ullmann (1950, pp. 19–22), Hald (1951, p. 12), Matthäi (1979, pp. 4–6), Seiler (1981, p. 33) or Jaeger and Laudel (2003, p. 70).

[4]See e.g. Wolters (1973, p. 31) or Seiler (1981, pp. 33–34).

H.-J. Schramm, *Freight Forwarder's Intermediary Role in Multimodal Transport Chains*, Contributions to Management Science, DOI 10.1007/978-3-7908-2775-0_2,

commission agent or being a despatcher of cargo shipments on behalf and account of a shipper.

In addition to this, another regulation closely connected to the "Stapelrecht" was the "Umschlagsrecht" standing for the allowance of cargo handling operations for domestic carriers.[5] Specialized agents called "Güterbestätter" or "Güterfertiger" were organizing and supervising these handling operations as well as checking the goods being unloaded.[6] They can be regarded as the real ancestors of foreign freight forwarders, because step by step, they expanded their operations to expedition of cargo and customs brokerage.[7] With the increasing importance of railway operations becoming the dominant inland mode of transport during the nineteenth century, freight forwarders added new fields of activity like cargo consolidation for shippers and cartage service on behalf of railway companies.[8] All these developments resulted in the forwarding business as we know it today.

2.1 The Freight Forwarder from a Legal and Functional Point of View

Freight forwarders are always described along their legal status and/or their functions, so in the following first the legal framework of forwarding business in Germany, as well as in Austria are briefly described and differences to the forwarding business in other countries will be highlighted. Then freight forwarder functions as well as general fields of activity and specialization in forwarding business are outlined as a second, functional point of view.

2.1.1 Actual Legal Status of Forwarding Business in Germany and Austria

Forwarder law was codified for Germany as a nation-state with the German Commercial Code (HGB) of 1897 (DRGBl 219) and for Austria with the Austrian

[5]Cf. Vadnai (1921, p. 30a–31), Securius and Böning (1941, pp. 10–11), Palmhofer (1944, p. 9), Ullmann (1950, p. 19–23), Hald (1951, pp. 12–13) or Matthäi (1979, p. 6). According to Goerres (1909, p. 10) or Vadnai (1921, p. 31), the "Stapelrecht" can be regarded as a privilege of commercial trade and the "Umschlagsrecht" as a privilege of cargo movement.

[6]Cf. Goerres (1909, pp. 11–13), Vadnai (1921, p. 31a–32), Palmhofer (1944, pp. 9–10), Ullmann (1950, p. 23–24), Matthäi (1979, pp. 6–7), Seiler (1981, pp. 34–35) or Jaeger and Laudel (2003, p. 70).

[7]Cf. Vadnai (1921, p. 31a–33a), Palmhofer (1944, pp. 89–92), D'Amato and D'Amato (1977), Seiler (1981, pp. 34–35) or Gass (1991, pp. 16–17).

[8]Cf. Goerres (1909, pp. 21–49), Vadnai (1921, p. 34), Ullmann (1950, pp. 28–49) and Wolters (1973, p. 27–28).

Commercial Code (UGB) already established in 1862.[9] As one of many causes of the occupation of Austria by the German Reich in 1938, the content of the original UGB of 1862 was fully synchronized with the HGB with DRGBl 1938 I 1428 (GBlÖ 1938/520) and DRGBl 1938 I 1999 (GBlÖ 1939/86). After the end of the German Reich in 1945, the original UGB of 1862 was never set into force again so that today, the actual UGB parallels the actual HGB in many ways.[10]

Now, in the fourth book of the HGB as well as the fourth book of the UGB, the legal statuses of:

- Forwarding (§§ 453–466 HGB and §§ 407–415 UGB)
- Transportation (§§ 407–452d HGB and §§ 425–452 UGB)
- Warehousing (§§ 467–475h HGB and §§ 416–424 UGB)
- Commissioning (§§ 383–406 HGB and §§ 383–406 UGB)

as special forms of commercial business are explicitly addressed.[11] In Austria, the term "Spediteur" used for freight forwarder is explicitly defined by law in § 407 UGB:[12]

"§ 407

(1) A freight forwarder is someone who undertakes by profession arrangements for dispatching goods shipments through [inland] carriers or carriers of seagoing vessels on account of a third person (the consignor) in his name.
(2) If this section contains no provisions for the rights and duties of a freight forwarder, provisions applicable to a commission agent, especially the provisions in §§ 388 to 390 [UGB] about reception storekeeping, and insurance of goods have to be applied."

Or, in other words, a freight forwarder is in first instance (1) a professional, who (2) dispatches goods for transport in his name and (3) signs contracts of

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[9]Stamm (1908, pp. 3–4), Goerres (1909, pp. 17–18), Palmhofer (1944, pp. 93–94), Ullmann (1950, pp. 31–32) or Gass (1999, pp. 17–20) trace German forwarding law back to the first general German commercial code called "Allgemeines Deutsches Handelsgesetzbuch" (ADHGB) of 1861 and remarked that the provisions there about freight forwarding were not altered when the HGB was set into force in 1897. But lacking political unity until the establishment of the German Reich in 1871, the ADHGB was adopted only by a fraction of all states in the German Union of that time so that it cannot be considered to be a proper commercial law concerning the whole German territory. For ease of exposition, in the following, the abbreviations HGB ("Deutsches Handelsgesetzbuch") standing for German Commercial Code and UGB ("Österreichisches Handelsgesetzbuch"), recently renamed in "Unternehmensgesetzbuch" with "Handelsrecht-Änderungsgesetz" (BGBl. I No. 120/2005) standing for Austrian Commercial Code are used.

[10]Cf. Kirchner (1950, p. 5), Hausmaninger (2000, p. 233) or Straube (2003, pp. 1280–1281).

[11]For a more detailed discussion of the actual UGB see Straube (2003, pp. 1280–1574) or Krejci (2005, p. 368–419) with further references. In addition to this, the fifth book of HGB as well as the fifth book of UGB, contains provisions of national sea trade law in §§ 474–905 UGB, §§ 476–905 HGB and supplement to § 664 HGB.

[12]Translation by the author.

affreightment with carriers by land or sea.[13] In addition to this, he may act as a commission agent on behalf of a consignor and/or does other ancillary tasks closely connected to the carriage of goods like temporary storage or insurance provision.

With the German Transport Law Reform Act of 1998 (DBGBl.1998 I 1588, revised with DBGBl.1999 I 42), the fourth book of the HGB as well as other sources of German transport law were subject to a fundamental revision.[14] Doing this, the former legal definition of a freight forwarder identical to the actual § 407 UGB was abandoned in favour of a more elaborate listing of obligations and duties constituting a freight forwarding contract in §§ 453–454 HGB:[15]

"§ 453: Forwarding contract

(1) By virtue of the forwarding contract the forwarder is obliged to arrange for the dispatch of the goods.
(2) The sender is obliged to pay the agreed remuneration.
(3) The provisions of this chapter only apply if dispatching goods is part of the operation of a commercial enterprise. [...]
§ 454: Arranging for the dispatch of the goods
(1) The duty to arrange for the dispatch of the goods includes organization of the carriage, in particular (a) determination of the means and route of transport, (b) choice of performing enterprises, conclusion of carriage, warehousing and forwarding contracts required for the dispatch, as well as providing information and giving instructions to the performing enterprises, and (c) securing the sender's claims for compensation.
(2) The duties of the forwarder also include the provision of other agreed services relating to carriage such as insuring and packaging the goods, labelling them and clearing them through customs. However, it is only if the agreement calls for it that the forwarder shall be obliged to arrange for the conclusion of contracts for these services.
(3) The forwarder concludes the required contracts in his own name or, if he is authorized to do so, in the name of the sender.
(4) In fulfilling his obligations the forwarder shall act in the interest of the sender and carry out his instructions."

Comparing this actual legal status of forwarding business in Germany with the § 407 UGB, the actual §§ 453–454 HGB places organization of a carriage of goods in the foreground followed by an explicit description, whereas obligatory main tasks as well as ancillary tasks have to be executed upon request. Doing this, the freight forwarder acts normally in his name on behalf and account of a consignor, like a commission agent.

In addition to this "core business" of freight forwarding, a freight forwarder is, according to § 458 HGB or § 412 UGB, allowed to act as carrier "im Selbsteintritt"

[13] Carriers by air are not explicitly mentioned here, because at the time of initial codification in the nineteenth century, no-one could think of transportation by air at all. But nowadays, § 407 UGB is regarded to be applicable for national air transport operations, too.

[14] A full description of the actual provision in the HGB after 1998 are beyond the scope of this work. See Herber (1998), De la Motte (1998a), Gass (1999), Schauer (2001), Müglich (2002), Jaeger and Laudel (2003), Wieske (2003, pp. 39–65) or Lorenz (2005, pp. 85–148) for an overview and some commentary notes on the actual §§ 407–475h HGB.

[15] Translation by Deutsche Gesellschaft für Transportrecht e.V., see http://www.transportrecht.org/hgb_4_synopse.html.

that means performing carriage of goods by own means and on own account with the rights and duties of a carrier as codified in §§ 453–466 HGB and §§ 407–415 UGB, too. Furthermore, § 459 HGB and § 413(1) UGB allows forwarding at fixed costs. Doing this, the freight forwarder has, as far as the carriage is concerned, again the rights and duties of a carrier by land or sea. Last but not least, a freight forwarder is entitled by § 460 HGB and § 413(2) UGB to arrange a dispatch of goods from several consignors on the basis of a contract for a collective consignment concluded on his account called groupage service.[16] Again, as far as the carriage as a collective consignment is concerned, he has then the rights and duties of a carrier by land or sea. These provisions in §§ 458–460 HGB and §§ 412–413 UGB give freight forwarders permission to provide cargo consolidation and transport services on own account. Further important aspects in forwarder law are provisions for subsequent forwarding contracts which are codified in § 465 HGB as well as § 411(1) UGB. There, the consequences of a procurement of tasks out of a freight forwarder's forwarding contract with a consignor to another freight forwarder are regulated.[17]

Another important legal source in forwarding business are General Terms and Conditions (GT&Cs) issued by freight forwarding associations, sometimes together with other federations representing shippers.[18] In first instance, they want to clarify rights and duties of freight forwarders and consignors as well as to give more elaborate provisions for everyday forwarding business, especially concerning ancillary services like customs brokerage or third-party logistics not explicitly addressed by law. Furthermore, they usually reduce the maximum liability raised by law and sometimes establish a special system of forwarding insurance. Normally, these GT&Cs are considered as trade customs, at least after some notification.[19]

A well-known and widely accepted GT&C in the German forwarding business are the "Allgemeine Deutsche Spediteursbedingungen" (ADSp). They were first formulated in 1927 by a mixed consortia with forwarding as well as shippers' associations and underwent several revisions with the actual version called ADSp 2003 effective as of 01/01/2003.[20] They are applicable to

> "[...] all contracts for the transportation of goods, irrespective of whether they concern freight forwarding, carriage, warehousing or other services common to the forwarding trade;

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[16]According to Nickenig (1996, p. 92), the first groupage service dates back to 1877, where German railway companies introduced the "Reformtarif" with a differential tariff structure divided in express, part loads and wagon loads which allowed freight forwarders to consolidate small shipments for wagon loads.

[17]See Krejci (2005, pp. 378–379) for more details.

[18]Cf. Mayer (1933, pp. 20–21), Ullmann (1950, pp. 64–66) or Gass (1991, p. 37).

[19]For further discussion, see e.g. Krejci (2005, pp. 369–370) for Austria and De la Motte (1998b) or Lorenz (2005, pp. 149–151) for Germany.

[20]See Valder (2002), Jaeger and Laudel (2003, pp. 73–95) or Lorenz (2005, pp. 149–175) for the ADSp 2003. Already in 1908, the Verein Deutscher Spediteure (VDS) passed the "Allgemeine Beförderungsbedingungen" (ABB), but these GT&C was in the following merely regarded as a non-obligatory recommendation by their member companies, see Esch (1923).

> these also include logistics services commonly provided by freight forwarders in connection with the carriage or storage of goods."[21]

Furthermore, the ADSp 2003 takes precedence in case of deviating trade customs or legal provisions and a freight forwarder is only responsible for arranging the necessary contracts required for the performance of these services, unless there are no other legal provisions mandatory.[22] Exceptions to this are "contracts that deal exclusively with packaging, the carriage of removal goods and their storage, crane lifting, assembly jobs or heavy lift and high volume transports, except for normal transhipment services of the freight forwarder, the carriage and storage of goods to be towed or salvaged"[23] and contracts with private consumers[24], because provisions for this kind of services are given either by other GT&Cs or by HGB. The ADSp 2003 adds special provisions for e.g. transmission of instructions, customs clearance, packaging, marking, handling, warehousing or payment issues to the regulations of forwarding business in the HGB. Moreover, it lowers the liability of a freight forwarder in concordance of § 431 HGB and gives some new provisions about insurance issues discussed later on in the case of Austria.

In addition to the ADSp 2003, the "Vertragsbedingungen für den Güterkraftverkehrs- und Logistikunternehmer" (VBGL) are issued by the "Bundesverband Güterkraftverkehr, Logistik und Entsorgung" (BGL) with the latest version called VBGL 2003, effective as of 27/01/2003.[25] The VBGL 2003 contains virtually all provisions of the ADSp 2003 and adds additional provisions for the carriage of goods as well as some new ones for transport of disposal, carriage on basis of a charter party and other more or less uncommon logistics services for goods not covered by HGB.[26] To some extent, the VGBL 2003 can be considered to be a good alternative to the ADSp 2003, especially if a freight forwarder is more engaged in carriage of goods on own account and/or provides third-party logistics services.

In Austria, the "Allgemeinen Geschäftsbedingungen im Österreichischen Speditionsgewerbe" (AGBSp) were first issued in 1930[27], succeeded by the "Allgemeinen Österreichischen Spediteursbedingungen" (AÖSp) in 1947, with the actual version effective as of 01/01/2002.[28] Generally, the AÖSp take precedence over local and

[21] See Art. 2.1. ADSp 2003, translation by Verein Hamburger Spediteure e.V., see http://www.vhsp.de.

[22] Art. 2.2. and 2.5. ADSp 2003.

[23] Art. 2.3. ADSp 2003.

[24] Art. 2.4. ADSp 2003.

[25] See Schindler (1998, 2003) or Jaeger and Laudel (2003, pp. 108–114) for a brief overview and some comments.

[26] Strictly speaking, the VBGL 2003 deviates from the provisions in the ADSp 2003 in two ways: There is a uniform liability for all tasks done by a freight forwarder and the transport insurance is only covered after a written order.

[27] Cf. Mayer (1933, pp. 20–21) or Stern (1938, p. 54).

[28] In the mean time, the AGBSp were abandoned in favour of the ADSp in 1939, see Ullmann (1950, p. 119–123). From time to time, the AÖSp were subject to some minor revisions, the last

municipal trade customs and they are applicable to all activities performed by a freight forwarder in forwarding, carriage of goods, warehousing, commission or any other business related to.[29] Conversely, they are not applicable if a freight forwarder is acting solely as an agent of a carrier in accordance with special conditions, works as a carrier on basis of a surface transport contract of the Austrian Federal Railways or performs removal operations (including warehousing) on a national scale or from/to Austria, provided that the forwarding activities are done under § 407 UGB.[30] Furthermore, the AÖSp contains additional provisions to the legal framework of the non-compulsory UGB about orders, communication, inspection, packaging, warehousing, customs clearance and payment issues. But the most important topic is, that the AÖSp limits liability of a freight forwarder otherwise being unlimited under UGB and introduces an one-for-all risk insurance policy which covers all damage to goods and loss of property occurring under a forwarding contract or contract of carriage concluded with reference to the AÖSp. This kind of a combined forwarding and transport insurance is unique in forwarding business all over the world. In Germany before 2003, likely a similar one-for-all risk insurance policy system existed for a very long time. But with the German Transport Law Reform Act of 1998 giving the provision of the fourth book of HGB a status of compulsory law, this system of a combined forwarding and transport insurance was questioned more and more.[31] At last, it was abandoned after about 75 years in favour of an obligatory liability insurance for the freight forwarder and additional coverage through a cargo insurance upon request.

2.1.2 Comparisons with Legal Status of Forwarding Business in Other Countries

Looking at the legal status of forwarding business in other countries like Switzerland, France, Denmark, Norway, Sweden, Finland, United Kingdom and the United States considerable deviations from the provisions found in the HGB and UGB can be remarked.[32]

In Switzerland, the commercial code is called the "Obligationenrecht" (OG) established in 1911. In Art. 439 OG, the freight forwarder is legally defined as

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revision in 2002 was because of Austria joining the European Monetary Union. See Spera (2011, p. 76–81) for a brief overview.

[29] See § 2a) and 2c) AÖSp.

[30] See § 2b) AÖSp.

[31] Cf. Valder (2002), Wieske (2002), Häusser and Abele (2003), Heuer (2003) or Lorenz (2005, p. 176–192).

[32] For more international comparisons of forwarding law and/or definitions of freight forwarders in different countries see Matthäi (1979, pp. 28–38), Thaler (1990, pp. 92–96), Gass (1991, pp. 27–30, 67–72) or Jaeger and Laudel (2003, p. 71).

a special kind of commission agent and so subject to Art. 424–438 OG.[33] But concerning the carriage of goods, provisions for carriers in Art. 440–447 OG with a full liability system are applied to him. Therefore, local swiss freight forwarder associations joined together and issued the "Allgemeinen Bedingungen des Schweizerischen Spediteurs-Verbandes" (AB-SSV) in 1922 (actual version as of 01/07/2005 under the title of AB SPEDLOGSWISS) in order to reduce their liability.[34]

Under the French "Code de Commerce" (CdC) of 1808, a forwarder can either act as a commission agent of the consignor for ancillary services to the carriage of goods called "transitaire," or like a contracting carrier called 'commissionaire de transport' as legally defined in Art. L 132–1 to 132–3 CdC.[35] Furthermore, the "Fédération des Entreprises de Transport et Logistique de France" (TLF) issued a model GT&C for both forms of operations called "Conditions générales de ventes TLF" with the latest version as of 01/10/2001 which also limits liability of all kind of forwarders to actual fault.[36] According to Gass (1991, pp. 48–49), a French forwarding company has to decide in advance which field of activity it wants to serve due to a restrictive licensing system.

In the four Scandinavian countries Denmark, Norway, Sweden and Finland, up to now there does not exist any codified law concerning forwarding business. But already in 1919, a first version of the General Conditions of the Nordic Association of Freight Forwarders ("Nordisk Speditørforbunds Alminnelige Bestemmelser" (NSAB)) was issued by the "Nordiskt Speditör Förbund" (NSF), the latest version is NASB 2000 effective as of 01/06/1998.[37] In this GT&C, a distinction is drawn between a freight forwarder acting on own account called "Speditör" or as a commission agent on behalf of a consignor called "Ekspeditör." Following § 1 NASB 2000, a freight forwarder has a liability like a carrier if he performs the carriage of goods by own means or he has expressly or impliedly accepted liability of a carrier like issuing a transport document in his name or quoting own prices for transport.

[33] See Vadnai (1921, p. 6), Kirchner (1950, p. 6), Tschudi (1975, p. 41) or Seiler (1981, pp. 21–22). Further, Guhl et al. (2000, pp. 588–603) or Foglar (2009) for a brief overview of legal provisions in the actual OR regarding commission agents, carriers and freight forwarders.

[34] Cf. Tschudi (1975, pp. 34–36), Seiler (1981, pp. 27–30), Foglar (2009) or http://www.spedlogswiss.ch.

[35] Cf. Ullmann (1950, pp. 30–31), Matthäi (1979, p. 36), Chevalier (1989), Thaler (1990, p. 94), Tetley (1992), Müller-Feldhammer (1996, pp. 105–116), Ramberg (1998) or Victor-Granzer (2005).

[36] Notably, as a commission agent, the forwarder is only liable for actual fault, but as a contracting carrier, his liability is extended to actual and third party fault in case of loss, damage or late delivery of cargo, see L 132–4 to 132–6 CdC.

[37] See Gass (1991, p. 70), Wegdell (1996, pp. 171–239) or http://nordicfreight.org/engsida/model.htm.

In the United Kingdom as well as in other case law countries, there exists no codified law for forwarding business, either.[38] Freight forwarders in the German and Austrian sense usually act under the Law of Agency mainly as forwarding agents on behalf of their consignors and/or carriers by land, sea or air and therefore they sign contracts of affreightment in the name of their principal, indicating this at least with the formulation "on behalf of our principals."[39] Running their business in this manner, they are called "forwarding agents" or "freight forwarders."[40] In addition to this, a freight forwarder in the United Kingdom can be regarded as a "forwarder as principal," if he actually performs the carriage of goods by own means.[41] Regarding GT&Cs, the British International Freight Association (BIFA) issued the "Standard Trading Conditions" (STCs) applicable to all kinds of forwarding business "as rules of the game."[42]

In the United States, foreign freight forwarders emerged first in the early nineteenth century mainly acting at sea ports as agents on behalf of shipowners and later on expanding their business to cargo consolidation for inland shippers.[43] After decades of a laissez-faire policy, first legal regulations about foreign freight forwarding business were included in the US-American maritime commercial law in 1942.[44] After 1950, all freight forwarding companies had to be registered and from 1961 to 1996 they were even subject to a licensing system, restricting them mainly to a despatching and/or cargo consolidation function in water-born trade.[45] Therefore, affreightment of carriers including despatch of goods for carriage on a national scale are normally done by "transportation brokers," "shippers" agents'

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[38] Cf. Gass (1991, pp. 62–65), Benson et al. (1994, pp. 305–307), Triebel et al. (1995, pp. 153–159) or Ramberg (1998).

[39] Cf. Gass (1991, p. 23) or Triebel et al. (1995, pp. 157–159).

[40] Cf. Matthäi (1979, pp. 37–38), Thaler (1990, pp. 93–94) or Triebel et al. (1995, p. 157).

[41] Matthäi (1979, p. 37) proposed to call a freight forwarder then "private carrier." According to Benson et al. (1994, pp. 305–306), a "private carrier" is in opposition to a "common carrier" with the first acting only on basis of private "Conditions of Carriage" between them and their customers and the second providing carriage of cargo on a regular basis with full liability only limited to a few exceptions like Act of God, Act of the Queen's enemies, inherent vice, fault or fraud of the consignor.

[42] BIFA (2000, p. 1). By the way, terms like "freight forwarder" or "forwarding agent" are never mentioned in this GT&C. Instead of this, the term "company" as a BIFA member trading under the STC is used.

[43] Cf. Barton and McGehee (1942), D'Amato and D'Amato (1977), Murr (1979, pp. 3–10), Rahman (1989, pp. 15–18), Dempsey (2000) or Kehagiaras (2004).

[44] C.f. Murr (1979, pp. 11–13, 23–55).

[45] See Barton and McGehee (1942), D'Amato and D'Amato (1977), Murr (1979, pp. 23–55), Brown (1984b), Crum (1985), Morash (1986, 1987), Hill (1988), Sherwood and Burns (1992), Johnson and Schneider (1995a), Wood et al. (1995, p. 116), Wood and Johnson (1996, pp. 264–267), Lambert and Stock (1999, pp. 180–185), Taylor and Jackson (2000) or Dempsey (2000). Further see the actual provisions in the "Code of Federal Regulations" (CoFR), especially 49 CoFR, Chap. 139, Sect. 13901–12908 about registration of motor carriers, water carriers, brokers and freight forwarders.

or "shipper associations." In the case of cross-border cargo movements, "ocean transportation intermediaries" (OTIs) or other forms of "non vessel operation common carriers" (NVOCCs) are usually employed for export shipments whereas "customs-house brokers" work on the import side.[46] But as subsequent surveys performed by Murphy et al. (1992) or Murphy and Daley (1995, 2000) showed, more and more international freight forwarders in the United States provide all these specialized services in a one-stop shopping manner.[47] The National Customs Brokers and Forwarders Association of the United States (NCBFAA) issued GT&Cs called "Terms and Conditions of Service," which seem to be a widely acknowledged industry standard contract practice employable by regular members of NCBFAA *vis-à-vis* their clients after some notification.[48]

Last, but not least, the International Federation of Forwarding Agents Associations ('Fédération Internationale des Associations de Transitaire et Assimilés' (FIATA)) adopted "FIATA Model Rules for Freight Forwarding Services" in 1996.[49] Again, basic provisions for everyday business as well as a limitation of forwarder's liability are given and two different concepts of forwarding business are defined. First, a freight forwarder can act as a "forwarder as agent" on behalf of his principal like the "Spediteur" in Germany or Austria, the "transitaire" in France, the "Ekspeditör" in the Scandinavian Countries and the "forwarding agent" or "freight forwarder" in the United Kingdom.[50] Second, he can act as a "forwarder as principal," procuring or even performing carriage of goods in his name and on own account with his rights, duties and liability being the same as a normal carrier by land, sea or air. If he performs the carriage of goods by own means, he is usually called a "performing carrier," otherwise he is regarded as a "contracting carrier," still assuming carrier liability despite another carrier is actually shipping the goods. Being a performing carrier, he is called "Spediteur im Selbsteintritt" in Germany and Austria, "Speditör" in the Scandinavian countries and "forwarder as principal" in the United Kingdom. Being a model rule, they can be regarded as a blue print for

[46] Cf. Thomchick et al. (2004, p. 44) or Passas and Jones (2007). Both are still subject to a strict licensing system according to 46 CoFR, Chap. 36, Sect. 1718 (ocean transportation intermediaries) and 19 CoFR, Chap. 4, Sect. 1641 (customs-house brokers). See Hill (1988), Sherwood and Burns (1992), Wood et al. (1995, pp. 115–116), Lambert and Stock (1999, pp. 205–207), Clott (2000), Thorby (2001a) or Kehagiaras (2004) for more information about US-based OTIs and NVOCCs.

[47] According to their survey from 2000, 81.0% of their responding international freight forwarders act as customs-house brokers and 57.0% as NVOCCs with half of the respondents doing both. Further, 64.7% of their revenues are from sea freight and 34.4% from air freight operations.

[48] See e.g. http://www.cargolaw.com/guides_usingterms.html.

[49] See Ramberg (1998, 2000) with further comments.

[50] This holds likely in the same manner for customs brokerage services, where a freight forwarder acts as an agent, when he clears goods at customs house on behalf of his principal on his account. Doing this special service, he is named e.g. "Zollspediteur" or "Grenzspediteur" in Germany and Austria, "transitaire agrée en douance" or "commissionaire agrée en douance" in France, "clearance forwarder" in the United Kingdom and "customs-house broker" in the United States, see Gass (1991, p. 59a-67).

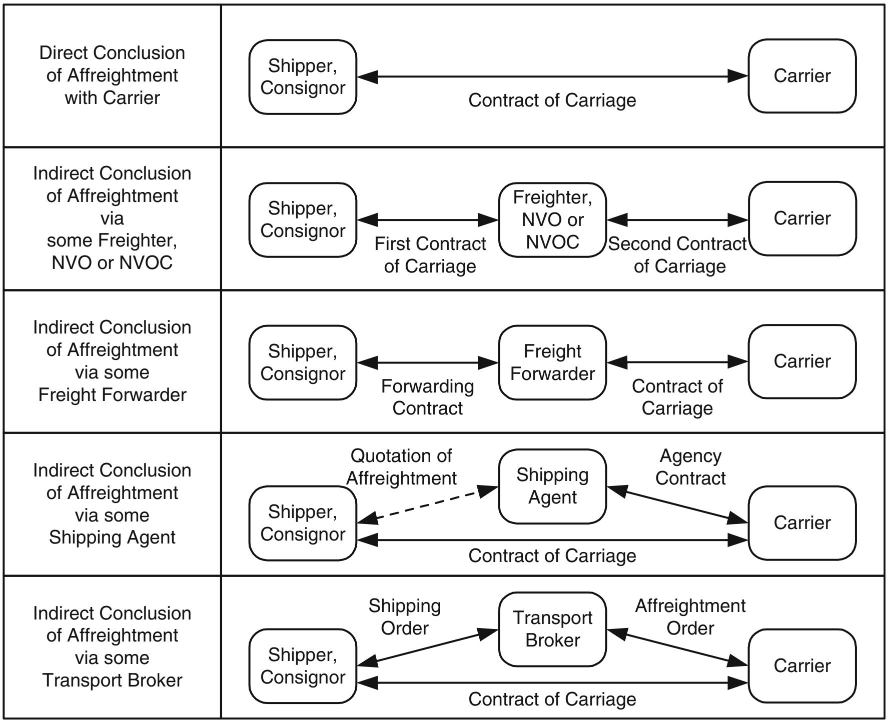

Fig. 2.1 Contract forms of affreightment

GT&Cs for freight forwarding associations as well as individual forwarders all over the world.

In order to clarify these different concepts of forwarding business, it is worth to have a closer look at different contract forms of affreightment as shown in Fig. 2.1. The first and foremost simple form of affreightment is a contract of carriage directly concluded between a shipper and his carrier, including the case of a freight forwarder acting as a "performing carrier." The other four forms can be subsumed under the label "indirect conclusions of affreightment," because there is always some third-party involved. In case of a carrier holding a contract of affreightment with a shipper but acting as a "contracting carrier," he procures the actual carriage of goods to another carrier, called the "performing carrier." Doing this, he is usually called "freighter," "non-vessel operator" (NVO) or "non-vessel owning carrier" (NVOC) bearing full liability concerning the carriage of goods.[51] If a freight forwarder is enacted by a shipper to dispatch goods for carriage on basis

[51] See Klippel (2000) or Branch (2000, pp. 94–95). In the United States, NVOs are usually called NVOCCs or OTIs which are terms originating from the US-American maritime commercial law, see Sect. 2.1.2.

of a forwarding contract, he concludes affreightment with the carrier for carriage of goods on behalf of his principal as a beneficiary person.[52] Next form of indirect conclusion occurs, if the third-party acts as an agent for the carrier based on an agency contract.[53] Then, he is usually called "shipping agent" giving quotation to the consignor and concluding contracts of affreightment in the name of his principal on a regular basis, with the carrier paying him for his work.[54] Last but not least, a "transport broker" is an independent third-party matching shippers and carriers in his name and on own account.[55] He gets a payment called "commission" or "courtage," if a contract of affreightment is concluded.

Looking on the legal status of forwarding business and comparing it with these contract forms of affreightment, it is quite obvious, that the last two contract forms of affreightment described above are usually not concluded by a freight forwarder. As it will be shown later on in Sect. 2.2.4, these shipping agents and transport brokers are specialized intermediaries often employed in sea and/or air transport cargo operations standing between the freight forwarder or his consignor and a carrier.

2.1.3 Freight Forwarders from a Functional Point of View

A freight forwarder is always considered as "The Architect of Transport."[56] In order to do a right job, he seems to have some specialized knowledge or means to organize

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[52]Cf. Mittendorf and Oelfke (1974, pp. 24–25).

[53]Cf. Mittendorf and Oelfke (1974, pp. 232–234), Trappe (1995), Puttfarken (1997, pp. 248–250) or Herber (1999, pp. 168–171).

[54]In Germany and Austria, a shipping agent is legally defined as an agent according to §§ 84–92 HGB or the Austrian "Handelsvertretergesetz" (HVertG) of 1993. In common law countries, agents are acting on basis of the Law of Agency, but with (86/653/EEC), the United Kingdom and Ireland have to enact now a uniform law of agency on the national level, see Triebel et al. (1995, pp. 166–178). Conversely, the third party might also be an agent acting on behalf of a shipper or consignor based on an agency contract. But this seems actually to be a very rare practice, only Spera (2011, pp. 81–82) referred to such a "Transportagent" in the case of Austria and Brown (1984b), Morash (1986) or Johnson and Schneider (1995b) described "shippers agents" or "shipping associations" as intermediaries working for shippers in railway piggybacking as well as other transport operations in the United States on a national scale.

[55]Cf. Svendsen (1958, pp. 298–306), Mittendorf and Oelfke (1974, pp. 228–232), Puttfarken (1997, p. 248), Branch (1998, p. 212–217) or Herber (1999, pp. 169–171). Other terms are "loading broker," "discharging broker" or "air freight broker." Legal provisions for this business of brokerage are §§ 93–104 HGB for Germany and the "Maklergesetz" (MaklerG) of 1996 in the case of Austria. According to Triebel et al. (1995, pp. 179–180) or Trappe (1995, p. 321), it is worth to remark, that in common law countries, a "broker" is not the same as a "Makler" defined by German or Austrian law. But in the context of this work, such a distinction is not drawn so that in the following, the term "broker" is used to describe a "Makler" in the German or Austrian sense.

[56]Cf. FIATA (1975, p. 4), Schumacher (1987a, p. 131), Thaler (1990, pp. 83–84), Danzas Lotse (2002, p. 146), Lorenz (2005, p. 57) or Dischinger et al. (2005, p. 23).

carriage of goods by land, waterways (including sea transport and inland navigation) and air supporting national as well as cross-border cargo movements. In addition to this, he provides merely ancillary services like warehousing, handling, packaging and transportation of goods. According to a brochure of the FIATA in 1975, a freight forwarder principally:[57]

1. Gives advice to customers on the quickest and most economical means of transportation (consultancy function).
2. Gives advice to customers on packing problems (packaging function).
3. Cares for customs clearance (clearance function).
4. Secures compliance with foreign trade regulations and Letter of Credit instructions (documentary function).
5. Makes choice of the most suitable carrier and the conclusion of the contract of carriage (affreightment function).
6. Provides groupage service as a particular contribution to economy (consolidation function).
7. Gives insurance coverage during transportation (insurance function).
8. Gives advice to customers on warehousing and distribution (logistics function).
9. Provides carriers' as well as forwarders' documents (fiduciary function).
10. Provides supervision of the movements of goods (supervision function).

Reviewing authors defining freight forwarder functions like Metzger (1922, pp. 89–99), Schlichting (1931, pp. 11–58), Mayer (1933, pp. 12–14), Stern (1938, pp. 28–35), Ohling (1950, pp. 216–218), Rosenthal (1950, pp. 116–121), Ullmann (1950, pp. 71–107), Kirchner (1950, pp. 11–45), Smith (1974, p. 178–179), Mittendorf and Oelfke (1974, pp. 25–29), D'Amato and D'Amato (1977), Murr (1979, pp. 20–21, 293–297), Seiler (1981, pp. 40–49), Matthäi (1985, pp. 24–26), Dehn (1987, pp. 22–23), Schumacher (1987a, p. 131–139), Thaler (1990, pp. 87–88), Sherwood and Burns (1992), Murphy and Daley (1995), Johnson and Wood (1996, p. 410–412), Branch (2000, pp. 417–418), Lucke et al. (2001, pp. 265–267), Pfohl (2003, p. 285–286), Lorenz (2005, pp. 61–63, 492–494) and Dischinger et al. (2005, pp. 23–24) two typical functions can be added, where a freight forwarder

11. Credits freights, fees, and duties payable at once and bills it later on or collects and submits money on behalf of the consignor (quasi-banking function) or
12. Acts as a carrier on own account (transport function).

In the following, these twelve functions of a freight forwarder as found in the literature are briefly commentated one after another before 25 freight forwarder definitions from the above mentioned authors are compared:

Having usually a direct contact to shippers, a freight forwarder serves first a *consultancy function* (1) in quoting freight rates, making routing recommendations and advising in export and/or import regulations as well as helping in choosing appropriate terms of sales and/or payment.

[57] Cf. FIATA (1975), the words in brackets are added by the author.

The *packaging function* (2) of a freight forwarder mainly consists of securing proper export packing and marking of shipment as well as organizing, stuffing and stripping of containers. Sometimes, neutralising, relabeling and/or repacking of shipments are needed, if e.g. a consignor wants to disguise their origin. All these packaging functions are either organized by the freight forwarder or even conducted by him on own account.

In case of cross-border shipments, the *clearance function* (3) of a freight forwarder acting as an agent for a consignor or consignee is very important to speed up cargo movements at frontiers. Despite the fact that in the member states of the European Union today almost everyone is allowed to deal with customs authorities, a freight forwarder is usually regarded to have more expertise than normal shippers. Therefore, he is often asked for dealing with customs like submitting export declarations at the country of departure, opening and closing transit procedures and/or performing import procedures in connection with customs clearance at the country of destination on behalf of a consignor or consignee.[58] In other countries like the United States, the clearance function is mainly served by special intermediaries called "customs broker" or "customs-house broker" due to strict licensing requirements.[59]

The *documentary function* (4) comes along with preparing and processing documentary paperwork for a shipment in concordance with customs and consular requirements or concerning terms of sales and payment as described in an underlying contract closed between consignor and consignee. Prominent examples of this kind of paperwork are export licenses or embargo permits needed for export procedures at the country of departure and import licenses, delivery permits, commercial invoices, consular invoices, inspections certificates, certificates or declarations of origin needed for import procedures at the country of destination.[60] Furthermore, a freight forwarder can issue own documents like movement certificates or a Forwarding Agent Certificate of Receipt (FCR).

The *affreightment function* (5) seems to be the most important one of a freight forwarder. It includes usually booking cargo space or chartering vessels as well as despatching of shipments, including arrangements for inland transportation and handling operations at place of departure, at transhipment points and/or place of destination on behalf and account of a consignor.[61] The handling of cargo includes

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[58]Following DSLV (2005, p. 2), freight forwarding companies in Germany are heavily engaged in customs brokerage, covering 70% of all import and 90% of all export movements. Furthermore, 75% of all EU transit procedures are issued by them, too. See Kummer et al. (2010, pp. 204–226) for a brief overview of German and Austrian external trade law, the European Customs Code and export, import and customs procedures therein regulated in the case of Germany and Austria.

[59]See Murr (1979, pp. 261–266) or the provisions in 19 CoFR, Chap. 4, Sect. 1641 for the customs brokerage licensing system in the United States.

[60]See Kummer et al. (2010, pp. 193–200) for a brief description of the paperwork needed for cross-border shipments and further references.

[61]Of course, arrangement of loading of cargo at the point of departure and unloading it at the point of destination by a freight forwarder is usually restricted to some industrial high-and-heavy goods

loading, unloading, reloading and temporary storage of goods, if needed. A freight forwarder can do these handling operations either by own means (serving a logistics function) or procure it to some specialized handling company. In addition to this, some freight forwarders act as shipping agents for carriers or loading brokers.

As a *consolidation function* (6), the freight forwarder arranges consolidation of cargo in order to lower freight expenses as well as to save money spent on documentary issues by sending shipments in groupage service or collecting smaller shipments for one consignee to consolidate them at the point of departure and sending them in one shipment. At the point of destination, a freight forwarder in groupage service breaks bulk consolidated cargo and distributes shipments to their consignors.

In concluding a forwarding contract, there is always some forwarding or liability insurance coverage provided up to a certain limit, which is called the *insurance function* (7) of a freight forwarder. To cover additional interest on a shipment in transit, a cargo insurance can be easily arranged by him upon request. Usually, he holds some open insurance policy contract with a cargo insurance company which allows him to conclude insurance contracts at reasonable premiums and issue certificates on behalf of the insurer.

In FIATA (1975), the *logistics function* (8) of a freight forwarder was argued only to be consultant in warehousing and distribution matters. But considering the ongoing development in the field of third- and fourth-party logistics today, freight forwarding companies serve a more active role: loading, unloading, reloading and temporary storage of cargo as well as warehousing for a longer time period are logistics services directly conducted by them.[62] Sometimes, a freight forwarder offers more complex ones like running consignment stocks or bonded warehouses at his premises. In connection with these handling and warehousing operations, a freight forwarder often performs additional services, like quality inspections, sample drawing, cleaning, drying, pest control of goods and even assembly of products on behalf of his customer.[63] Therefore, the logistics function of a freight forwarder is expanded to both consultancy with or without actual service provision.[64]

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or removal operations, where a consignor or consignee is not able to load or unload shipments by own means.

[62]See Sect. 3.3.4 for a more detailed treatment.

[63]Cf. Pfohl (2003, pp. 285–287).

[64]This is in line with FIATA (2004) where freight forwarding and logistic services together were defined as "[...] services of any kind relating to the carriage (performed by single mode or multimodal transport means), consolidation, storage, handling, packing or distribution of the Goods as well as ancillary and advisory services in connection therewith, including but not limited to customs and fiscal matters, declaring the Goods for official purposes, procuring insurance of the Goods and collecting or procuring payment or documents relating to the Goods. Freight Forwarding Services also include logistical services with modern information and communication technology in connection with the carriage, handling or storage of the Goods, and de facto total supply chain management. These services can be tailored to meet the flexible application of the services provided."

The *fiduciary function* (9) of a freight forwarder is closely connected with the dispatch or delivery of goods to a beneficiary person. Concerning the dispatch of goods, Bills of Lading (B/Ls) or other documents of title issued by carriers are compiled, verified and submitted to banks for Letter of Credit (L/C) or Documentary Collection (D/C) transactions. In the same way, freight forwarders can issue own documents of title like the "FIATA Forwarders Certificate of Transport" (FCT), or the "FIATA Multimodal Transport Bill of Lading" (FBL).[65] On delivery or in connection with warehousing, a freight forwarder releases goods subject to such transactions upon request and submission of documents of title to the beneficiary.

Under the *supervision function* (10) several operations of a freight forwarder can be subsumed, including tracking and tracing of shipments and documents, arranging inspection of cargo if needed or notification of arrival if special arrangements have to be made in the country of destination. Furthermore, a freight forwarder is obliged to inform his customer as soon as possible in case of irregularities occurring due to loss, damage or late delivery of cargo. In addition to this, cargo claims and freight rate billings usually have to be filed on behalf of a consignor.

Often forgotten is the *quasi-banking function* (11) of a freight forwarder. In first instance, he pays freight as well as handling charges and ancillary fees e.g. for documents prepared on behalf of a consignor as well as credits the Value Added Tax (VAT) or other duties payable at once to customs house in order to speed up processes.[66] Moreover, in Cash on Delivery (COD) transactions he collects and submits money for freight costs and/or goods payment from the consignor when he is authorized by the consignor.

The *transport function* (12) is mainly served in inland road transportation, when a freight forwarder acts on own account as a performing carrier or provides cartage services for pre- and onward-carriage of shipments e.g. for railway companies.[67] In other transport modes, freight forwarders transporting goods by own means are very rare, so that booking cargo space or chartering whole transport units from carriers on own account for resale as a contracting carrier is a more common feature.

Of course, this list of freight forwarders' functions is by far not complete, other functions not belonging to the core of freight forwarding business may be buying and selling goods as a commercial agent, providing other banking services like providing loans, del credere or factoring, acting as travel agencies or car rental companies only to name a few.[68]

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[65] See Jaeger and Laudel (2003, pp. 245–251), Wieske (2003, pp. 123–26), Lorenz (2005, pp. 70–73), Kummer et al. (2010, pp. 322–323), Spera (2011, pp. 83–97) or http://www.vhsp\penalty\z@.spediteure.de/fiata.htm for a brief description of these FIATA forwarder documents of title.

[66] Cf. Vadnai (1921, pp. 59–60), Eller (1996) or Lorenz (2004, pp. 308–315).

[67] In former times, cartage services for railway companies were at the core of business for many freight forwarders. But today, they play a diminishing role, because of more and more railway companies like the Deutsche Bahn AG gave up the provision of rail-based groupage services.

[68] Cf. Vadnai (1921, pp. 59–63), Schlichting (1931, pp. 56–58), Mayer (1933, p. 13), Ullmann (1950, pp. 106–107), Tschudi (1975, pp. 13–15) or Seiler (1981, p. 85).

Table 2.1 Forwarder functions

Authors	Forwarder functions as described by FIATA (1975)										Functions added	
	1	2	3	4	5	6	7	8	9	10	11	12
Metzger (1922:89–99)	C	–	C	C	C	–	A	–	C	–	A	A
Schlichting (1931:11–58)	A	A	C	C	C	C	C	C	A	A	C	C
Mayer (1933:12–14)	C	C	A	A	C	C	A	C	A	–	A	A
Stem (1938:28–35)	X	X	X	–	X	X	X	X	X	–	X	X
Ohling (1950:216–218)	X	–	X	X	X	–	X	–	X	X	X	–
Rosenthal (1950:116–121)	–	–	X	X	X	X	X	–	X	X	X	–
Ullmann (1950:71–107)	C	C	A	A	C	C	A	A	C	A	C	–
Kirchner (1950:11–45)	C	–	A	A	C	C	A	A	A	–	A	A
Smith (1974:178–179)	C	A	C	C	C	A	A	A	–	–	A	A
Mittendorf & Oelfke (1974:25–29)	A	A	A	A	C	C	A	C	A	A	A	C
D’Amato and D’Amato (1977)	X	X	X	X	X	X	X	–	X	X	X	–
Murr (1979:20–21, 293–297)	X	X	X	X	X	X	X	–	–	X	X	–
Seiler (1981:40–86)	C	C	A	C	C	C	A	C	C	C	A	A
Matthäi (1985:24–26)	–	A	A	A	C	A	A	C	C	C	–	A
Dehn (1987:22–23)	A	A	A	A	C	C	A	–	–	–	A	–
Schumacher (1987a:131–139)	C	C	C	C	C	A	A	C	C	C	A	A
Thaler (1990:87–88)	C	A	A	A	C	A	A	A	C	C	A	A
Sherwood and Burns (1992)	X	–	–	X	X	–	X	–	X	X	–	–
Murphy and Daley (1995)	X	X	X	X	X	X	X	X	X	X	X	–
Johnson and Wood (1996:410–412)	X	–	X	X	X	X	X	–	X	X	–	–
Branch (2000:417–418)	X	X	X	X	X	X	X	X	–	X	X	–
Lucke et al. (2001:265–267)	X	X	X	X	X	X	X	X	X	X	X	X
Pfohl (2003:285–286)	C	A	A	C	C	A	A	A	C	A	A	–
Lorenz (2005:61–63, 492–494)	X	X	X	X	X	X	X	X	X	X	X	X
Dischinger et al. (2005:23–24)	X	X	X	X	X	X	X	X	X	X	X	X

For purpose of comparison, these twelve forwarder functions as described above are compiled in Table 2.1. Some of the authors distinguished between core functions of a freight forwarder (denoted by ‘C’) and ancillary services provided (denoted by ‘A’), whereas other authors made no distinction (denoted by ‘X’) or did not mention some functions at all (denoted by ‘-’). According to these 25 authors, who explicitly define functions of a freight forwarder, dispatching of cargo (5) seems to be the foremost prominent core function, followed by consultancy in transportation matters (1), consolidation of cargo for groupage services (6) and serving a fiduciary function (9). According to ancillary functions of a freight forwarder, providing insurance coverage (7), acting as a performing or contracting carrier (12) and caring for customs clearance (3) are most mentioned. Astonishingly, over the whole time frame of over 80 years of freight forwarding business being observed, definitions of basic freight forwarder functions did not seem to be altered, with the authors from the 1920s to the 1950s laying only more stress on knowledge of trade usances and tariff issues and less on the topic of logistics as it is done today.[69] Notably, most Anglo-Saxon authors taken into account did not think of a freight forwarder to serve a transport function (12) at all, whereas most of the authors from German-speaking countries indicate this function at least to be ancillary. Reason for this is a different legal status of forwarding business in most Anglo-Saxon countries restricting freight forwarders to organize cargo movements but not to perform transport operations on own account as already shown in Sect. 2.1.1.

2.1.4 Fields of Activity and Specialization in Forwarding Business

Fields of activity of forwarding companies are subject to some specialization along several dimensions like:[70]

- Mode of transport predominantly employed.
- Type and scope of forwarding operations.
- Geographical scope of operations.
- Location of forwarding premises.
- Direction of cargo movements and/or
- Cargo type and/or shipper industry served.

Considering different modes of transport predominantly served, a freight forwarder is usually named “road haulage agent” in road transport, “railway agent” or “railway forwarder” in railway transport, “loading agent” or “shipping agent” in connection with inland navigation or sea transports and “air freight agent” or “air freight forwarder” in transports by air.[71]

Concerning the type and scope of operations, a freight forwarder can be engaged in single shipments of general cargo or bulky goods usually called “full-truck-load” (FTL) or “full-container-load” (FCL) as well as “less-than-truck-load” (LTL) or “less-than-container-load” (LCL) in groupage service as a “cargo consolidator.”[72] Furthermore, he can act as a non-vessel operator (NVO), organize intermodal

[69] At this time, the freight forwarding business as well as the rest of the transportation industry was subject to a strict regulatory tariff framework, see Ohling (1950, pp. 200–201), Ullmann (1950, pp. 75–85).

[70] Cf. Fischer et al. (1930, p. 281), Schlichting (1931, pp. 3–4), Mayer (1933, p. 26), Securius and Böning (1941, p. 13), Ullmann (1950, p. 73), Kirchner (1950, pp. 8–10), Hald (1951, pp. 15–16), Rössger (1960, pp. 48–50), Mittendorf and Oelfke (1974, p. 27), Seiler (1981, pp. 87–89), Matthäi (1985, pp. 27–6), Schumacher (1987a, p. 141), Chevalier (1989), Thaler (1990, pp. 130–143), Zöllner (1990, pp. 44–67), Diederich (2000), Lucke et al. (2001, p. 267) or Pfohl (2003, p. 288).

[71] Cf. Securius and Böning (1941, p. 12), Seiler (1981, p. 87), Matthäi (1985, p. 27), Chevalier (1989), Gass (1991, p. 64), Triebel et al. (1995, pp. 157–158), Lucke et al. (2001, p. 267), Jaeger and Laudel (2003, pp. 66–68) or Lorenz (2005, pp. 63–66).

[72] Cf. Mayer (1933, p. 26), Seiler (1981, p. 88) or Matthäi (1985, p. 27) or Lorenz (2005, p. 66–67).

transportation of goods as a “combined transport operator” (CTO) or door-to-door shipments as a “multimodal transport operator” (MTO).[73] In addition to this, he can carry out customs formalities for exporters and importers as a “customs broker” or “customs agent”[74] or provide additional logistics services on a long-term regular basis like warehousing as a “warehouse operator.”[75]

The location of a freight forwarder’s premises are usually closely connected with the mode of transport predominantely employed, because he has to be at the points of transhipment, like a “port agent” at seaports or an “airport agent” at airports.[76] Furthermore, he can be a “border agent” or “transit agent” at frontier crossing points.

If the direction of cargo movement is taken into account, a freight forwarder can be labelled as a “loading agent,” “export agent” or “FOB-agent” despatching outgoing shipments at the place or country of departure, a “receiving agent,” “landing agent,” “import agent” or “CIF-agent” despatching incoming shipments at the place or country of destination or being again a “transit agent” at transhipment points somewhere in between.[77]

Concerning the geographical scope of operations, freight forwarders can either act on a national or an international scale with the last labelled as “international freight forwarder” (IFF).[78] In addition to this, he can specialize himself on distinct transport routes, destination countries or regions like Eastern Europe, Middle East or Latin America where special expertise and/or equipment needed.

Some freight forwarders are focusing on special cargo types and/or shipper industries.[79] The most prominent example of such a specialization is the “removal agent” who basically cares for packaging, transportation and warehousing of household goods.[80] Usually, these forwarding companies extent their operations to distribution services for new furniture, white and brown goods[81] as well as transportation of object d’art, computers or other electronic devices and even high-and-heavy goods. Other specialization of freight forwarders are fairs and exhibition

[73]Cf. Matthäi (1991), Wolf (2000a,b) or Sect. 2.2.4.2.

[74]Cf. Chevalier (1989), Wood and Johnson (1996, p. 522).

[75]Cf. Lorenz (2005, p. 67).

[76]Cf. Schlichting (1931, p. 3), Securius and Böning (1941, p. 12), Matthäi (1985, p. 27), Chevalier (1989), Lucke et al. (2001, p. 267) or Lorenz (2005, p. 65).

[77]Cf. Schlichting (1931, pp. 3–4), Securius and Böning (1941, pp. 60–69), Mittendorf and Oelfke (1974, p. 241), Matthäi (1985, p. 27), Müglich (2002, pp. 6–7) or Jaeger and Laudel (2003, pp. 263–267). The abbreviations “FOB” and “CIF” are standing for the terms of sales “free-on-board” and “cost-insurance-freight” as defined in the “International Commercial Terms” (INCOTERMs) by the “International Chamber of Commerce” (ICC).

[78]Cf. Seiler (1981, pp. 88–89), Matthäi (1985, p. 27) or Lorenz (2005, pp. 63–65).

[79]Cf. Fischer et al. (1930, pp. 301–303), Mayer (1933, p. 26), Matthäi (1985, p. 27), Lucke et al. (2001, p. 267).

[80]Cf. Fischer et al. (1930, pp. 303–306), Mayer (1933, pp. 40–41), Charissé (2000) or Lorenz (2005, p. 67).

[81]The cargo segment of “white goods” consists of washing machines, stoves, teller machines or other kitchen appliances whereas “brown goods” are television sets or other multimedia devices.

services or project logistics, where they virtually perform all operations requested by their customer, including even mounting of appliances at the point of destination.[82] Furthermore, freight forwarding companies specialize themselves on special types of cargo like hazardous materials, food stuff, textiles and garments, mineral oils, coal, wood, cotton, valuables or live animals.

In the last decades, at least two new fields of activity not explicitly mentioned above added to the traditional forwarding business: an emerging segment of courier, express and parcel services and contract or third-party logistics.[83] The first grew from freight forwarder's traditional groupage service with a focus on small, standardized shipments.[84] The second seems to be a quite natural extension to existing transport, handling and warehousing operations of freight forwarders leading to contract or third-party logistics provision as a "third-party logistics provider" (3PL), a "fourth-party logistics provider" (4PL) or a "lead logistics provider" (LLP).[85]

In Table 2.2, some empirical evidence is shown about fields of activity and specialization of freight forwarding companies in Germany.[86] The majority of respondents to the last two surveys conducted regularly in a five years frequency by the former German Bundesverband Spedition und Lagerei (BSL) – now Deutscher Speditions- und Logistikverband (DSLV) – regard international freight forwarding and affreightment of hauliers in road transport as a main field of their activity, followed by outbound logistics, short distance road transport, inbound logistics services, customs brokerage, groupage service and long distance road transport on own account.[87] Furthermore, about two out of five lay their focus on affreightment of hauliers on road transport, one third on international freight forwarding, and about a

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[82] Cf. Obergfell and Senghas (2000).

[83] With the stepwise deregulation of postal markets, privatization and international expansion of some national post offices, this small shipment transport segment is now often named courier, express and postal services with parcel services being a part of the express services, see http://www.m-r-u.de.

[84] Cf. Schumacher (1987a) or Lorenz (2005, pp. 537–602).

[85] See Sect. 3.3.4.

[86] Similar studies were conducted by the Wirtschaftskammer Österreich, Fachverband der Spediteure, in 1993 and 1998 with the last survey reaching a very low response rate so not more than some figures were made officially. According to the first survey, WIFI (1993, p. 12), Austrian freight forwarders are mostly engaged in international freight forwarding (75%), followed by warehousing (55%), customs brokerage (53%), cartage service (49%), national freight forwarding (44%), long distance road transport by own means (37%), handling of hazardous materials (36%), combined transports (30%), air cargo forwarding (27%), removal agency and/or transport of new furniture (22%), parcel and express service (22%), groupage service (22%) and freight forwarding in inland navigation (8%). Apart from long distance road transport operations by own means, the fields of activity of them seem be quite similar in comparison to the German figures from 2000 and 2005.

[87] Both surveys can be regarded as representative for the German freight forwarding business as a whole as BSL (2000) reported a sample size of 3,300 member companies with a response rate of approximately 50% and DSLV (2005) a sample size of 2,900 with a response rate of approximately 33%.

Table 2.2 Forwarder fields of activity in Germany (Source: BSL (2000), DSLV (2005))

Forwarder fields of activity	Usually offered (% of total sample)		Focus laid on (% of total sample)	
	2000	2005	2000	2005
Groupage service	47	50	26	26
Parcel or express service	23	20	11	7
Long distance road transport on own account	47	47	26	26
Affreightment of Hauliers in road transport	66	73	28	40
Short distance road transport	56	53	24	24
Affreightment of Railway companies	16	13	5	4
International freight forwarding	68	69	33	34
Sea Cargo forwarding	34	38	18	21
Air Cargo forwarding	34	30	16	14
Forwarding in Inland navigation	10	10	4	3
Customs brokerage	47	51	17	19
Handling of Hazardous materials	40	28	10	10
Transportation of new furniture	8	7	3	3
Removal agency (including Warehousing)	10	9	5	5
Forwarding for objects and facilities	13	21	9	9
Warehousing for distribution	37	33	16	14
Warehousing for bulky goods	10	10	4	4
Warehousing for Hazardous materials	8	9	3	3
Inbound logistics services	47	52	21	25
Outbound logistics services	57	59	25	31
Reverse logistics services	9	11	3	4

quarter on groupage service, long distance road transport on own account and short distance road transport with in- and/or outbound logistics services getting more and more important. Remarkably, about one third of all respondents in 2005 agreed to be a forwarding company engaged in shipments by sea or air with 21% of them focusing on sea cargo and 14% on air cargo.[88] According to BSL (2000, p. 11) as well as DSLV (2005, p. 10), each respondent serves on average seven different fields of activity as shown in Table 2.2, with a third of small forwarding companies with less than ten employees serving not more than three and the majority of big forwarding companies with more than 100 employees serving at least nine fields of activity.

[88]Of course, some of these freight forwarders are engaged in both fields and some of the respondents mentioning international freight forwarding as a their focus may subsume haulage by road, sea and air under this term, so that the real amount of freight forwarders engaged in such field of international operations seems to be rather underestimated as e.g. Dehn (1987, pp. 17–20) concluded. The same might be true in the case of Austrian freight forwarders, where 75% of them are engaged in international freight forwarding and 27% in air cargo forwarding with sea cargo operations not asked for, see WIFI (1993, p. 12).

2.2 Freight Forwarding in Multimodal Transport Chains

After describing the freight forwarder business in general, now the focus is set on freight forwarding operations in multimodal transport chains. After some introductory notes and basic definitions, two fields of multimodal transport – the general cargo segment in ocean shipping and the cargo segment of the airline industry – are thoroughly outlined along functional aspects, institutional environment, technological developments, and market structure. Then inter-organizational relationships in transport or logistic chains and cargo movements at sea- and airports are mapped in order to clarify, where the freight forwarder's business is located there.

2.2.1 Introductory Notes and Basic Definitions

Looking at transport as well as logistics related literature, a cacophony with ever new definitions and redefinitions of already existing terms can be found. In current research literature, often well defined terms like "logistical channel," "transport chain," "logistic chain" or "supply chain" occur, standing for different point of views on transport and logistics processes.

The first term originates in the US-American marketing channel literature, where a "logistical channel" (sometimes also called "physical distribution channel") serves a special marketing function, namely the movement of physical goods in space (transportation or handling) and time (storage or warehousing) or closely related processes of transformation (e.g. packaging, sorting or labelling).[89] The other channels (as shown left hand side of Fig. 2.2) are often subsumed under the label "commercial channel," "distribution channel" or "primary channel" having all in common, that they can be regarded as means to trade physical goods as well as services, including negotiation, ordering, ownership change, financing, risking, promotion and information diffusion.[90] In addition to this, Johnson and Wood (1996,

[89]Cf. Morash (1986, pp. 91–95), Kleer (1991, pp. 9–15), Bowersox and Cooper (1992, pp. 96–98), Rosenbloom (1999, pp. 100–101) or Pfohl (2003, pp. 221–224).

[90]Originally, Vaile et al. (1952, pp. 113–129) considered that a marketing channel consists of eight different forms of flows, which can be grouped in (1) forward flows of negotiation, ownership and physical possession, (2) backward flows of ordering and payment and (3) two-way flows of information, financing and risking. Later on, this classification was step by step updated with renaming physical possession flows in physical distribution or logistics flows and highlighting promotional tasks as the most important component of information flows, see e.g. Stern and El-Ansary (1992, pp. 11–13) or Rosenbloom (1991, pp. 12–15, 1995, pp. 147–149, 1999, pp. 107–108). Another development was, that these flows in a marketing channel were considered to be channels, too, see e.g. Stern and El-Ansary (1992, p. 14). This notion was adapted by most authors later on like Gompf (1994, p. 11), Johnson and Wood (1996, pp. 30–35) or Trost (1999, pp. 66–67), so that in contemporary marketing channel literature, always different channels are discussed instead of different flows. Recently, Taylor and Jackson (2000) employed this marketing channel methodology to describe intermodal channels on a national scale.

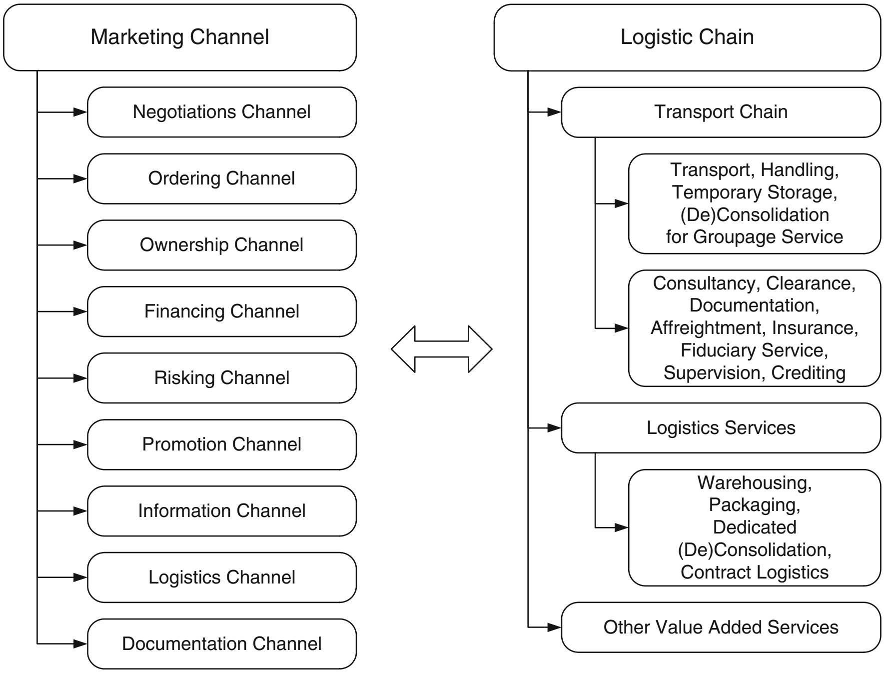

Fig. 2.2 Logistics channel versus logistic chain

pp. 400–401) claimed, that in international marketing operations a "documentation channel" has to be added due to excessive documentary needs for cross-border shipments to meet terms of sale and payment fixed in the underlying contracts or trade regulations and restrictions imposed by e.g. customs authorities or other governmental agencies at home as well as abroad.

For the term "transport chain," a common basic source of definition is the German DIN 30 781, Part 1:[91]

> "A transport chain is a sequence of technical and organizational processes tied together, where persons or goods are moved from a source to an end. The transport chain has to be regarded as a system.[...] The organizational connection is reached by coordination of information and control systems for legal and commercial issues. The transport chain as a system holds close relationships to other neighbouring systems like manufacturing and consumption of goods."

With logistics services getting more and more important, the term "logistic chain" was introduced, with the transport chain as the basic subcomponent (see right

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[91]Translation by the author. DIN is an abbreviation for "Deutsches Institut für Normung," the German Institute for Standardization which develops standards and technical rules. See Gompf (1994, p. 7), Michaletz (1994, pp. 37–39), Isermann (1995, pp. 604–605), Köberlein (1997, p. 192) or Wolf (2000d) for critical comments on this useful but rather wide definition.

hand side of Fig. 2.2).[92] Around this provision of physical handling or movement of shipments and transport-related services, additional logistics activities as well as other value added services for the ordering, promotion and information channels are summing up to a "logistic chain." In addition to this, recent research literature employed the term "supply chain" in connection with transport or logistic chains, too.[93] This should indicate a far more intensified integration of all business processes along a logistic or a transport chain from source to sink and even beyond them. But for the purpose of this work, the focus is merely restricted on transport chains and less on logistic or even supply chains because third-party logistics and supply chain management operations of freight forwarders are considered to be of minor importance in this work.

Another approach followed in this context to distinguish transport from logistic chains is to align it with the twelve functions of a freight forwarder already discussed in Sect. 2.1.3. Doing this, the consolidation and the logistics function of a freight forwarder may fall in both categories, depending on duration and/or purpose of action. In the case of the logistics function, a distinction between temporary storage and warehousing has to be drawn: The first is regarded as being a short-term, transport-related storage of shipments while the second can be characterized as merely long-term and not directly transport-related.[94] Referring to the consolidation function, a (de)consolidation of cargo can occur either in order to perform groupage service to lower transport costs or as a dedicated logistics service on behalf of a shipper or consignee.[95] A transport chain can be further split in two groups of business processes with actual handling, manipulation or movement of shipments done on one side and transport-related services performed on the other.[96]

In addition to this, several forms of transport chains can be distinguished as shown in Fig. 2.3.[97] First, a transport chain can include some transhipment points between source and sink, where a change in the mean of transport occurs leading to a multi-stage transport chain.[98] Furthermore, typical subsequent stages of multi-stage transport chains are usually called "pre-carriage," "main haul" and

[92]See Michaletz (1994, pp. 37–39) or Isermann (1995) for a similar description and Gompf (1994, pp. 101–105) for further discussion concering the air cargo industry.

[93]See Grandjot (2002, p. 126) or Schüller (2003, pp. 89–156) with the last one developing a model framework for airline-driven supply chains.

[94]Notably, this distinction is exactly drawn in the legal provisions of the HGB or UGB as well as their corresponding GT&Cs as discussed in Sect. 2.1.1.

[95]The very difference between these two types of (de)consolidation is, that the first can be regarded as being transport-related and is done on freight forwarder's account and the second is not necessarily transport-related but performed on behalf and account of a shipper or consignee.

[96]Thinking of storage as a movement of shipments in time without moving them physically, there is no need to add this term explicitly.

[97]See Michaletz (1994, p. 39), Trost (1999, p. 70), Wolf (2000d), Pfohl (2003, pp. 164–166) or Kummer (2006, pp. 47–50) for a similar classification.

[98]Cf. Pirath (1934, p. 160), Wolf (2000b) or Pfohl (2003, p. 164).

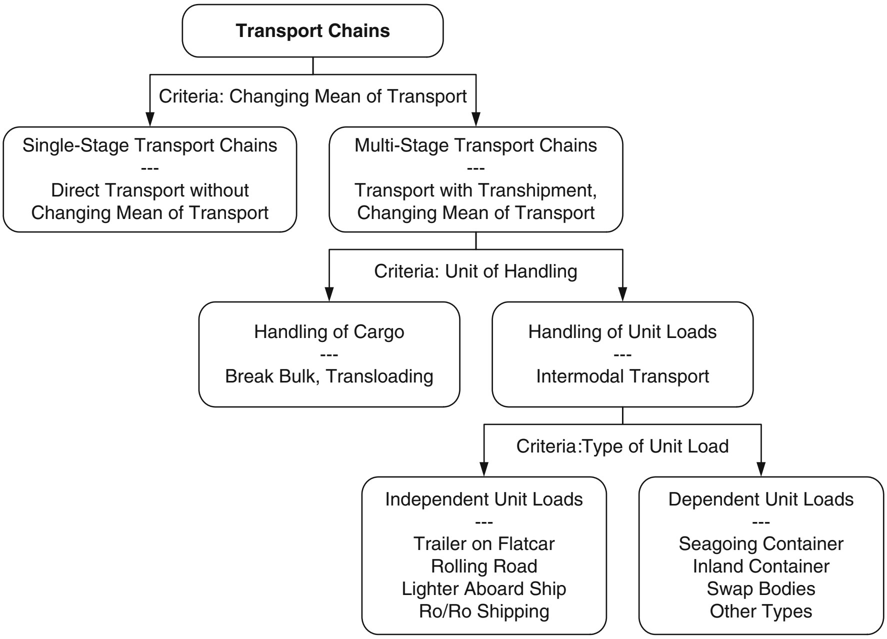

Fig. 2.3 Forms of transport chains

"onward-carriage."[99] If there is only a direct transport from source to sink and therefore no change in means of transport at any point in the transport chain takes place, it is usually called a single-stage transport chain.[100] Next, referring to the unit of handling at a point of transhipment, a direct handling of cargo can be done, called "break bulk" or "transloading."[101] If several pieces of cargo are collected together to form a unit load (like a container, swap body or road trailer) and this unit load is transhipped in a whole, then this kind of transport operation is usually called an 'intermodal transport', if it comes along with a change in the mode of transport employed.[102] According to the type of unit load used, several criteria might be applicable. One of them is dependency, referring to whether a unit load needs in ever instance additional handling facilities like a forklift truck or is at least to some extent self-sustained and therefore able to get moved without them.[103]

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[99]Cf. Wolf (2000d) or Pfohl (2003, p. 164).

[100]Cf. Pirath (1934, p. 160), Wolf (2000b), Pfohl (2003, p. 164) or Kummer (2006, p. 47).

[101]Cf. Pirath (1934, p. 160), Beplat (1970, pp. 29–30), Jennings and Holcomb (1996).

[102]Cf. Eurostat (2003, p. 103) or Kummer (2006, p. 48).

[103]See Köberlein (1997, p. 98), Seidelmann (2000b), Lucke et al. (2001, pp. 287–293) and Pfohl (2003, p. 173–178) with the last one calling them shortly "piggy-back" and "container." According e.g. to Müller-Feldhammer (1996, pp. 24–25), Aberle (2003, p. 22) or Lorenz (2005, pp. 606–609) another distinction can be drawn between "accompanied" and "unaccompanied" transports,

In addition to these distinctions as shown, transport chains generally can be classified in uni-, inter- and multimodal ones, referring to the number of modes employed for transportation between source and sink. Since a lot of very different definitions for these three terms are stated in research literature, authors like Jennings and Holcomb (1996), Taylor and Jackson (2000), Jones et al. (2000) or Bontekoning et al. (2004) came to the conclusion, that a fundamental interpretation of these terms does currently not exist. But from a semantic point of view, the distinction between these three types seems to be quite straightforward: Unimodal transport chains are restricted to one single mode of transport, intermodal ones employ two (or more) and multimodal ones at least two so that intermodal transports can be regarded as a particular type of multimodal transports.[104] Furthermore, as UN/ECE (2001, p. 18) or Eurostat (2003, p. 103) regard 'combined transport' as an "intermodal transport, where the major part of a journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road are as short as possible," a strict rank ordering can be established: "Combined transport" is some sort of 'intermodal transport' and both are part of "multimodal transport."[105] Moreover, the term "multimodal" is at the same time legally well defined and more thoroughly discussed later on in Sect. 2.2.4.2, which first appeared in the "UN Convention on International Multimodal Transport of Goods" initiated by the United Nations (UN) in 1980.[106] To conclude this discussion and for ease of exposition, in the following 'intermodal' is employed to indicate that unit loads are transferred between two or more modes of transport and "multimodal" is used either as a legal term or it stands for a not explicitly defined number of modes employed along a transport or logistic chain, where either unit loads or cargo are the unit of handling while changing the mode of transport.

According to Beplat (1970, pp. 17–25), principally two approaches to the analysis of transport chains can be distinguished: a functional and an institutional

with the last one as a more common practice in multimodal transports. Further, unit loads can be distinguished according to handling technologies employed during transhipment, like lift-on/lift-off, roll-on/roll-off, swim-in/swim-out, or truck-to-truck (see Müller-Feldhammer (1996, pp. 22–27), Trost (1999, p. 70) or Seidelmann (2000b)).

[104]See Slack (1998, p. 263), Wolf (2000d), Lucke et al. (2001, pp. 251–254), UN/ECE (2001, p. 16–17) or Eurostat (2003, p. 103) for quite similar definitions. Furthermore, it is worth to mention that an alternative term for "unimodal" might be also "intramodal," stressing on the fact that changes in means of transport are done within one mode of transport. But this term is not used in literature.

[105]Especially among German-speaking authors, the term "combined transport" is often unnecessarily restricted to mainly road-rail transport operations, see e.g. Linden (1966, p. 822) or Aberle (2003, p. 21–22) and short statements by Slack (1998, pp. 263–264) or Müller-Feldhammer (1996, pp. 5–6). But in this piece of work, it is used in the original sense defined as a transport of a unit load combining at least two means of transport (or better say a passive mean of transport carried by an active one) and employing one or more modes of transport, see Beplat (1970, p. 31), Köberlein (1997, pp. 97–98). Seidelmann (2000b) or Eurostat (2003, p. 103).

[106]Cf. Müller-Feldhammer (1996, p. 4), Wolf (2000d) or Eurostat (2003, p. 103).

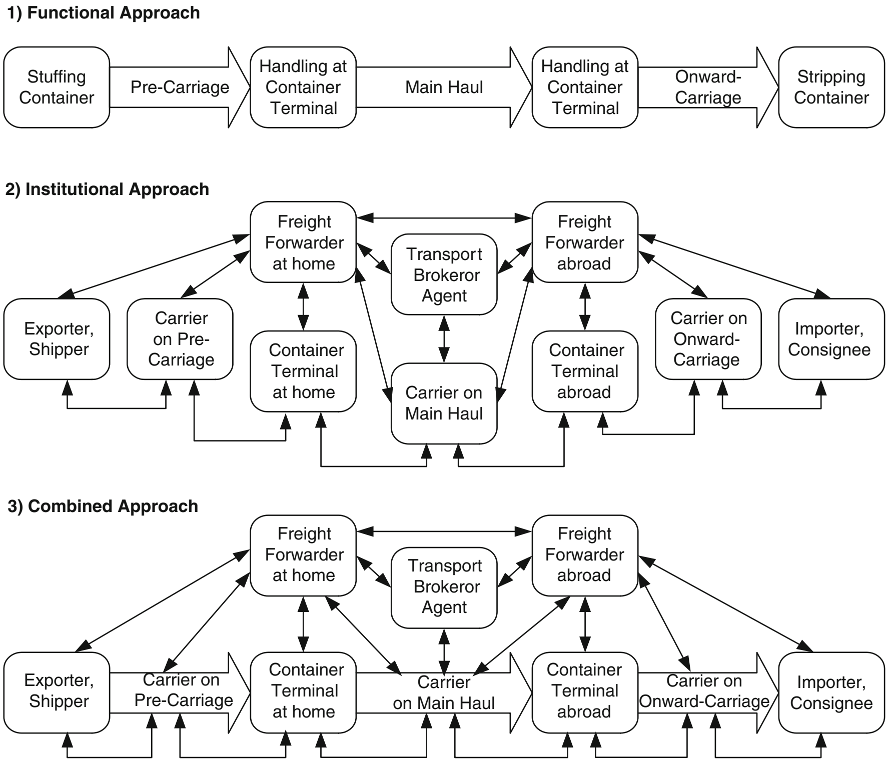

Fig. 2.4 Three approaches to analyze transport chains

one.[107] In the functional approach, a focus is set on cargo flows along a transport chain composed of subsequent business processes like transport or handling of shipments. This can be visualized by a graph, consisting of nodes standing e.g. for cargo handling at points of departure, destination or transhipment and edges representing transport operations in between as shown at the top of Fig. 2.4.[108] If a transport chain is realized by more than one individual or institution, it can be

[107]More recent similar description can be found in Michaletz (1994, pp. 39–40), Trost (1999, pp. 67–68) or Wolf (2000d). Further this is also valid in the case of a logistic chain, see Beplat (1970, p. 18).

[108]Originally, Beplat (1970, pp. 18–20) did not think of handling processes at the point of departure or destination being part of a transport chain. Therefore, he got to the conclusion, that direct transports cannot be analyzed in this way. Assuming, that these two endpoints are part of a transport chain allows to define the smallest form of a functional transport chain to be loading a shipment at a source, unloading it at a sink with a transport from source to sink in between, see Köberlein (1997, p. 192) with a similar explanation.

analyzed following an institutional approach.[109] There, individuals or institutions being part of the transport chain and their contractual relationships are then the objects under observation. A visualization of such an institutional transport chain is again a graph, but with individuals or institutions as nodes and their contractual relationships between them represented as edges (see the graph in the middle of Fig. 2.4). For the purpose of this work, a combined approach is chosen to map transport as well as logistic chains as depicted at the bottom of Fig. 2.4. There, nodes are standing for persons or institutions being part of a transport or logistic chain which were connected together by two types of edges: (1) big arrows as directed transport links indicating physical movement of shipments by some carriers from one point to another and (2) bidirectional edges representing some kind of contractual relationships as well as exchange of documents and information between them.

As it will be shown in the following, two technological developments in the last 50 years had a tremendous impact on both transport industries as shown in Fig. 2.5. The first, called "cargo handling revolution," comes along with a systematic unitization and/or containerization of cargo starting in the late 1950s and leading

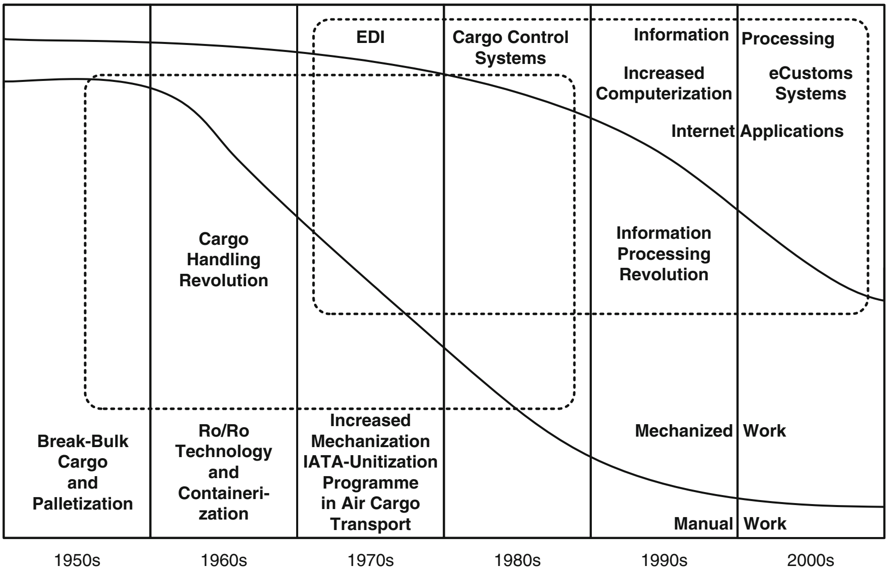

Fig. 2.5 Cargo Handling and Information Processing Revolution (Source: Ojala (1991, p. 13) with extensions)

[109]Beplat (1970, p. 19) claimed, that these persons or institutions must be independent from each other. But thinking of the mirad of cooperative agreements and dependencies occuring in contemporary transport as well as logistic chains, this notion of independency seems to be rather too restrictive and therefore it was dropped.

to tremendous improved transport as well as handling operations.[110] Related to information processing along a transport or logistic chain, a second revolutionary development started in the 1970s with an ever faster adoption of new developed information and communication technologies having decisive impacts on transport documentation and information flows.

2.2.2 The Ocean Shipping Industry in the General Cargo Segment

2.2.2.1 Technological Development and Functional Aspects

Seagoing transport is a very old transport business and was performed for centuries by tramp ships employed by merchants on own account. The modern ocean shipping industry dates back to the 1870s, when improving steamship technology first allowed to offer scheduled liner services.[111] These scheduled liner services were run by shipping companies employing fleets of multi-deck vessels with own cargo handling gear. Although these multi-deck vessels were quite flexible carrying all kinds of general cargo, ship-to-shore handling operations were time and labour intensive.

A first approach to improve handling productivity at seaports was palletization of shipments beginning in the 1940s.[112] After their initial usage to improve productivity in lift-on/lift-off ship-to-shore handling, special purpose-built ships with side doors for truck-to-truck operations were designed later on. But this approach of assembling seagoing cargo on a unit load allowing mechanized handling with fork lift trucks through side doors was not so successful, because it was mainly limited to a quay-to-quay or shed-to-shed service for many reasons.[113]

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[110]See e.g. Pfohl (2003, pp. 154–162) for a more general description of unitization and containerization.

[111]Cf. Fischer et al. (1930, pp. 218–223), Philipp (1980, pp. 21–23), Richter (1985, p. 4), Stopford (2000, pp. 338–340) or Fleming (2002, p. 370). According to Stopford (2000, p. 343) a liner service is "a fleet of ships, with a common ownership or management, which provide a fixed service, at regular intervals, between named ports, and offer transport to any goods in the catchment area served by those ports and ready for transit by their sailing dates. A fixed itinerary, inclusion in a regular service, and the obligation to accept cargo from all comers and to sail, whether filled or not, on the date fixed by a published schedule are what distinguish the liner from a tramp."

[112]Cf. Kirschnick (1969, pp. 133–134), Rath (1973, p. 8), Burg (1975, pp. 45–57) or Stopford (2000, p. 4).

[113]Following Seidelmann (1969, p. 22) or Burg (1975, pp. 45–57). To Käselau (1971, pp. 10–11), Zinnecker (1972, pp. 64–65), Berg (1975, pp. 53–57), major problem fields of this truck-to-truck handling were protection of goods, through transports under bond and a lack of standardization in unit load dimensions. In addition to this, pallets needed multiple mechanical handling at each point of interchange like from inland carrier to shed, from shed to quay, from quay to ship and

During the 1960s, the ocean shipping industry underwent a tremendous change, well known under the term "the container revolution."[114] Long before that time, non-standardized containers were already used for regular shipments in railway operations with early experiments already in the 1830s in the United Kingdom and France, "liftvans" in removal business around the 1900s as well as containerized military goods transports of the Allied Forces during World War I and II.[115] But the first large scale container transport operations as part of commercial transport activity can be dated back to the late 1950s where e.g. Sea-Land Service, a former trucking company set up by Malcolm MacLean, started to transport wheel-less trailers between Newark and Houston in 1956.[116] The first regular inter-continental container service started in 1966 on the North Atlantic, again operated by Sea-Land Service.[117]

From that time on, a rapid adoption of the container technology occurred in the ocean transport industry, which resulted in an overwhelming dominance of containerized shipments, especially in the segment of seagoing general cargo.[118] At least two contributing factors led to this development:[119]

- At the advent of containerization, a world-wide accepted ISO-container standard applied to dimensions, strength, gross weight and other specifications for seagoing containers (called ISO-1) as well as inland containers (called ISO-2) was

onboard a ship, too. So it can be regarded only as a temporary solution between traditional break bulk operations and containerization of shipments in the case of the ocean shipping industry.

[114]The term "container" can be tracked back to "continere" (Lat.) which simply means to enclose or surround something, see Rackwitz (1969, p. 7).

[115]See Fischer et al. (1930, pp. 304–205), Mayer (1933, pp. 39–40), Mayercordt (1958, pp. 7–13 and 44–46), Rackwitz (1969:4–7), Seidelmann (1969, pp. 14–17), Baumöller (1970, pp. 8–16), Beplat (1970, p. 77), Burg (1975:66–69), Richter (1985, pp. 5–6), Michaletz (1994, pp. 64–66), Wood et al. (1995, pp. 164–165), Wood and Johnson (1996:246), Exler (1996, p. 40), Slack (1998, pp. 264–265) or Fleming (2003:74–75) with further references. Beplat (1970, pp. 77–83) e.g. supports this view dividing the history of containerization in four subsequent phases: (1) unsystematical application long before World War I, (2) systematical military application beginning with World War I, (3) systematical intra-continental application in the United States after 1956 and (4) systematical inter-continental application of containers after 1966. Rath (1973, pp. 5–6) even dates the early beginnings of containerization back to the time of the Roman Empire, where cages with wild beasts were transported as unit loads in an intermodal manner from Africa to the Circus Maximus in Rome.

[116]Cf. Seidelmann (1969, p. 18), Beplat (1970, pp. 77–79), Rath (1973, pp. 26–31), Burg (1975, p. 111–114), Michaletz (1994, pp. 65–66), Talley (2000) or Levinson (2006).

[117]Cf. Rackwitz (1969, p. 11), Seidelmann (1969, pp. 18–19), Beplat (1970, pp. 79–80), Burg (1975, p. 114–115), Exler (1996, pp. 40–41), Stopford (2000, p. 341) or Talley (2000), or Levinson (2006).

[118]Of course, other modern handling methods like roll-on/roll-off for rolling cargo and swim-on/swim-off for bulky shipments were developed at that time, too. But being only interesting for nice markets of breakbulk cargo or 'neo-bulks', they had a minor impact on ocean shipping industry as a whole, see Kirschnick (1969, pp. 131–133), Käselau (1971, pp. 14–18), Williams (1973), Gilman (1977) or Gürsel (1996, pp. 29–41).

[119]Cf. Stopford (2000, pp. 340–342).

developed.[120] In concordance with ISO-Norm 668, standard seagoing containers have common dimensions of 8' height and 8' width with a length of 5', 6' 2/3", 10', 20', 30' or 40'.[121] In 1976, the maximum height of these standard ISO-containers was increased to 8' 6" and later on, high cube containers were introduced with a height of 9'6" in order to provide additional volume for cargo. Today, most of the seagoing containers are either 20' or 40' ones, despite they seem to be a second-best solution with regard to the European pallet standards.[122]

- Another important feature of the container revolution is the facilitation of inter- or multimodality in cargo transportation in order to build up integrated transport chains allowing a provision of door-to-door services.[123] According to Seidelmann (2000b), there are four closely interrelated aspects of integration which have to be taken into account: a technical, an organizational, a pricing and a legal one. First, the usage of standardized containers as a unit load is suitable for all means of transport involved in a multimodal transport chain. This led to an improved transferability of shipments between different means or modes of transport without a need for unloading and reloading it manually at transhipment points.[124] Second, technical problems being solved, multimodal transport operators (MTOs) could combine the most suitable modes of transport in order to organize a more or less seamless transport of shipments from door-to-door, employing different modes of transport on pre-carriage, main haul and onward-carriage.[125] Third, being a MTO and providing a door-to-door-service, an all-inclusive price for the whole multimodal transport chain could

[120] 'ISO' is an acronym for the "International Standardization Organization." See Rackwitz (1969, pp. 94–105), Seidelmann (1969, pp. 22–34), Käselau (1971, p. 12), Rath (1973, pp. 49–67), Burg (1975, pp. 111–125), Michaletz (1994, pp. 54–63), Benson et al. (1994, pp. 204–206), Gürsel (1996, pp. 21–29), Hebeler (1998), Branch (2000, pp. 71–79), Seidelmann (2000a), Pumpe (2000, pp. 5–11) or Jaeger and Laudel (2003, pp. 200–203) for further details about this ISO-standardization of containers.

[121] Notably, the US–American pioneers in container shipping used non-ISO-standard containers like the Sea-Land-Container with a length of 35' and the Matson-Navigation-Container with a length of 24', see Seidelmann (1969, p. 23), Rackwitz (1969, p. 101), Baumöller (1970, p. 5), Rath (1973, p. 37) or Michaletz (1994, p. 66). In addition to the ISO-Norm 668, further important specifications for containers can be found in ISO-Norms 1496 and 6346.

[122] See Hebeler (1998) or Pfohl (2003, pp. 158–159) with further comments.

[123] Cf. Benson et al. (1994, p. 202), Slack (1998, pp. 264–265), Seidelmann (2000b) or Fleming (2002, pp. 73–74). Branch (2000, pp. 94–100) used the term "multi-modalism" instead of intermodality, but his conclusions are likely the same. To him, "multi-modalism is the process of providing a door-to-door or warehouse-to-warehouse service to the shipper which embraces two or more forms of transport, and involves the merchandise being conveyed in a unitized form in the same unit througout transit" (Branch (2000, p. 94)).

[124] Cf. Jaeger and Laudel (2003, pp. 199–200).

[125] Cf. Wolf (2000b,c) or Biebig et al. (2004, pp. 247–261). According to Biebig et al. (2004, pp. 252–256), there are many variants of MTO, including both non-carrier MTOs like freight forwarders or shipping agents and carrier MTOs like shipping companies, road hauliers or railway companies.

be offered to shippers.[126] Finally, with the "UN Convention on International Multimodal Transport of Goods," an obligatory legal framework for multimodal transport was attempted in 1980, but it never came into force.[127] Instead of this, several uniform rules for transport documents and carrier liability in multimodal transport operations were developed, which became a commercial "best practice."[128] Furthermore, some countries like Germany, the Netherlands or the United States incorporated special provisions for multimodal transports in their national transport laws.[129]

These two factors, namely standardization of seagoing containers and facilitation of intermodality, allowed a tremendous increase in productivity along the whole logistic chain of seagoing cargo. But containerization of shipments and automating cargo handling processes at seaports came along with heavy investments in mechanized systems and equipment for both sea and landside operating companies.[130] Furthermore, shipping companies investing in purpose-built containerships of ever increasing size perceived huge economies of scale on the sea leg. Whereas the early containerships of the first generation were converted liquid bulk carriers with a loading capacity of less than 1,000 TEUs, the fifth generation of purpose-build cellular container ships can carry more than 7,500 TEUs and even bigger ones with more than 10,000 TEU recently came into service.[131]

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[126] See Biebig et al. (2004, pp. 263–266) about pricing in multimodal transport chains.

[127] Cf. Müller-Feldhammer (1994, p. 273), Puttfarken (1997, p. 180), Asariotis et al. (1999, pp. 21–22), Spera (2002, pp. 241–248) or Clarke (2002, p. 74).

[128] As a first attempt in this direction, the ICC issued "Uniform Rules for a Combined Transport Document" (ICC-Publication No.273) in 1973, which were revised in 1975 with ICC-Publication No.298 and replaced by the "UNCTAD/ICC Model Rules for Multimodal Transport Documents" (ICC-Publication No.481) in 1992, see Müller-Feldhammer (1994, 1996:267–274), Asariotis et al. (1999, pp. 21–25), Wolf (2000a,c), Clarke (2002, pp. 74–80) or Biebig et al. (2004, pp. 259–261). Further, all these works have been incorportated in the GT&Cs for the "FIATA Multimodal Transport Bill of Lading" of 1992 replacing the "FIATA Combined Transport Bill of Lading" of 1970 and influenced the "FIATA Model Rules for Freight Forwarding Services" of 1996, see Müller-Feldhammer (1994, pp. 272–273) or Ramberg (2000).

[129] See Müller-Feldhammer (1996, pp. 99–105) or Asariotis et al. (1999, pp. 23–24). In the case of Germany, § 452 HGB gives legal provisions for carriage of goods using various modes of transport on the basis of a single contract of carriage, but their applicability to multimodal transport chains including a leg by sea is more and more questioned by authors like Rabe (2000), Blettgen (2001), Teutsch (2001) or Drews (2003).

[130] See Baumöller (1970, pp. 71–78), Käselau (1971, pp. 12–14), Rath (1973, pp. 8–9), Benson et al. (1994, p. 211–214), Slack (1998, pp. 273–274), Böhme (2000c) or Levinson (2006) with further references.

[131] Cf. Slack (1998, pp. 267–268) or Peters (2001, pp. 9–10). Further, AXS-Alphaliner (2010) see a rise in the cellular container ship fleet above 7,500 TEU from 272 (31/12/2009) to 540 until 31/12/2013 of which 202 alone have a capacity of more than 10,000 TEU (projections based on orderbook as of 01/11/2010 assuming that no ships are deleted after this date).

A second, still ongoing technological development is the information processing revolution in ocean transport operations (see Fig. 2.5) with early beginnings in the mainframe computer system era of the 1960s and 1970s.[132] In the early 1980s, first seaport-driven Cargo Community Systems (CCSs) were established like the "Daten-Kommunikationssystem" (DAKOSY) at Hamburg or the "Datenbank Bremische Häfen" (DBH) at Bremen and Bremerhaven.[133] They are on-site value added networks (VANs) for all participants engaged in cargo and transport documentation handling at seaports.[134] In addition to this, they provide direct links to customs authorities and carriers.

In the mid 1990s, first internet-based maritime information services like SeaNet and carrier-driven CCS like INTTRA, GTN and CargoSmart occurred in the ocean shipping industry.[135] While internet-based maritime information systems offer "only" all kind of transport-related information, these carrier-driven CCS allow booking of cargo space, transmitting documents as well as tracking and tracing shipments in transit via Internet applications.

Furthermore, some customs authorities like in Canada, Norway and the Netherlands began in the late 1980s to facilitate cross-border movements by employing information technologies, but wide-spread adoption of electronic customs clearance systems started in the late 1990s.[136] One prominent example is the ongoing EU customs procedures reform, with the main objective to end in a totally paperless customs clearance environment.[137]

Looking at this rapid development and adoption of information technologies in the ocean transport industry, one serious problem is still unsolved: the electronic transmission of B/Ls as the main transport document in sea transport operations with its special fiduciary function.[138] Although several ambitious approaches like the SEADOCS-Project by INTERTANKO and Chase Manhattan Bank in 1986, the "CMI Rules for Electronic Bills of Lading" of the Comité Maritime International (CMI) in 1990 or the BOLERO Bill of Lading by BOLERO.NET in 1998, paper-based B/Ls are still used if there is a need to transfer title of shipments in transit. The main reason to this seems to be, that such electronic B/Ls are only valid in a special legal environment backed by all participants (e.g. shippers, carriers, freight forwarders and banks) being member of a closed community.

[132] See Stopford (2002) for a general overview for this and the following.

[133] See Salzen (2000), Pumpe (2000, pp. 54–59), Jaeger and Laudel (2003, pp. 438–442), Kummer et al. (2010, p. 340–343), http://www.dakosy.deorhttp://www.dbh.de.

[134] See Gudmundsson and Walczuck (1999) or Dautel (2000) with further references.

[135] Cf. Kummer et al. (2010, pp. 339–340).

[136] Cf. Hellberg and Sannes (1991), Heaver (1992), Carr and Crum (1995), Briggs (1997) or Thorby (1997).

[137] Cf. Kummer et al. (2010, pp. 222–226).

[138] See Kummer et al. (2010, pp. 248–251) with further references.

2.2.2.2 Institutional Environment and Market Structure

With the introduction of the first scheduled liner services in the 1870s, a fierce competition on routes served by more than one shipping company broke out leading to a liner conference system.[139] At this time highly seasonal volumes of cargo came together with an over-capacity of ships and so tariffs were forced down to levels often not covering average costs. In order to relax competition, shipping companies operating on the same trades formed cartels in order to limit sailings and to fix rates. In addition to this, they agreed on ports served, goods carried and even shared freight revenues obtained. The first liner conference was established in 1875 by shipping lines operating between the United Kingdom and Calcutta.[140] This liner conference system builds on the following three blocks.[141] First, there are closed liner conferences, which control membership, share cargo and charge lower contract rates for regular shipper. Second, other liner conferences are open ones, which allow any shipping company to join agreeing to the rate agreements. Third, there are shipping companies not member of a liner conference, called outsiders, which usually undercut freight rates offered by the liner conferences. However, a shipping company can be member of liner conference on one trade, whereas be an outsider on the other, because liner conferences are formed for distinct trade routes and ranges as well as ports of call.

Within a few years, this liner conference system got very powerful so that it was constantly under attack and subject to anti-trust measures.[142] Although this, it reached its peak in the beginning 1950s but declined in the following years due to strict legal measures like the “UNCTAD Code of Conduct for Liner Conferences” of 1964 (and set into force in 1983), the US Merchant Shipping Act of 1984, the Regulation (EEC) 4056/86 or the US Ocean Shipping Reform Act of 1998, which all still allow to form liner conferences, but within severe limitation of activities.[143] Moreover, with Regulation (EC) 1419/2006 the block exemption for liner shipping conferences according to Regulation (EEC) 4056/86 was abandoned

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[139] Cf. Svendsen (1958, pp. 334–336), Philipp (1980, pp. 5–7), Scheibe (1980, pp. 58–59), Stopford (2000, pp. 348–349) or Sjostrom (2004).

[140] Cf. Svendsen (1958, p. 336), Philipp (1980, p. 5), Scheibe (1980, p. 58), Brooks et al. (1993, p. 222), Wood et al. (1995, pp. 106–108), Branch (1998, p. 453), Böhme (2000d), Stopford (2000, p. 349), Fleming (2002, p. 380) or Sjostrom (2004).

[141] Cf. Svendsen (1958, pp. 338–348), Geuther (1990, pp. 29–31), Ordemann (1996, pp. 47–49), Böhme (2000c) or Biebig et al. (2004, pp. 217–219).

[142] Cf. Rosenthal (1950, pp. 39–51), Wood et al. (108–116), Clarke (1997), Böhme (2000d), Stopford (2000, pp. 349–351) or Sheppard and Seidman (2001:356–358).

[143] Cf. Philipp (1980, pp. 9–16), Franck and Bunel (1991), Brooks et al. (1993, pp. 228–231), Slack et al. (1996, pp. 289–290), Böhme (2000a, pp. 13–14, 2000d), Sheppard and Seidman (2001, p. 358–360), Reitzes and Sheran (2002), Biebig et al. (2004, pp. 221–223), Dinger (2004) and Benacchio et al. (2007).

so that since 18/10/2008 liner shipping conferences calling ports in the EC are now unsustainable.[144]

After the 1960s, huge investments needed for running scheduled container services led to a rapid consolidation in the ocean shipping industry. Some shipping companies focused on specialized fields, other went bankrupt or were objects in mergers or acquisitions.[145] In addition to this, liner consortia and later on in the 1990s strategic alliances of liner shipping companies were formed as an alternative to the traditional liner conference system.[146] Consortia are joint ventures of shipping companies pooling already existing vessels or new built ones to jointly operated fleets whereas strategic alliances are co-operative agreements of otherwise independent shipping companies to establish joint-services on certain trades.[147] The most prominent forms of co-operation in strategic alliances are based on (1) vessel-sharing agreements to maintain a certain level of service frequency in one trade, (2) slot charter agreements, enabling shipping companies to offer cargo space on a particular route without the need of shipping them by their own vessels or (3) joint service agreements combining both with a considerable higher commitment.[148] After years of ongoing consolidation in the ocean shipping industry, there are two main blocks of container shipping companies remaining:[149]

- a number of powerful liner alliances or shipping groups like the Grand Alliance (Hapag-Lloyd, P&O-Nedlloyd (until 2006), Nippon Yushen Kaisha (NYK), Oriental Overseas Container Line (OOCL), Malaysian International Shipping Corp. (MISC)) or the New World Alliance (American President – Neptune Orient Lines (APL-NOL), Mitsui Osaka Shosen Kaisha Lines (MOL), Hyundai Merchant Marine (HMM)) and

[144]See Czerny and Mitusch (2005), Schmidt (2007), Benacchio et al. (2007) or http://ec.europa.eu/comm/competition/antitrust/legislation/maritime.

[145]Cf. Slack et al. (1996, p. 291), Odrich (1998, pp. 81–83), Stopford (2000, pp. 376–378), Böhme (2000a, pp. 65–66), DVB (2002, p. 61) or Panayides and Gong (2002). Almost all of the pioneering shipping companies in container shipping of the late 1960s like Sea-Land Service, United States Lines, Moore Mc Cormack Lines or American Export Isbrandsten Lines did not survive.

[146]Cf. Burg (1975, pp. 126–130), Richter (1985, pp. 98–117), Geuther (1990, pp. 28–35), Brooks et al. (1993, p. 223–228), Ordemann (1996, pp. 45–73), Slack et al. (1996, pp. 291–292), Clarke (1997, pp. 22–23), Slack (1998, pp. 272–273), Böhme (2000d), Sheppard and Seidman (2001), Peters (2001, pp. 8–9), Ewert (2006) or Herrebosch (2008).

[147]See Rath (1973, pp. 37–40), Scheibe (1980, pp. 74–85), Richter (1985, pp. 100–117), Kindleberger (1993, p. 172–173), Brooks et al. (1993, pp. 223–227), Ordemann (1996, pp. 65–67), Branch (1998, p. 454–455) or Sheppard and Seidman (2001, pp. 352–356). The most prominent consortia is Atlantic Container Lines (ACL) established in 1965 (now part of the Grimaldi Group), see Burg (1975, pp. 127–128). Other consortia founded at this time were Overseas Container Limited (OCL), Associated Container Transportation (ACT) or HAPAG-LLOYD Container Linien (now Hapag-Lloyd), see Seidelmann (1969, pp. 54–56) or Rath (1973, pp. 38–40).

[148]Cf. Evangelista and Morvillo (1999, pp. 30–32) or Sheppard and Seidman (2001, pp. 353–355).

[149]Cf. Stopford (2000, pp. 377–378), Heaver et al. (2001, p. 294), Slack et al. (2002), DVB (2002, p. 62), Midoro et al. (2005, pp. 96–101) or Kummer et al. (2010, pp. 296–297).

- some so-called "outsiders" which are independent carriers just running their business on their own like Maersk, Mediterranean Shipping Company (MSC), Evergreen, and Hamburg Süd as the most prominent ones.

2.2.3 The Cargo Segment in the Airline Industry

2.2.3.1 Institutional Environment and Market Structure

From the very beginning, institutional environment was of special importance in the air transport industry as a whole. Even before the first motorized aircraft flight was performed by Wilbur and Orville Wright in 1903, legal provisions were laid down for vehicles based on the principle of the "lighter than air" technology in the eighteenth and nineteenth century.[150] After a first unsuccessful attempt of establishing rules for international aviation at the Paris Air Navigation Conference in 1910, the Paris Peace Conference after the World War I resulted in the Paris Convention of 1919. There, basic rules of cross-border flight operations were fixed and the "Commission Internationale pour la Navigation Aérienne" (CINA) as the first supranational organization for civil aviation issues was established in 1922.[151] Also in 1919, six European airlines formed the "International Air Traffic Association" (IATA) in order to standardize their transport operations.[152]

Towards the end of World War II, fundamental issues concerning post-war civil aviation like the freedom of the air rules and basic regulations for scheduled air transport operations were negotiated at a conference in Chicago, resulting in the Chicago Convention of 1944. At the end of this conference, the "International Civil Aviation Organization" (ICAO) was founded as a supranational union of all nations which participate in aviation traffic in order to supersede the CINA and further improve international co-operation on a national and governmental level.[153] Furthermore, the pre-war IATA of 1919 was re-established under the name "International Air Transport Association" (IATA).[154] Both organizations work closely together to facilitate civil aviation in every aspect. Important outcomes of this co-operation are technical, operational and legal provisions leading to a very secure but heavily regulated transport environment. Prominent examples with

[150]Cf. Schäffer (2003, pp. 377–379).

[151]Cf. Berendt (1961, pp. 194–1995), Buchwald (1973, pp. 54–55) or Schäffer (2003, p. 379).

[152]Cf. Maaß(1927:81–85), Stahlberg (1931, pp. 46–50), Kreuter (1931, p. 11), Berendt (1961, p. 30–32), Buchwald (1973, p. 53), Kehrberger (1996) or Lorenz (2005, p. 505).

[153]Cf. Berendt (1961, pp. 198–199), Buchwald (1973, pp. 55–60), Kehrberger (1996), Opgenhoff (1997, p. 33), Grandjot (2002, pp. 55–56), Schäffer (2003) or Lorenz (2005, pp. 500–501).

[154]Cf. Berendt (1961, pp. 75–82), Buchwald (1973, pp. 79–85), Kehrberger (1996), Opgenhoff (1997, pp. 33–34), Grandjot (2002, pp. 57–59) or Lorenz (2005, p. 505).

special importance for air cargo operations are common conditions of carriage and transport documents or provisions for the transport of hazardous materials.[155]

Today, the IATA is the most important interest group in civil aviation, resembling to some extent to a huge price and condition cartel of airlines and their approved agents, which is often called the "IATA agency system."[156] There are three IATA traffic conference areas, where freight rates as well as other operative and legal provisions are negotiated.[157] But today these official airport-to-airport IATA-freight rates published in "The Air Cargo Tariff" (TACT) are usually undercut by up to 85%, so that they can be regarded nowadays merely as a recommended price not reflecting actual competition.[158] Furthermore, the IATA serves a unique banking function for their member airlines and approved agents with the "IATA Clearing House" (ICH) and the "IATA Cargo Accounts Settlement System" (IATA-CASS).[159]

Due to operational needs and an ongoing heavy competition, co-operations between otherwise independent operating airlines are quite common, both in the passenger and air cargo segment.[160] First, a common form of co-operation are interlining agreements backed by the IATA Interlining-System, where a mutual recognition of operational and legal issues allows a "seamless travel" of cargo or passengers on a single waybill or ticket conducted by two or more airlines. In pool agreements, two airlines agree to serve destinations as a joint operation, sharing their costs and revenues. Furthermore, there are numerous code sharing agreements, where a flight performed by one airline called "operating carrier" has several flight designators from other partner airlines marketing this flight, too. In addition to this, some airlines formed cargo alliances within the last years. Examples to this are[161]

- New Global Cargo or WOW (Lufthansa Cargo, SAS Cargo[162], Singapore Airlines Cargo and Japan Airlines Cargo),

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[155] Cf. Kehrberger (1996), Branch (2000, pp. 160–174), Jaeger and Laudel (2003:467–268) or Kummer et al. (2010, pp. 303–304).

[156] Cf. Wood et al. (1995, pp. 148–151), Wood and Johnson (1996, p. 546), Pfohl (2003, p. 351) or Schüller (2003, p. 13). Further, see Berendt (1961, pp. 74–80), Kehrberger (1996), Opgenhoff (1997, p. 34–37) or Lorenz (2005:505–517) for a more elaborated overview of the IATA.

[157] Actually, the TACT is subject to a block exemption rule according to Regulation (EC) 487/2009 which demands a free formation of prices within EC and EFTA, see e.g. Spera (2011, p. 254).

[158] Cf. Opgenhoff (1997, pp. 34–35), Becker (1999, pp. 45–50), Bertsch (2000a), Grandjot (2002, p. 153–158), Schüller (2003, pp. 17–19), Shaw (2004, pp. 189–192) or Spera (2011, p. 254–257).

[159] Cf. Berendt (1961, pp. 133–134), Kehrberger (1996), Opgenhoff (1997, pp. 35–37), Grandjot (2002, p. 58–59) or Kummer et al. (2010, pp. 338–339).

[160] Cf. Berendt (1961, pp. 138–142), Göpfert (1994), Kehrberger (1996), Opgenhoff (1997, pp. 42–44), Albers (2000, pp. 35–43), DVB (2001, p. 26), Grandjot (2002, pp. 106–114) or Kummer et al. (2010, p. 311–313).

[161] See DVB (2001, pp. 26–27), DVB (2002, pp. 48–49) and Kummer et al. (2010, pp. 312–313) with further references. In the meantime, the WOW cargo alliance was terminated by Lufthansa Cargo.

[162] 'SAS' is the abbreviation for "Scandinavian Airlines System," an inter-Scandinavian airline consortia.

- Sky Team Cargo (Air France Cargo, Korean Air Cargo, Delta Air Logistics, Aeromexico Cargo, Alitalia Cargo and Czech Airlines Cargo, KLM Cargo[163] joined by Northwest Airline Cargo in 2005).

To some extent, these cargo alliances can be considered as being a natural extension to already existing strategic alliances in the passenger segment.

2.2.3.2 Technological Development and Functional Aspects

In contrast to the ocean transports industry discussed before, the air cargo industry developed very late, only in the twentieth century.[164] Shortly after World War I with a rapid development of aircraft technology, a lot of airlines started scheduled air transport operations for passengers, mail as well as cargo backed by heavy governmental subsidies.[165] At that time, aircraft flying range and payload capacity were considerable low, so that intercontinental air traffic could only run by flying boats or airships and other cargo than parcel shipments were quite unusual.[166]

World War II was a very important landmark contributing to the continued development of the air freight industry.[167] During the war, aircrafts proved their value in many military logistics operations like landing operations of paratroopers or supply of locked troops. In the late 1940s, even a whole city like Western Berlin was kept supplied with food stuff and fuel by the Berlin Airlift of the Allied Forces during the blockade by the Soviet Union. In the 1960s, civil aviation adopted jet-propulsion engines developed during the World War II which lead to a replacement of propeller-driven by jet aircrafts due to their superior lifting capacity.[168] In the

[163]'Koninklijke Luchtvaart Maatschappij' (KLM) – or better say the Royal Dutch Airlines – merged recently with Air France with the latter in a leadership role in this joint company.

[164]Wells (1999, p. 364), considered the first air cargo shipment to be five bolts of silk cloth strapped onto the passenger seat of a plane of from Dayton to Columbus, where a department store wanted to sell strips of the cloth as mementos of "the first air shipment." Further, Wells (1999, p. 364) reported about a sack of mail transported from Albany to New York City for the Post Office Department in 1910, whereas Puffer (1949) referred to first experiments in air-mail services between Nassau Boulevard, Long Island, New York and Mineola conducted in 1911, Wood et al. (1995, pp. 127–128) saw the first occurence of an air freight transport 1911 in India where 6.500 pieces of mail were carried on distance of 5 miles and Grandjot (2000) dated it back to 1911, too, but failed to give more information about.

[165]Cf. Maaß(1927:8–71 and 95–107), Schenk (1930, pp. 75–124), Stahlberg (1931, pp. 14–36 and 86–105), Kreuter (1931, pp. 7–14), Ulderup (1935, pp. 14–74 and 101–146), Ziegler (1938, pp. 50–56), Maetz (1937, p. 12–22), Rosenthal (1950, pp. 419–420), Berendt (1961, pp. 12–23 and 34–47), Buchwald (1973, p. 18–21), Graham (1995, pp. 10–12), Wood et al. (1995, pp. 128–131) or Wells (1999, p. 35–47).

[166]Cf. Maetz (1937, pp. 39–43), Ziegler (1938, pp. 56–60) or Lorenz (2005, p. 495).

[167]Cf. Berendt (1961, pp. 74–63), Buchwald (1973, pp. 22–27), Wood et al. (1995, p. 131), Wells (1999, p. 48–51) or Lorenz (2005, p. 495).

[168]Cf. Berendt (1961, pp. 214–218), Heinrich (1966, pp. 92–140), Krebs (1974, pp. 96–100), Graham (1995, p. 12–14), Wells (1999, pp. 51–54) or Fricke and Dussoye (2000).

following decades, bigger and bigger aircrafts were build like the Boeing 747 Jumbo Jet with a payload capacity of over 100 tons in the pure freighter version or former Soviet military aircrafts like the Antonov AN-124 Ruslan with a maximum payload capacity of about 120 tons or the Antonov AN-225 Mrija with a maximum payload capacity of about 250 tons.[169]

In the early 1960s, palletization of air freight cargo was enforced in order to allow loading and unloading cargo of aircrafts within minimum time.[170] In 1963, the IATA started a unitization programme, which lead in the 1970s to a rapid containerization of air cargo.[171] This happened also due to a special tariff concept issued in 1969 with bulk unitization charges as a "freight-all-kind"-rate for unit load devices (ULDs) being lower than a normal commodity rate.[172] Today, these standardized air cargo pallets with nets or igloos and containers are indispensable for contemporary air freight operations. There are about 20 different sizes of ULDs existing up to the largest one with the dimensions of a twenty-foot ISO-1 container. But most of these ULDs are much smaller and they have a special design to fit exactly on the main or lower deck of aircrafts without wasting too much space. This extremely adoption to aircraft loading space and the need for roller-bed handling facilities prevent to some extent intermodality in the case of the ULDs.[173] So up to now, most of these ULDs are build up and/or broken down at the airport or premises nearby.[174]

Despite "Sales And Business Reservations Electronically" (SABRE), the first airline computer reservation system for passenger transport was established already in 1962, the information processing revolution in air cargo operations started in the early 1970s.[175] At about the same time, several airports around the world developed dedicated on-site CCS to control cargo handling operations.[176] Furthermore in 1978, an electronic customs procedure system called 'Automatisiertes Luftfrachtabwicklungsverfahren' (ALFA) was established at German airports, which is now

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[169] See Buchwald (1973, pp. 181–201), Burg (1975, pp. 196–198), Wood et al. (1995, pp. 136–139), DVB (2001, pp. 15–19), Lorenz (2003, pp. 505–506), Sjögren (2004) or Kummer et al. (2010, pp. 314–315) with further references.

[170] Cf. Seidelmann (1971, pp. 96–99), Ashford et al. (1997, pp. 293–304) or Shaw (1999, p. 141).

[171] Cf. Seidelmann (1969, pp. 100–104), Rath (1973, pp. 287–289), Smith (1974, pp. 165–173), Burg (1975, p. 89–91) or Ashford et al. (1997, pp. 293–297). Before that time, usage of containers in air cargo transport operations on regular basis was virtually non-existent, see Mayercordt (1958, pp. 47–48).

[172] Cf. Seidelmann (1971, pp. 112–117), Burg (1975, pp. 194–195), Shaw (1999, pp. 141–142), Wells (1999, pp. 380–382), Grandjot (2002, pp. 61–65) or Lorenz (2005, pp. 515–516).

[173] Cf. Seidelmann (1971, pp. 117–119) or Grandjot (2000, 2002, pp. 95–96).

[174] Cf. Smith (1974, p. 172), Wood and Johnson (1996, pp. 260–262) or Steiger (2006).

[175] Cf. Smith et al. (1992), Bertsch (2000b) or Schüller (2003, pp. 24–25). Specifically, Freight SABRE was established in the 1970s by American Airlines as the first computer reservation system for air cargo shipments, see Arndt and Kinkeldei (1978, pp. 69–70).

[176] Cf. Bey (1972, pp. 2–3), Arndt and Kinkeldei (1978, pp. 66–72), Ashford et al. (1997, pp. 305–307), Gräf and Leßmann (2000), Bertsch (2000b) or Schüller (2003, pp. 25–27). Examples are the "London Airport Cargo Electronic Data Processing System" (LACES) at London Heathrow and the "Système d'ordinateur du Frêt International Aérien" (SOFIA) at Paris.

a subsystem of the "Automatisiertes Tarif- und Lokales Zollabwicklungsssystem" (ATLAS).[177]

In the 1990s, IATA-CASS was established as a clearing system for air freight operations between IATA member airlines and their IATA cargo agents backed by the IATA-Resolution 851.[178] Furthermore, 'Tracking and Tracing Online' (TRAXON) was founded in 1991 as a neutral CCS serving carriers, freight forwarders as well as other participants in the air cargo logistic chain with a fully integrated information technology-driven communication system.[179] Recently, three neutral, air cargo focused computer reservation systems, namely "Global Freight Exchange" (GF-X), "Cargo Portal System" (CPS) and "Ezycargo," started to provide online booking of air cargo shipments.[180]

Today, the air cargo industry can be divided in several segments referring to airline's fleet structure and their commitment to air cargo business as shown in Fig. 2.6.[181]

First, there are *cargo* and *non-cargo focused passenger airlines*, marketing only their lower deck capacity called 'belly' merely as a by-product of their passenger transport operations.[182] The next group are *combination airlines*, whose fleets are a mix of passenger aircraft and pure freighters. In addition to this, some of them own hybrid forms like "combi carriers" with a movable bulkhead dividing the main deck in a passenger and a cargo section or aircrafts with easily removable seats called "quick change," allowing carriage of passengers by day and cargo at night.[183]

The other three groups of airlines are mainly employing pure freighters.[184] *Integrators* offer time definite door-to-door services and are mainly focused on small shipments like documents and parcel size consignments up to a weight of 30 kg, but some of them recently broadened their operations and allow now

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[177] Cf. Gräf and Leßmann (2000) or Kummer et al. (2010, pp. 222–224).

[178] See Grandjot (2002, pp. 53–54), IATA (2004, pp. 29–31), Kummer et al. (2010, pp. 338–339) and http://www1.iata.org/cargo/distribution/cass/index.htm.

[179] See Damsgaard (1999), Gräf and Leßmann (2000), Bertsch (2000b), Grandjot (2002, pp. 162–163), Schüller (2003, p. 26), Kummer et al. (2010, pp. 339–340) or http://www.traxon.com.

[180] See Grandjot (2002, pp. 170–171) or Kummer et al. (2010, pp. 337–338) with further references.

[181] See DVB (2001, pp. 9–14) or Grandjot (2002, pp. 97–103). A similar segmentation of the air cargo industry in pure freighter airlines, combination carrier and integrators can be found in Eaton (1994), Wells (1999, pp. 369–371), Albers (2000, pp. 19–23) or HSH Nordbank (2007, pp. 17–25).

[182] Cf. Eaton (1994), Shaw (1999, pp. 138–140), Grandjot (2002, pp. 9–10), Schüller (2003, p. 11) or HSH Nordbank (2007, pp. 23–32).

[183] Cf. Wood et al. (1995, p. 141), Opgenhoff (1997, p. 10), Shaw (1999, pp. 140–141), DVB (2001, p. 15), Grandjot (2002, p. 10), Vahrenkamp (2002, p. 14) or Schüller (2003, p. 11).

[184] See Grandjot (2002, pp. 70–81) for technical descriptions of commonly used pure freighter aircrafts. Most of these pure freighters employed in the air cargo industry are former passenger aircrafts converted into freighters, removing all passenger-related facilities, see DVB (2001, p. 15) or HSH Nordbank (2007, pp. 27–32).

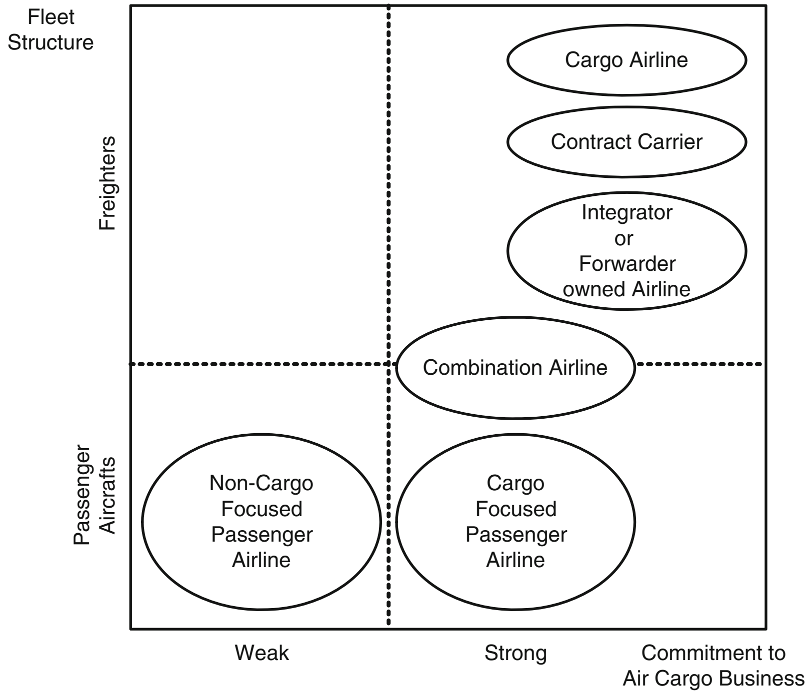

Fig. 2.6 Fleet Structure and Commitment of Airlines (Source: DVB (2001))

shipments of bigger size, too.[185] The most prominent ones are Dalsey-Hillblom-Lynn (DHL), Federal Express (FedEx), Thomas Nationwide Transport (TNT) and United Parcel Service (UPS), having together an overwhelming world market share.[186] In addition to this, some *freight forwarders* had their own fleet of aircrafts, like Emery Worldwide or BAX Global in order to offer an integrated air cargo

[185] Cf. Wood et al. (1995, pp. 144–147), Opgenhoff (1997, p. 23), Bess (1996, pp. 48–59), Bjelicic (2000) or DVB (2001, p. 10).

[186] Despite many authors like Schneider (1993, pp. 50–54), Opgenhoff (1997, p. 19), Becker (1999, p. 41) or Bachmeier (1999, p. 44) dating the early beginnings of this segment back to the end 1970s, provision of courier-, express-, parcel and/or postal services itself can be traced back to the Ancient Age and some of these four big players were established long before, see Hector (1987) or Bess (1996, pp. 29–32). UPS was established in 1907 in the United States, TNT 1946 in Australia followed by DHL in 1969 and FedEx in 1974 in the United States, see Gutthal (1999, pp. 17–24), Bachmeier (1999, pp. 82–119) or Lucke et al. (2001, p. 294). With the recent development on the European postal market TNT was acquired by the Dutch The Post Groep (TPG) and DHL by the German Deutsche Post World Net (DPWN).

transport service, too.[187] Another group of airlines are pure *cargo airlines* which operate scheduled or charter services on own account, employing their pure freighter fleet like Cargolux, Nippon Cargo Airlines and Kalitta Air.[188] The last group of airlines are mainly focused on the main haul and operate as *contract carriers* for other airlines as well as integrators and forwarders on a long-term charter basis.[189] Of course, some airlines belong to several groups and therefore the lines between one group and another are rather blurred.

Another aspect in air cargo operations are surface transportation of air cargo shipments between two airports, called "road-feeder-service" or "trucking" backed by IATA-Resolution 507b.[190] Some reasons for this ever increasing partly substitution of air cargo transport by surface operations are (1) insufficient air cargo capacity on flight destinations from/to smaller airports, (2) pooling of air cargo at central hubs by airlines as well as freight forwarders or (3) a general restriction of night flight operations on many airports.[191]

2.2.4 Mapping of Inter-organizational Interaction and Cargo Movement

In the following sections first, traditional forms of sea transport operations with conventional general cargo as well as contemporary forms with containerized cargo are discussed. Then, the focus is set on contemporary air cargo transport operations.

2.2.4.1 Traditional Sea Transport Operations of General Cargo

As Martin and Thomas (2001) described in the case of break bulk berth operations in the early 1960s, following inter-organizational interaction and cargo movement can be seen in conventional (non-containerized) general cargo trades as shown in

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[187] Cf. Eaton (1994), Mosler (1999) or DVB (2001, pp. 31–32). Recently, Emery Worldwide was sold to UPS and BAX Global (former Burlington Air Express) was acquired by Deutsche Bahn and merged with their freight forwarding operations under their brand name DB Schenker.

[188] See e.g. HSH Nordbank (2007, pp. 20–21).

[189] Cf. DVB (2001, pp. 33–34) or HSH Nordbank (2007, p. 24). Examples are Atlas Air Worldwide Holding or Air Atlanta Icelandic.

[190] See Arndt and Kinkeldei (1978, pp. 58–66), Mosler (1993), Müller-Rostin (1996), Opgenhoff (1997, p. 11), Odrich (1998:95–97), Becker (1999, pp. 55–62), Dautel (2000), Button and Stough (2000, pp. 293–295), Grandjot (2002, pp. 193–194), Schüller (2003, pp. 21–23) or Bottler (2006). According to Dautel (2000), in Germany about 70% of all air cargo is being trucked.

[191] Further, there is a tendency to a full substitution of air freight operations by road haulage especially in Europe up to a distance of 1,000 km, because of transit time and cost reasons, see Windisch (1996, p. 44), Becker (1999, p. 56) or Bottler (2006).

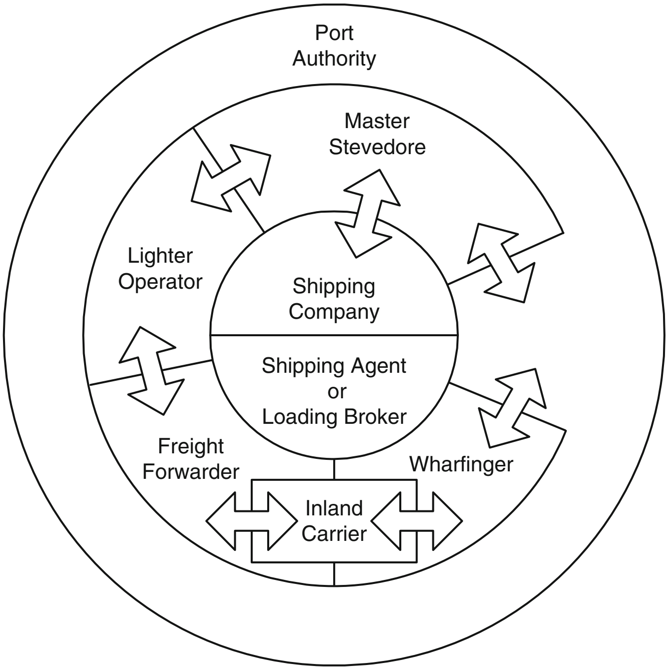

Fig. 2.7 Interorganizational Interaction and Cargo Movements in General Cargo (Source: adapted from Martin and Thomas (2001))

Fig. 2.7.[192] The arrows indicate cargo movements, while organizations adjacent to each other have some inter-organizational business relationships.[193]

- Beside providing basic port infrastructure, *port authorities* usually ensured temporary storage or warehousing of cargo at own premises as well as offering mechanized ship-to-shore cargo handling by cranes.[194]
- At that time, *shipping companies* mainly restricted their business operations to sea transport having responsibility for the cargo shipped starting at the port of departure crossing the ship's rail and ending at the port of arrival passing their ship's rail again.[195] In the general cargo segment, they were engaged in scheduled

[192]In addition to this, see Schulz-Hanßen (1965:53–70 and 142–68) for a quite similar description of seaport operations or Jansson and Shneerson (1982, pp. 9–26) who focused more on the development of handling capacity at seaports.

[193]Of course, this list of companies working in and around a seaport is by far exhaustible, e.g. there are tug operators, private firms specialized in mooring vessels, ship building yards or other companies staffing, supplying and maintaining vessels, see Schulz-Hanßen (1965:142–154), Benson et al. (1994, pp. 88–96), Diederich (2000) or Jaeger and Laudel (2003, pp. 219–221).

[194]Cf. Schlichting (1931, pp. 13–14), Martin and Thomas (2001, p. 280) with further references.

[195]Cf. Böhme (2000b).

liner trades which were subject to shipping conferences as already discussed in Sect. 2.2.2.2.

- The landside business of shipping companies was usually run by shipping agents and loading brokers.[196] Having an agency contract with shipping companies, *shipping agents* cared for both ships and cargo on behalf and account of their principals on a regular basis.[197] According to the ships, their duty was to organize all operations needed to supply, maintain and clear seagoing vessels inwards and outwards calling their seaport.[198] Referring to outgoing cargo, they marketed the liner services, concluded contracts of affreightment, collected freight payments, issued and handled transport documents like B/Ls. In the case of incoming cargo, they organized delivery of shipments in concordance to the transport documents including collection of remaining freight payments and secured interests of their principals in the case of loss or damage of cargo. The actual form of relationship between a ship agent and his principal greatly varied both from company to company and from port to port with shipping companies often performing ship agency functions in-house at home ports or at ports of call with a high volume of traffic.[199] However, at the majority of ports of call, shipping companies normally did not run a permanent office and therefore, shipping agents were appointed. *Loading brokers* were usually engaged in cargo brokerage and chartering business as neutral third parties.[200] Doing this, they matched shippers and shipping companies in order to arrange contracts of affreightment or charter parties on a non-regular basis without further involvement.
- *Wharfingers* were small private companies licensed and subcontracted by the port authority to perform on-site movement of cargo.[201] In addition to this, wharfingers were also responsible of loading, unloading and storage of incoming

[196] Cf. Securius and Böning (1941, pp. 64–67), Ohling (1950, pp. 222–224), Trappe (1995), Puttfarken (1997, pp. 247–249), Knudsen (1998), Herber (1999, pp. 168–171), Böhme (2000b), Jaeger and Laudel (2003, pp. 219–221) or Dischinger et al. (2005, pp. 269–271). According to Miller (2002, p. 8–11), principally three forms of shipping agents can be distinguished: (1) firms whose principal identity and work was shipping agency, (2) trading agencies running shipping agency department and (3) shipping companies owning shipping agents.

[197] Serving this double-role, shipping agents are usually called “husbandry agent” or “ship’s husband” if they care only for the vessel and “charter’s agent” if they set their focus on cargo, see Puttfarken (1997, pp. 249–250).

[198] Cf. Murr (1979, p. 84), Trappe (1995, p. 324) or Knudsen (1998, p. 155).

[199] Cf. Martin and Thomas (2001, p. 282).

[200] Cf. Mittendorf and Oelfke (1974, pp. 228–232), Murr (1979, pp. 83–84), Puttfarken (1997, pp. 248–249), Knudsen (1998, pp. 153–154), Herber (1999, pp. 169–171), Strandenes (2000) or Fiotakis (2005).

[201] Cf. Martin and Thomas (2001, p. 280) with further references. In Hamburg, warehousing of merchandizes like spices, tea, coffee, cacao, wines or carpets is done up to now by “Quartiersleute” in the former freeport area called “Speicherstadt,” which is still one of the biggest warehousing complexes in the world, see Ohling (1950, pp. 183–184), Diederich (2000), Lauenroth (2001) and Jaeger and Laudel (2003, p. 220). But with the new “Hafencity” project in Hamburg, this traditional form of warehousing will vanish within a few years, see http://www.hafencity.com/en/home.html.

and outgoing cargo from inland carriers. Doing this, they acted on behalf and account of freight forwarders as well as shippers.

- *Master stevedores* were small private companies engaged into stowing and unstowing cargo onboard of ships as well as lighters.[202] They were contracted by shippers, shipping companies or through their respective agents.
- *Lighter operators* were private barge companies licensed by the port authority to provide cargo movements by barges or lighters within the seaport area.[203] Again, they were contracted by shippers, shipping companies or through their respective agents, especially in the case of bulky shipments, transhipment to inland navigation on basis of a through transport contract or simply to save handling charges raised by the port authority for ship-to-shore movements of cargo.[204]
- The dominating *inland carrier* at that time were national railway companies.[205] Especially at German seaports there was a heavily regulated market with special tariffs for hinterland traffic of seagoing cargo performed by the German Reichsbahn. In addition to this, small road hauliers were contracted by freight forwarders for short distance transports as well as inland navigation companies for rather bulky shipments.

In this traditional environment, *freight forwarders* served a distinct role acting as an agent on behalf and account of a shipper, consignor or consignee.[206] Mainly, they arranged affreightment with shipping agents and/or loading brokers for the sea leg on one hand and affreightment of cargo with inland carriers by rail, road or inland navigation for hinterland transport on the other, including the organization of cargo handling operations actually performed by port authorities, stevedores, wharfingers and lighter operators.

In addition to this, they represented the interests of their principals in every aspect, including supervision of cargo handling operations, cargo inspection, arranging customs clearance, crediting duties, fees and charges payable at once. As a "loading agent" for outgoing shipments, a freight forwarder booked cargo space in advance, organized delivery of cargo to the seaport of departure, despatched shipments and handled transport documentation. As a "landing agent" for incoming

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[202] See Fischer et al. (1930, pp. 239–240), Schlichting (1931, p. 14), Jansson and Shneerson (1982, pp. 24–26), Diederich (2000) or Martin and Thomas (2001, p. 281) with further references.

[203] See Martin and Thomas (2001, p. 281) with further references.

[204] Cf. Schlichting (1931, pp. 14–15).

[205] Cf. Schlichting (1931, pp. 23–31).

[206] Cf. Schlichting (1931, pp. 13–58), Seidelmann (1969, pp. 92–93), Mittendorf and Oelfke (1974, pp. 241–265), Murr (1979, p. 237–248), Schumacher (1987:148–149), Herber (1999, pp. 179–180), Beamer-Downie (1999, pp. 13–21) or Jaeger and Laudel (2003, pp. 263–267). According to Vadnai (1921, p. 19) or Seiler (1981, p. 82–84), some freight forwarders were working as shipping agents at the same time, but this field of activity was not so common and mainly run by some subsidiary company.

shipments, he organized handling operations for unloading shipments, temporary storage, customs clearance and delivery, usually on behalf of his principal.

An additional field of activity at this time was consolidation of small shipments, where a freight forwarder as a "cargo consolidator" collected shipments from several shippers in order to ship them under a single contract of affreightment and split them for delivery afterwards. Doing this, considerable lower freight rates and therefore a high bargain were reached due to usually high minimum rates and charges raised by shipping companies. But these cargo consolidation operations needed at least a correspondent firm at the port of arrival who acted on behalf of the cargo consolidator at the port of departure.

All in all, this break bulk berth system of conventional general cargo was a strictly divided, step-by-step approach to cargo handling at seaports, with:

- Freight forwarders and inland carriers being responsible for hinterland operations.
- Wharfingers, lighter operators and the port authority as a ship-to-shore-crane operator taking care for on-site and ship-to-shore movement of cargo.
- Master stevedores engaged in stowage and unstowage of cargo under supervision of shipping companies' officials onboard their ships.[207]

Although a clear interdependence existing between all the organizations in several stages of cargo movement at a seaport, they did not work together. Only little communication and a lack of co-ordination occurred, so that cargo handling rates and performance of these break bulk berth systems for general cargo movements were considerably low.[208]

2.2.4.2 Contemporary Sea Transport Operations of Containerized Cargo

With the advent of containerization, organization of cargo movement as well as inter-organizational relationships at seaports changed dramatically, introducing the container terminal system as shown in Fig. 2.8:[209]

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[207] Again, this supervision could be outsourced to agents like shipping agents or tallymen, who were usually engaged on behalf and account of a shipping company to inspect and measure outgoing and incoming shipments, see Ohling (1950, pp. 224–233), Jaeger and Laudel (2003:240), Diederich (2000) or ITZ (2002).

[208] Cf. Svendsen (1958, pp. 94–102), Baumöller (1970, pp. 62–71), Slack (1998, p. 264) or Martin and Thomas (2001, p. 282–283).

[209] Cf. Jansson and Shneerson (1982, pp. 9–26), Slack (1998, pp. 273–276), Pumpe (2000, pp. 29–44), Juhel (2001), Robinson (2002), Steenken et al. (2004) or Vanelslander (2005, pp. 126–140). According to Martin and Thomas (2001, p. 283) "[t]he name 'terminal' has been introduced, implying an integrated activity providing services not just to the shipping line but also to importers, exporters and transport operators. The name 'terminal' is now applied to facilities that provide a comprehensive range of specialized services to users." Following them, this kind of terminal system is nowadays also valid for other segments of seagoing cargo. But a detailed discussion

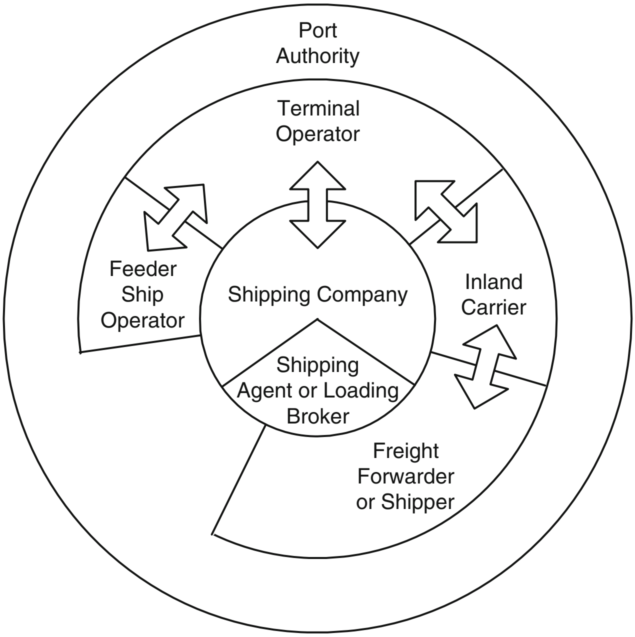

Fig. 2.8 Interorganizational Interaction and Cargo Movement in container trades (Source: Adapted from Martin and Thomas (2001))

- *Terminal operators* today control all ship-to-shore handling operations as well as temporary storage and other container handling operations on their container yards. They integrated virtually all cargo handling operations done before by wharfingers, master stevedores as well as other cargo related handling operations formerly organized by the port authorities.[210] In order to secure smooth cargo movement at seaports, terminal operators had to completely redesign existing dock structures, invest heavily in suprastructure (e.g. specialized container

about differences between handling of containerized and non-containerized cargo at seaports is beyond of the scope of this work.

[210]See Herber (1999, pp. 173–175), Breitzmann (2000), Pumpe (2000, p. 39), Stopford (2000, pp. 29–32), Peters (2001, pp. 17–25), Martin and Thomas (2001, p. 287), Notteboom and Winkelmans (2001, p. 84), Juhel (2001), Notteboom (2002, p. 263), Miller (2002, p. 18) or Brooks (2004). The role of port authorities nowadays often resembles more than that of a landlord, just providing infrastructure and granting concessions to one or more terminal operators if they are not stakeholders or solemn owners of terminal operations on their premises. According to Baird (2002, p. 275), in 36% of the seaports responding to a survey of the International Association of Ports and Harbours (IAPH), container terminals are run by private companies and in 34% they are operated by the port authority. Further, 62% of the seaports responding offer information services and 63% warehousing as value added services.

handling facilities) and information processing technology.[211] Some of them are working now as dedicated container terminals, serving only one shipping company, consortia or strategic alliance on basis of an exclusive agreement.[212] Furthermore, they diversified their field of activity to additional services like storing, cleaning, maintaining, stuffing and/or stripping of containers and even engaged in hinterland transports or established inland terminal operations.[213] During the last decade, some terminal operators merged or extended their business considerably by taking over and/or setting up new terminals in other ports in order to offer merely a network of terminals than just to market a single site.[214]

- *Shipping companies* extended their field of operation to cargo handling at sea ports and/or inland operations.[215] Some of them are running their own shipping agencies, at least through partly owned subsidiary companies in order to have more control on the marketing of their services.[216] Furthermore, they are owning a considerable amount of containers shipped and organize hinterland traffic on own account called carrier haulage and then act as a carrier MTO in door-to-door services.[217] Moreover, they have dedicated terminals, some of them even run their own container terminals.[218] In addition to this, shipping

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[211]Cf. Rackwitz (1969, pp. 52–63), Slack et al. (1996, pp. 297–298), Talley (2000, pp. 940–944), Böhme (2000:66–67) or Heaver (2002b, pp. 388–389).

[212]Cf. Evangelista and Morvillo (1999, pp. 32–34), Heaver et al. (2001, p. 298), Notteboom and Winkelmans (2001, p. 74), Haralambides et al. (2002) or Midoro et al. (2005).

[213]Cf. Notteboom (2002, pp. 259–260), McCalla et al. (2004) or Debrie and Gouvernal (2006).

[214]Cf. Peters (2001, pp. 17–25), Notteboom and Winkelmans (2001, pp. 78–83), Heaver et al. (2001, pp. 300–302), Notteboom (2002, p. 260–262), Woodbridge (2002), DVB (2002, pp. 74–75), Midoro et al. (2005), Vanelslander (2005, pp. 20–75), Slack and Frémont (2005), Bichou and Bell (2007), Olivier et al. (2007), Notteboom (2007) or Kummer et al. (2010, pp. 297–298). Prominent examples of this ongoing expansion of terminal operators are Hutchison Port Holding (HPH) from Hongkong, Port of Singapore Authority Corp. (PSA), European Combined Terminals (ECT) of Rotterdam, or the German joint venture of Bremer Lagerhaus-Gesellschaft (BLG) and Eurokai called Eurogate.

[215]Cf. Casson (1986, pp. 23–27), Kindleberger (1993, pp. 173–174), Evangelista and Morvillo (1999, pp. 32–34), Talley (2000, pp. 938–939), Heaver et al. (2000, pp. 365–367), Notteboom and Winkelmans (2001, pp. 74–75), Heaver (2002a, pp. 218–224, 2002b, p. 385), McCalla et al. (2004) Debrie and Gouvernal (2006), Notteboom and Merckx (2006) or Frémont (2009).

[216]Cf. Casson (1986, pp. 22–27), Knudsen (1998, pp. 151–152), Heaver et al. (2001, p. 303), Notteboom and Winkelmans (2001, pp. 74–75), Stapleton and Hanna (2002, p. 6) or Miller (2002, pp. 18–19), McCalla et al. (2004), Notteboom and Merckx (2006) or Frémont (2009).

[217]According to Branch (2000, p. 68) or DVB (2002, p. 72), about 50% of all containers are owned by shipping companies or other freight carriers and the residue are shipper-owned or leased. Following Notteboom and Winkelmans (2001, pp. 75–76), the average share of carrier haulage in European hinterland traffic is about 30% with a maximum of 70% in the United Kingdom and a minimum of 10% for Switzerland.

[218]Especially the container shipping companies Mearsk Line (APM), COSCO, Evergreen und MSC are engaged in terminal operations, see Heaver et al. (2001, p. 302), Heaver (2002a, 2002b, pp. 383–385), Midoro et al. (2005) or Notteboom (2007).

companies offer their services directly to shippers with high shipment volumes, bypassing all intermediary firms in between.[219] This is especially valid for comprehensive door-to-door services as well as third-party logistics packages, often performed by fully-owned subsidiary forwarding companies.[220] All in all, shipping companies seem to have a very strong position in the container shipping industry.

- Nowadays, *shipping agents* and *loading brokers* offering traditional services to ships and cargo as already described in Sect. 2.2.4.1 seem to play a rather diminishing role in the contemporary container shipping industry.[221] Most of them vanished if they were not acquired by shipping companies or diversified their traditional operations of shipping agency and brokerage to third-party ship management and/or NVO services on the main haul.[222] As a NVO, they are providing scheduled shipping services without operating own ships by buying in cargo space or container slots under flat rates and reselling them to shippers.
- *Feeder operators* are connecting main ports or load centres like Hamburg, Bremen/Bremerhaven, Rotterdam or Antwerp on the north range in Europe with smaller ports in Scandinavia, the Baltic States or Russia not called by deep-sea containerships.[223] Moreover, some feeder operators connect inland container depots like Duisburg with these main ports or load centres by scheduled barge services over the River Rhine.[224] These feeder operations are often done on a through transport basis.
- *Inland carriers* like road hauliers nowadays act either as agents in merchant haulage for a shipper or a freight forwarder or as agents for a shipping company itself in the case of carrier haulage.[225] In addition to this, several railway operators are running scheduled block train services to inland container depots or inland terminals for intermodal transports by railway. These railway operators

[219]See Seidelmann (1969, p. 94), Burg (1975, pp. 135–136), Francesetti Cazzaniga and Foschi (2001:17–18) or Frémont (2009). Notably, Davies (1981) reports about forward integrating exporters directly negotiating with carriers in the case of United Kingdom leading to the same result.

[220]Cf. Branch (1998, pp. 188–192), Thorby (2001b), Beddow (2001), Heaver (2002a, pp. 222–224, 2002b, pp. 385–388), Oldenburg (2002), McCalla et al. (2004), Notteboom and Merckx (2006) or Baird (2006) or Frémont (2009).

[221]Cf. Knudsen (1998, pp. 150–154), Eller (2001), Miller (2002, pp. 15–22) or Fiotakis (2005).

[222]See Knudsen (1998, pp. 152–153), Böhme (2000b) or Eller (2001). In the container shipping industry, the classical chartering business is concentrated in Hamburg with a market share of about 75%, see Knudsen (1998) or Holtappels (2006). Further Branch (1998, pp. 293–302), Panayides (1999), Panayides and Cullinane (2002) or Mitroussi (2003, 2004) for a description of third party ship management.

[223]Cf. Ordemann (1996, pp. 89–93), Neuhof (2000), Stopford (2000, p. 375).

[224]Cf. Ordemann (1996, pp. 88–89).

[225]According to Notteboom (2002, p. 259), at least two terminal operators (HPH in Felixstowe and ECT in Rotterdam) own road haulier companies, but it seems to be merely unusual for terminal operators to run road transport operations. Moreover, road hauliers are often small private companies who provide simple for-hire trucking services.

are subject to several ownership structures, often in form of a joint venture with railway companies, terminal operators, shipping companies and/or interest groups of freight forwarders as stakeholders.[226]

Despite this more and more blurring image of ownership structures, co-operation and fields of activities as well as an ongoing process to higher concentration in the container shipping industry, *freight forwarders* still seem to have a steady source of cargo in the case of consolidated shipments and play an important middleman role between shippers and carriers as described in Sect. 2.2.4.1.[227] But they have to improve and diversify their range of services offered to vertically integrated transport operations and add third-party logistics services backed by IT-driven operations in order to allow shippers a one-stop shopping.[228] With more and more shippers asking for door-to-door shipments or forwarding at fixed costs, some freight forwarders even entered the ship brokerage business acting as a NVO on the main haul or providing door-to-door service as a MTO.[229] The freight forwarder issues then own transport documents like a FBL as a contracting carrier.

In order to give a full picture of contemporary container transport operations, different forms of pre- and onward-carriage arrangements have be taken into account, too.[230] First, as indicated already before, pre- and onward-carriage of container shipments can be organized either by the shipping company himself (called "carrier haulage") or someone else (so called "merchant haulage"), including consignor, consignee or freight forwarder.[231] Second, upon the place of loading (so called "stuffing") and unloading (so called "stripping") of a seagoing container, two different forms, namely "less-than-container-load" (LCL) and "full-container load" (FCL) adding up to four different combinations of pre- and onward-carriage can be distinguished as shown in Fig. 2.9:

- If shipments are stuffed and stripped directly at the container terminal or some container packing station nearby, this container shipment is called "LCL/LCL,"

[226]See Heaver et al. (2000, pp. 365–366), Notteboom (2002, pp. 41–43), Lennarz (2001), Heaver (2002a, p. 220–222) or Kummer et al. (2010, pp. 325–328) with further references.

[227]Cf. Rackwitz (1969, pp. 77–82), Seidelmann (1969, pp. 93–95), Seidenfus (1973, pp. 4–5), Heaver et al. (2000, p. 369), Cazzaniga Francesetti and Foschi (2001, pp. 18–19) or Lorenz (2005, pp. 492–494). DSLV (2005, p. 17) estimates that about 75% of general cargo leaving Germany are despatched by freight forwarding companies.

[228]Cf. Dehn (1987, pp. 15–17), Seidelmann (1969, pp. 94–95) or Heaver (2002b, pp. 380–382).

[229]Cf. Seidelmann (1969, pp. 94–95), Seiler (1981, pp. 82–84), Geuther (1990, pp. 36–37) or Wolf (2000b, 2000c). Further, see Herber (1999, pp. 243–244), Nielsen (2000) or Kehagiaras (2004) for a more comprehensive treatment of legal issues.

[230]See Ordemann (1996, pp. 103–105), Jaeger and Laudel (2003, pp. 204–206), Biebig et al. (2004, pp. 272–286) or Lorenz (2005, pp. 465–470) for the following and a more elaborated description, including cost and freight issues in container transport operations.

[231]In addition to this, there can occur some mixed arrangements, where e.g. the carrier forwards an empty container to the consignor with the next steps organized in form of merchant haulage, see Ordemann (1996, p. 103–104).

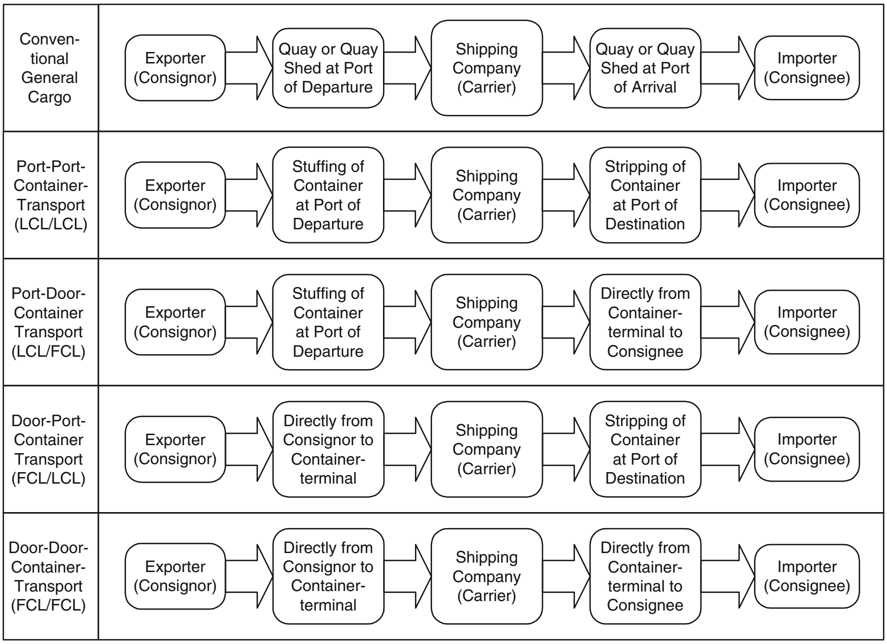

Fig. 2.9 Forms of container traffic (Source: Kummer et al. (2010, p. 294))

indicating a solely port-to-port container transport. An example are shipments of freight forwarders in groupage service.

- Next, “LCL/FCL” are called port-to-door container transports with a container stuffed at the port of departure before the cargo is shipped. At the port of destination, the container is directly delivered to the premises of the consignor. This combination is occurring, if a freight forwarder collects small amounts of cargo in favour of one consignor and then ships them to him in one container.
- Door-to-port container transports are called “FCL/LCL,” where shipments originating from one consignor are stuffed in a container for different consignees at the consignors’ premises and therefore have to be stripped and split off at the port of destination before delivery.
- A door-to-door shipment by container is usually abbreviated by “FCL/FCL,” because the container content is normally untouched on the whole distance from the consignor’s to the consignee’s premises.

The actual modal split of pre- and onward-carriage of cargo summing up to the hinterland traffic of a seaport heavily depends on geographic location and proximity to potential shippers.[232] In Hamburg, a lot of short distance road haulage is done due to a high amount of local consignors or consignees, while long distance

[232]Cf. Ordemann (1996, pp. 84–87) or Notteboom (2002, pp. 32–36).

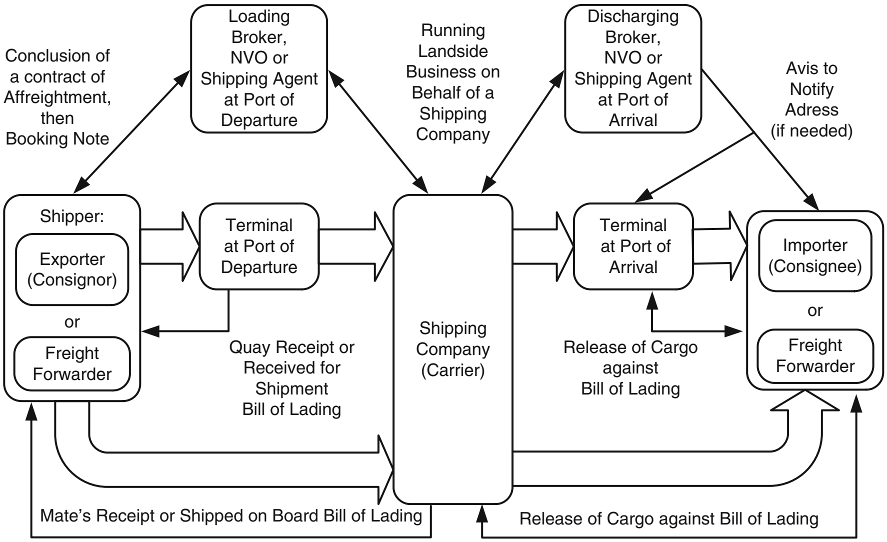

Fig. 2.10 Cargo and documentation flows in sea transport operations. (Source: Kummer et al. (2010, p. 276))

hinterland traffic is mainly served by scheduled block train services. The seaports of Bremen and Bremerhaven have not so many local sources of cargo, so most of the hinterland traffic is done by railway operators to more distant locations. Due to geographic reasons, road haulage is the dominant mode of pre- and onward-carriage of containers in the United Kingdom, whereas in Rotterdam and Antwerp, the most prominent modes in hinterland traffic are road haulage followed by barge operations.

Before switching to air transport operations, it is worth to have a closer look at the cargo and documentation flow for seagoing cargo as shown in Fig. 2.10 in order to clarify the freight forwarder's function in the documentary flow of seagoing shipments in connection with B/Ls.[233] First, the unimodal transport case is briefly described, before the through transport concept and multimodal transport chains are discussed.

In an unimodal port-to-port transport, a freight forwarder usually works as the shipper's agent in despatching outgoing shipments, normally based on a forwarding contract. Alternatively, a freight forwarder himself is the consignor of a shipment like in the case of cargo consolidated by him and shipped on own account. In both instances, he usually concludes a contract of affreightment with a shipping agent, a loading broker or a NVO and gets a booking note fixing this agreement as a document of evidence. Principally, the following delivery of cargo at the port of

[233]See Herber (1999, pp. 242–249), Jaeger and Laudel (2003, pp. 230–208) or Lorenz (2005, pp. 471–481) for a more detailed treatment.

departure can be done to a terminal operator or directly to the berth alongside a ship. Upon delivery of cargo, the freight forwarder as a shipper gets either a quay receipt or a mate's receipt, on which basis a B/L is issued by the terminal operator, the shipping company or his shipping agency later on. Sometimes, these dock receipts or mate's receipts are not issued in favour of a B/L at once and offered to the shipper. According to a speciality in German as well as Austrian national maritime law, the term 'shipper' in this context is called "Ablader" and refers to another third party not participating necessarily in the contract of affreightment.[234] Following § 642 HGB or § 642 UGB, he has the right to ask for a B/L according to specifications stated by him after the shipment is stowed onboard a ship (called "Shipped-Onboard Bill of Lading") or received for shipment at the port of departure (called "Received-for-Shipment Bill of Lading"). Being a document of title, these B/Ls issued represent the shipment in transit and can therefore be used as a vehicle to transfer title from one person to another.[235] At the port of destination, any beneficiary person can then release the shipment as described in the B/L either directly from the shipping company or some terminal operator. As often this function as a document of title is not needed any more like in the case of pure intra-firm trade, more and more sea waybills (SWBs) are issued being non-negotiable documents of evidence.[236]

If seagoing cargo is shipped on a door-to-door basis, principally three different approaches in terms of contractual scope and liability can be followed. First, a *series of unimodal transport contracts* can be closed e.g. by a freight forwarder on behalf of shipper for each phase and mode of transport following one after another in a transport chain.[237] At each transhipment point, shipments are then re-expedited under a new contract of carriage. Having a separate unimodal transport contract in each of these subsequent phases, liability of each performing carrier follows its mode-specific legal provisions. Second, a *through transport contract* can be closed between a shipper and a contracting carrier, where the contracting carrier enters into subsequent contracts of carriage with each performing carrier, if he does not transport the shipment by own means.[238] When doing this, usually a "Through Transport Bill of Lading" is issued by the contracting carrier on the main haul, covering the whole transport chain from source to sink.[239] By issuing such a through transport document, he undertakes responsibility for the shipment only when he

[234] Cf. Trappe (1995, pp. 322–324), Herber (1999, pp. 247–249), Jaeger and Laudel (2003, pp. 225–226) or Lorenz (2005, p. 450).

[235] See e.g. Jaeger and Laudel (2003, pp. 236–238).

[236] See Puttfarken (1997, p. 172), Jaeger and Laudel (2003, p. 256), Lorenz (2005, p. 479) or Kummer et al. (2010, p. 278).

[237] Cf. Müller-Feldhammer (1996, pp. 8–9), Puttfarken (1997, pp. 174–175) or Clarke (2002).

[238] Cf. Schlichting (1931, pp. 61–64), Mayer (1933, p. 32), Müller-Feldhammer (1996, pp. 7–8), Faber (1996, p. 503–504) or Puttfarken (1997, pp. 173–179).

[239] See Müller-Feldhammer (1996, pp. 262–266), Wolf (2000b) or Lammich (2000). According to Müller-Feldhammer (1994, p. 272), this approach was a common practice up to the 1960s.

has actual control on it or he faults in making arrangements with other performing carriers. In the case of loss, damage or delay of cargo, the owner of a shipment has then always to identify at which stage it occurred in order to address his claim directly to the actual performing carrier.[240] The third approach is a *multimodal transport contract*, where a MTO takes full responsibility for the entire transport chain from source to sink employing different means and modes of transport.[241] The transport document issued by the contracting carrier is then a "Multimodal Transport Bill of Lading" like the FBL from FIATA in the case of a freight forwarder.[242] Depending on the GT&Cs underlying such a multimodal contract, at least two different liability regimes can be distinguished.[243] First, a uniform liability system may be established, where in every stage of a multimodal transport chain the same provisions are imposed, irrespective of the mode of transport actually employed.[244] Another approach to liability under a multimodal transport contract is the network liability system, where either existing mode-specific liability provisions are applied if the place where delay, loss or damage of a shipment occurred is known or a uniform liability is imposed if it is virtually unknown.

2.2.4.3 Contemporary Air Cargo Transport Operations

Contemporary air cargo transport operations can be divided into three distinct market segments:[245]

- Traditional air cargo logistic chains, with a close co-operation between freight forwarders, airlines and their respective cargo agents mainly within the IATA agency system.
- A charter market for air cargo operations usually performed outside the IATA agency system.
- Integrated air cargo logistic chains run by one single operator, usually called "integrator."

In *traditional air cargo logistic chains*, there is a clear distinction drawn between surface and air transport operations backed by the IATA agency system of IATA

[240]If not a directly responsible performing carrier can be found, then the liability is determined by the applicable transport law of the contracting carrier issuing the through transport document. As Müller-Feldhammer (1994, p. 272) notes, this approach was rather insufficient.

[241]Cf. Müller-Feldhammer (1996, pp. 10–22), Faber (1996, pp. 503–504), Slack (1998, pp. 276–277), Wolf (2000c), Spera (2002, pp. 256–261) or Jaeger and Laudel (2003, p. 235).

[242]Cf. Müller-Feldhammer (1996, pp. 267–274), Beamer-Downie (1999, pp. 75–82), Wolf (2000a, 2000c), Lammich (2000) or Jaeger and Laudel (2003, p. 235).

[243]Cf. Faber (1996, pp. 507–508) or Müller-Feldhammer (1996, pp. 275–279).

[244]Such an uniform system of liability was first proposed in the "UN Convention on International Multimodal Transport of Goods" of 1980.

[245]Cf. Gompf (1994, pp. 20–43) or Kummer et al. (2010, pp. 307–316).

approved cargo agents.[246] Freight forwarders usually hold contacts to shippers, organize pre- and onward-carriage and despatch air cargo shipments to IATA cargo agents whereas airlines restrict their operations on the main haul by air.[247]

Apart from this institutionalized system of the traditional air cargo logistic chain within the IATA agency system, there exists a considerable huge *charter market* for air cargo capacity, too. One segment of this charter market are full charter and split charter of pure freighters in non-scheduled flight operations, often employed by freight forwarders.[248] This charter market is dominated by non-IATA airlines, because IATA airlines usually restrict themselves not to perform too much split charter operations in order not to cannibalize their scheduled flight operations. With an ever rising demand for air cargo space, today these non-scheduled charters are performed on a regular basis and resemble therefore to scheduled ones. The other segment are highly specialized air transport operations outside the IATA agency system dominated by air freight brokers or general sales agents, like ad hoc charter of aircrafts and air transport of heavy-lift shipments.

Offering fast and reliable time definite services for small shipments, *integrators* follow the strategy of controlling virtually all stages of the logistic chain.[249] They collect shipments at pre-carriage, organize main haulage via own hubs and deliver it at pre-carriage as a fully integrated door-to-door service run by own means. But today, they are also important buyers of air cargo capacity on scheduled flights of passenger, combination and cargo airlines, especially on destinations, where volumes do not justify employment of their own aircrafts.[250]

Looking at the inter-organizational interaction and cargo movement at airports as shown in Fig. 2.11:[251]

- *Airport authorities* are usually state- or municipal-owned institutions, but recently a lot of them got at least partly privatized.[252] At minimum, they provide traffic management for all flight operations, onside infrastructure and basic services for transhipment of passengers, their luggage, mail and freight.[253]

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[246]Cf. Gompf (1994, pp. 21–31), Opgenhoff (1997, pp. 7–8), Vahrenkamp (2002, p. 16) or Schüller (2003, pp. 16–20).

[247]Wood et al. (1995, p. 146) comments this co-operation with "If direct airlines are the wholesalers of space, forwarders are the retailers. They are indirect air carriers."

[248]Cf. Gompf (1994, pp. 31–37) or Lorenz (2005, p. 536).

[249]Cf. Gompf (1994, pp. 37–43), Opgenhoff (1997, pp. 20–23) or DVB (2001, pp. 15–16).

[250]Cf. Opgenhoff (1997, p. 24) or DVB (2001, p. 14). On the other hand, they market their excess capacity to other airlines in order to improve their load factors.

[251]Cf. Rössger (1960, pp. 16–18), Windisch (1996, pp. 22–28), Gompf (1994, pp. 44–58), Opgenhoff (1997, pp. 9–27), Becker (1999, pp. 35–39), Albers (2000, pp. 23–26) or Schüller (2003, pp. 27–35). Further, see Bey (1972, pp. 17–22), Arndt and Kinkeldei (1978, pp. 4–18), Smith (1974, pp. 158–178), Ashford et al. (1997, pp. 286–293) or Grandjot (2002, pp. 130–138) with special reference to documentation flow and physical handling of air cargo shipments at airports.

[252]Cf. Graham (2002, pp. 9–52).

[253]Cf. Gompf (1994, pp. 114–115), Bender (2000), Grandjot (2002, pp. 128–129) or Maurer (2003, pp. 97–100).

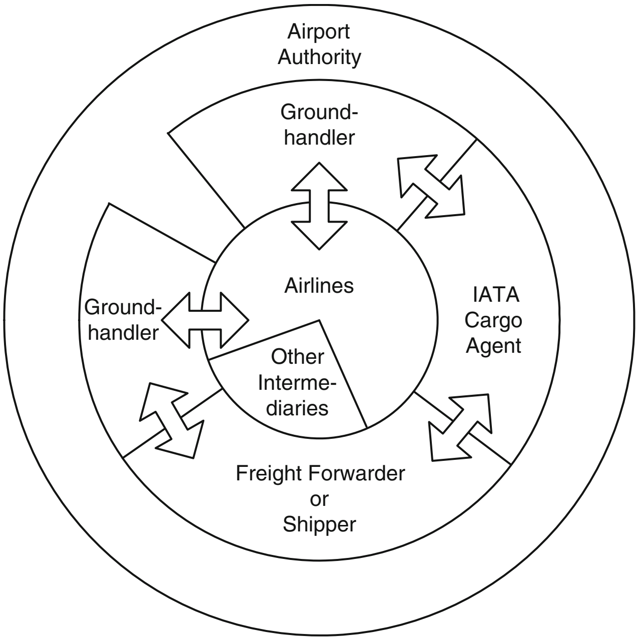

Fig. 2.11 Interorganizational interaction and cargo movements at Airports

- *Ground handler* or ground handling agents are performing all kinds of handling operations at an airport, like despatch and onside transport of passengers, luggage, mail and freight as well as all ramp services needed for supply or maintenance of aircrafts.[254] Their ownership structure is quite diverse: Some are airport-owned, airline-owned or independent third-party service providers. For a long time, at most European airports these handling services were offered only by one to two ground handlers at each airport in addition to ground handling operations focused on forefield done by incumbent airlines. But with Regulation (EC) 67/1996, ground handling services had to be liberalized, so that today this market segment is quite competitive with specialized third-party service providers like Menzies World Cargo, Swissport Cargo Services Ltd. or Globeground-Servisair operating on several airports at the same time.[255]
- *Airlines* are the carriers on the main haul, employing belly capacity of passenger aircrafts as well as pure freighters. Usually, they are not engaged in surface related operations, but some airlines today want to play a more active role in

[254]See Grandjot (2002, p. 129). Further Ashford et al. (1997, pp. 159–184), Kunz (1999), Pflugbeil (2000), Maurer (2003, pp. 97–100) or Templin (2007, pp. 21–58) for a more elaborated overview.

[255]Cf. Graham (2002, pp. 116–118), Maurer (2003, pp. 19–21), Wieske-Hartz (2004, p. 43), Conway (2005a) or Templin (2007, pp. 58–94).

the air cargo logistic chain.[256] Doing this, they arrange pre- and/or onward-carriage of shipments (usually called airline trucking), despatch at the airports on own account or through their respective agents and market this directly to shippers. Another aspect of surface operations are extensive road-feeder-services run by several airlines in Europe in order to feed their main hubs with cargo as discussed in Sect. 2.2.3.2.

- *IATA cargo agents* handle air cargo shipments as commission agents on behalf and account of the IATA-airlines based on an agency contract between the agent and the IATA in concordance to the IATA-Resolution 805r (or 805re in the special case of the European Common Aviation Area (ECAA)).[257] They are allowed to book cargo space, prepare air cargo shipments and documentation "ready for carriage," organize insurance coverage upon request and issue air waybills (AWBs) on behalf of the airlines. For this agency service, they are paid a fixed percentage on freight and ancillary costs of these air cargo shipments to attract traffic and to reimburse them for services offered. Most of these IATA cargo agents are at the same time freight forwarding companies specialized in air freight operations, so that many authors unfortunately draw no clear distinction between them.[258] Moreover, as in the new European Air Cargo Programme (EACP) freight forwarders and other forms of cargo agents working under IATA Resolution 805re are subsumed under the label "IATA cargo intermediaries," the differences seem to blur more and more.[259] But for the purpose of this work, freight forwarding and IATA cargo agency operations are clearly separated, because not every freight forwarder engaged in air cargo operations has an IATA cargo intermediary status.
- At least two *other intermediaries* can be mentioned. First, *air charter brokers* match supply and demand on air charter markets as independent middlemen.[260] On the demand side there are shippers or freight forwarders as their agents and

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[256]Cf. Mosler (1993), Gompf (1994, pp. 52–53), Opgenhoff (1997, pp. 17–18) or Grandjot (2002, p. 129–130).

[257]Cf. Rössger (1960, pp. 18–20), Mittendorf and Oelfke (1974, pp. 283–287), Weisskopf (1984, pp. 130–35), Gompf (1994, pp. 47–49), Wood et al. (1995, p. 150), Becker (1999, pp. 38–39), Trommer (2000a) or Lorenz (2005, pp. 532–533). Recognizing the changing needs and circumstances in the ECAA, IATA started in 2004 a special European Air Cargo Programme (EACP) in cooperation with IATA member airlines and intermediary representative organizations, see IATA (2004) for further details.

[258]Cf. Rössger (1960, pp. 17–18), Dehn (1987, pp. 19–20), Windisch (1996, pp. 22–23), Becker (1999, p. 38–39), Albers (2000, p. 25), Grandjot (2002, p. 128), Bowen and Leinbach (2004) or Neiberger (2007, 2008).

[259]According to IATA-Resolution 823: "'AGENT' (sometimes referred to as 'IATA Cargo Agent') means a legal person which is a registered IATA Cargo Agent whose name is entered on the Cargo Agency List, having executed an IATA Cargo Agency Agreement having been adjudged to have met the registration and retention criteria as specified in the Cargo Agency Rules. This term also includes European Air Cargo Programme Intermediaries who conduct transactions in accordance with Part 1 of the European Air Cargo Programme form of Cargo Intermediary Agreement."

[260]Cf. Mittendorf and Oelfke (1974, pp. 280–282), Odrich (1998, pp. 93–95) or Trommer (2000b).

on the supply side airlines. They are usually employed if there is a need for an ad hoc charter agreement. Second, there are numerous *general sales agents* (GSAs), who run agency services for one or more airlines within a defined territory.[261] This allows airlines to achieve cost-effective presence in markets where it is uneconomic for them to maintain its own sales force and premises. Recently, the IATA offered them the chance to apply for certification as a *general sales and service agent* (GSSA) based on IATA-Resolution 871 as most GSAs are not longer simple sales offices but offer a wide range of on-site services to the airlines.

Apart from the IATA cargo agents, *freight forwarders* are the most important partners for airlines in the traditional air cargo logistic chain.[262] In this environment, a freight forwarder acts as an independent company either as the agent of a shipper or as a cargo consolidator in groupage service on own account.[263] As already indicated above they are quite often at the same time approved IATA cargo agents, working on commission basis for IATA airlines.[264] As the agent of a shipper, the freight forwarder books cargo space on aircrafts, organizes delivery of cargo to the airport of departure, despatches shipments and handles transport documentation. In the case of consolidated cargo, he usually acts on own account, collects smaller shipments from different shippers and issues for each of them its own AWB called “House AWB” as a contracting carrier.[265] Then he forwards the consolidated shipments as a shipper under his name with one AWB called “Master AWB.” At the airport of destination, an own subsidiary or a correspondent breaks up this consolidated cargo for delivery. The difference between the freight rate offered by the airline to the forwarder and the forwarder’s own tariff rate to the shipper is then the forwarder’s gross yield from such cargo consolidation operation, so that most freight forwarders are engaged in consolidated air cargo shipments.[266] To support this cargo consolidation function, there exist horizontal alliances of small and medium sized freight forwarders like Future, Challenge Air Cargo Experts, German Airfreight Partners (GAP), Interessengemeinschaft Luftfracht GmbH (IGLU) or

[261]Cf. Seiler (1981, p. 82), Trommer (2000b) or Mosler (2002).

[262]According to estimates by DSLV (2005, pp. 17–19), 98% of all air cargo departuring Germany is despatched and delivered “ready for carriage” by freight forwarding companies with an overwhelming share being consolidated shipments. Further, 75% of air cargo in import is handled by them, too.

[263]Cf. Rosenthal (1950, pp. 438–439), Smith (1974, pp. 178–184), Weisskopf (1984, pp. 132–135), Schumacher (1987, pp. 149–150), Gran (1996), Gompf (1994, pp. 48–49), Bachmeier (1999, pp. 69–78), Trommer (2000c), Grandjot (2002, pp. 99–101), Schüller (2003, pp. 29–31) or Lorenz (2005, p. 533–535).

[264]Cf. Dehn (1987, pp. 19–20) or Gompf (1994, pp. 46–49). So they serve a dual role, being an agent for both shipper and airline, see Rössger (1960, p. 20) or Gompf (1994, pp. 113–114) with further comments.

[265] Cf. Gran (1996), Becker (1999, pp. 33–35), Trommer (2000a, 2000c), Branch (2000, pp. 133–135) or Lorenz (2005, pp. 534–535).

[266]Cf. Smith (1974, pp. 179–180) or Becker (1999, pp. 50–51).

World Cargo Organization (WACO) and Worldwide Independent Network (WIN) to name a few.[267] The main objects of these freight forwarder alliances is to pool their air cargo volumes and consolidate it under one common shipment for each destination in order to reach better freight rates, but recently further co-operation seems to be under way.

According to Opgenhoff (1997, pp. 13–19), Bowen and Leinbach (2004) or Neiberger (2007), the freight forwarder business in air cargo operations falls in two main groups, with small, highly specialized forwarding companies focused on air cargo transport on one hand and big forwarding companies offering more integrated air cargo services, including transport, warehousing, packaging and other value added services as a full-service package under their own branding on the other.

Integrators incorporate all these above operations done otherwise by freight forwarders, air freight brokers, IATA cargo agents and ground handlers in order to have full control of their integrated air cargo logistic chain.[268] By expanding into heavier shipments and offering third-party logistics services, they started to enlarge their base of operations in the 1980s.[269] Therefore, they are considered to be the most threat to both airlines and freight forwarders in the air cargo industry today.[270]

Another active player in the air cargo industry is a small but increasing number of shippers with considerable high volumes of air cargo, which deal directly with airlines, holding separate agreements with freight forwarders or other surface carriers for pre- and onward-carriage.[271]

According to pre- and onward-carriage of air cargo shipments, a distinction must be drawn between single air cargo shipments and ULDs in a door-to-door-service with the later increasing in importance on main routes.[272] Being often consignments of small volume and high urgency, single air cargo shipments are delivered or picked up at the airport directly by the shipper, consignee or consignor (see Fig. 2.12). Alternatively, they are transported in cartage service performed or organized by freight forwarders. Due to specialized equipment needed for the carriage of ULDs

[267]Cf. DVB (2001, pp. 30–31), Mosler (2001), Schüller (2003, pp. 38–39), Siegmund (2007) or Neiberger (2007). Following Rössger (1960, pp. 26–28), this is not a recent development because already in 1951, freight forwarders at Hamburg joined together in a "Frachtenkontor" in order to pool their air cargo shipments. This business practice was adopted by other freight forwarders in the air cargo industry within a short time and was finally legalized by the IATA in 1954.

[268]Cf. Schneider (1993, pp. 91–128), Windisch (1996, p. 27), Opgenhoff (1997, pp. 20–23), Bachmeier (1999, p. 78–81), Grandjot (2002, pp. 102–103), Vahrenkamp (2002, pp. 18–20) or Schüller (2003, pp. 33–35).

[269]Cf. Schneider (1993, pp. 52–54), Gutthal (1999, pp. 25–27), Bess (1996, pp. 33–63), Bjelicic (2000) or DVB (2001, pp. 32–33).

[270]Cf. Thaler (1990, pp. 104–109), Gran (1996), Bjelicic (2000) or Grandjot (2002, pp. 97–98).

[271]Cf. Gompf (1994, p. 116), Gran (1996), Opgenhoff (1997, pp. 24–26) or DVB (2001, p. 13).

[272]Following Steiger (2006), 33.0%–48.8% of all air cargo shipped between North America, Europe and the Asia-Pacific region are so-called "Build-up Units" – ULDs containing consolidated cargo delivered to the airport "ready for carriage" by freight forwarding companies.

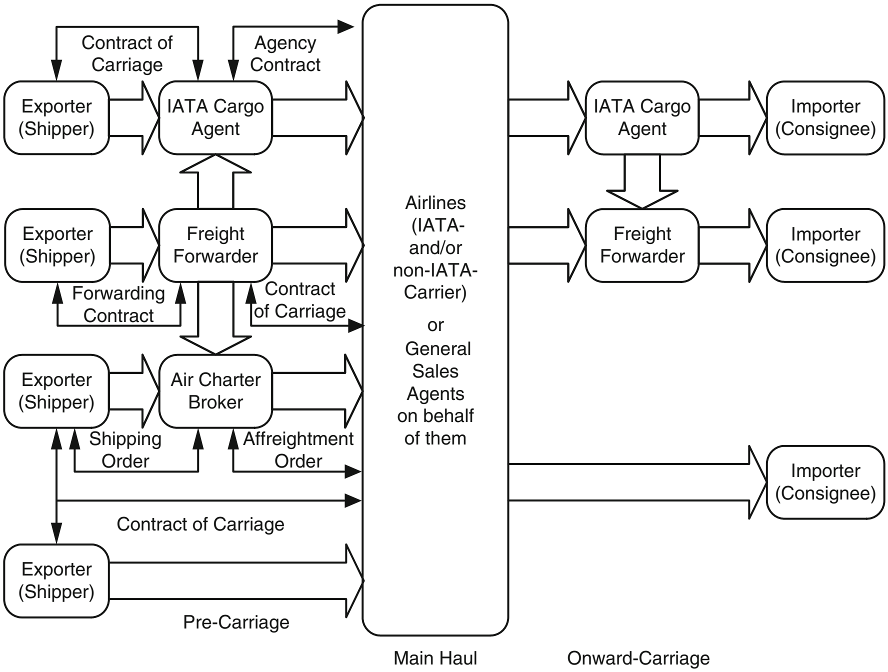

Fig. 2.12 Cargo flow and contractual relationships in air transport operations (Source: Kummer et al. (2010, p. 308))

in a door-to-door service, pre- and onward-carriage of such unitized shipments is generally performed or organized by freight forwarders.[273]

2.3 Summary and Concluding Remarks on the Functional Perspective

The findings of this part of the book can best be summed up along four environmental effects called (1) cargo structure effect, (2) integration effect, (3) (de)regulation effect, (4) logistics effect as shown in Table 2.3. They were first formulated by Gerd Aberle by describing the ongoing development of transport markets including the freight forwarding business.[274]

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[273]Usually, an ULD can be picked up at the airport up to 48 h in advance free of charge in order to be build up at the premises of a shipper or freight forwarder, whereas on the onward-carriage leg, the ULD can be again brought outside the airport for 48 h before a detention charge is raised, see Smith (1974, p. 170).

[274]Cf. Aberle (1989), but similar statements can be found in Matthäi (1981, 1991), Murphy and Daley (2001), Lorenz (2005, pp. 82–84) or Markides and Holweg (2006), too.

Table 2.3 Environmental effects on freight forwarding business

Level of analysis	Cargo structure effect	Integration effect	(De)regulation effect	Logistics effect
Economy and Trade	Less bulky goods and raw materials, more high valued industrial products	Building up regional trading blocks and political unions	GATT negotiations lowering trade barriers now institutionalized with WTO	From seller to buyer markets
		Free circulation of people, goods, capital and services	Increasing flexibility needed to stay in an ever volatile market environment	
Transport Industry	Changes in modal split smaller shipment sizes and more frequent transports	Increased cross-border economic activities	Widespread deregulation of transport markets in the USA and EU	Cost focus set on logistics
	Standardization of handling and transport operations	Geographic dispersion of supply chains	Heavy price competition	New logistics concepts for procurement, manufacturing and distribution
Forwarding Business	Opportunities of specialization to improve quality and service levels	Integrated multimodal transport chains	New entrants	Tailored logistics solutions including value added services in information processing
		International expansion of operations	Alliance building and/or mergers and acquisitions activities	

First, a *cargo structure effect* can be observed since the 1960s, originating from a change in production structure and resulting in a shift from low value bulky goods and raw materials to high value industrial products as an object of transportation.[275] This had a decisive impact on the modal split with an ever increasing amount of road transport and air cargo against railway and inland navigation losing ground. Another aspect often referred to are smaller shipment sizes coming along with more frequent transports, which supported a standardisation of handling and transport operations through palletization and containerization of cargo. This in turn had a tremendous

[275]Cf. Aberle (1989, pp. 6–7, 2003, pp. 91–94).

impact on market structure and operations on all transport markets with the freight forwarding business offering opportunities in specialization on (de)consolidation of cargo or documentary paperwork to improve their quality and service levels.

Referring to the *integration effect*, several different levels of integration have to be distinguished. On the world level, lowering trade barriers in the framework of the *General Agreement on Tariffs and Trade* (GATT) boosted international trade on a world wide scale. On a country level, establishment of trading blocks like the EC, EFTA, NAFTA with an almost free circulation of people, goods, capital and services led to increased cross-border economic activities.[276] This favoured a geographic dispersion of supply chains, which impacted the level of transport industry considerably: Cross-border cargo flows need reliable transport operations so that shippers of cargo increasingly switched to door-to-door delivery and one-stop shopping.[277] Therefore, more or less vertically integrated multimodal transport operations were demanded, where international freight forwarding companies seem to be key players.[278] Moreover, they expanded considerably their operations on an international scale in order to meet their shipper's requirements.

Apart from the already above mentioned (de)regulation of trade through GATT negotiations now institutionalized with the *World Trade Organization* (WTO), a (de)regulation of transport markets took place in the United States beginning in the 1970s and in the European Union in the late 1980s.[279] Both led to an ongoing excessive price competition among existing players, which is widely considered to be the (*de*)*regulation effect*. In addition to this, it allowed market entry of new players like integrators in the air cargo industry, worsening things even more. Moreover, heavy alliance building and/or merger and acquisition activities are a common feature not only in sea or air transportation markets: Since the mid 1990s, the freight forwarding business seems to be in an ongoing consolidation phase, too.[280]

Last but not least, the *logistics effect* is a logical step of shippers seeking for rationalization and cost-cutting potentials due to a change of environment from

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[276] Cf. Seidenfus (1973, p. 2), Aberle (1989, p. 8, 2003, pp. 96–98) or Thaler (1990, pp. 110–126).

[277] See e.g. Suelflow and Hille (1970), Dehn (1987, pp. 15–40), Semeijn and Vellenga (1995) or Aberle (2005, pp. 380–381).

[278] Cf. Beplat (1970, pp. 128–131, 143–156), Davies (1981), Matthäi (1991), Murphy et al. (1992), Murphy and Daley (1995, 1996a, 1996b, 2001), Gran (1996), Cazzaniga Francesetti and Foschi (2001), Heaver (2002b), Lorenz (2005, pp. 74–79) or Neiberger (2007, 2008).

[279] Cf. Aberle (1989, pp. 8–8, 2003, pp. 170–229, 2005, p. 380), Schachinger (1989), Simon (1993, pp. 58–94), Opatz (1994, pp. 17–73), Bess (1996, pp. 29–63), Button (2001) or Neiberger (2008).

[280] See various trade press contributions like Knee (2001), Conway (2005b), Cullen (2006) or MergeGlobal (2008a) commenting actual industry development as well as Dörrenbacher (1990), Burckhardt et al. (1998), Plehwe (1999), Klaus (1999), Ludvigsen (2000), Lemoine and Dagnæs (2003), Bowen and Leinbach (2004), Wettbewerbsverein (2004), Neiberger (2008) or Schramm and Niedermaier (2008a, 2008b) discussing this phenomenon.

seller-driven to buyer-driven markets.[281] Furthermore, introduction of new logistical concepts for procurement, manufacturing and distribution raised a demand for more flexible but time-sensitive transport operations and value-added services of information processing.[282] A logical consequence of this development was then an outsourcing of logistics functions to third-party logistics services, which offer tailored solutions including a wide range of value-added activities. This is still a booming market with big opportunities for all companies who want to participate.

Coming back to the freight forwarding business in multimodal transport chains with a leg by sea or air as the focus of this work, the following conclusions can be drawn:

- In ocean shipping operations a freight forwarder is a freight forwarder in the very legal sense: He organizes shipment of cargo and serves as an agent for shipper, consignor or consignee. This is well documented in contributions like Schlichting (1931, p. 6), Securius and Böning (1941, pp. 59–60), Mittendorf and Oelfke (1974, p. 241), Schumacher (1987a, pp. 148–149), Murr (1979, p. 18–22), Branch (2000) or Dischinger et al. (2005, pp. 268–269) describing activities of a freight forwarder in ocean shipping operations.
- In air cargo operations a freight forwarder is the quite natural partner of airlines in the IATA-system: Whereas air cargo freight forwarders deal with virtually all aspects of transport organization, the airlines are the performing carrier. This picture is reinforced by contribution of e.g. Weisskopf (1984, pp. 110–150), Schumacher (1987a, pp. 149–150), Bowen and Leinbach (2004) or Neiberger (2007, 2008).

Moreover, in terms of role theory as outlined in Sect. 1.2 it can be stated that a freight forwarder in multimodal transport chains with a leg by sea or air seems to be "The Architect of Transport" positioned between shipper, consignor or consignee as well as other participants of such multimodal transport chains and its role-set is well defined by legal status (at least in Germany, Austria or Switzerland) and functions served according to FIATA (1975) with two notable additions by the author (namely quasi-banking and transport function). Finally, this view is reinforced if we look at actual fields of activity and specialization in forwarding business in Germany (BSL (2000), DSLV (2005)) as well as Austria (WIFI (1993)).

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[281] See Welker (1988, pp. 12–26), Aberle (1989, pp. 7–8, 2003:94–95, 2005:384–385), Ihde (1989), Niegel (1991, pp. 46–65), Simon (1993, pp. 33–39), Schmidt (1996) or Allen (1997).

[282] Cf. Matthäi (1991), Gompf (1994, pp. 101–112), Aberle (2003, pp. 94–96), Lorenz (2005, p. 79–82) or Neiberger (2007).

Chapter 3
New Institutional Economics, Intermediation Theory, and the Intermediary Perspective

After this merely descriptive approach to forwarding business, a closer, more theoretically grounded work on the functioning of multimodal transport chains as well as intermediary roles and functions of freight forwarders therein is demanded. In the last sections, the market structure was taken for granted and freight forwarders were just considered as being one of many players serving some special functions in transport or logistic chains without looking "behind the scenes." Now, the question "why is it so?" is risen, because if freight forwarders are considered to be important intermediaries in multimodal transport and logistic chains, they cannot be only described from a legal and functional point of view. Therefore, a real intermediary perspective has to be developed, which will be done in the following sections.

First, a focus is set on the pure economic as well as to some extent on the law and economics side of New Institutional Economics (NIE) in order to clarify the role of property rights, transaction and agency costs in real-world economy from an institutional point of view, where imperfections are not exceptional but the rule.[1] Then outcomes of Market Microstructure Theory (MMT) and Intermediation Theory of the Firm (ITF) are thoroughly presented, which provide a theoretical background for an intermediary perspective. Finally, the findings obtained by this approach are applied on the topic of multimodal transport chains in an international environment in order to provide a well theoretically based intermediary perspective of freight forwarding.

[1]These ideas of NIE are wide-spread and were adopted in many disciplines of the social sciences, but to discuss all these schools of thought is far beyond of the scope of this work. Some prominent examples not taken into consideration are e.g. Hayek (1960, 1973) or Buchanan (1975) declaring constitutional law, North (1981) focusing on long-term socio-economic as well as political developments or Picot et al. (2002) describing organizational structures.

H.-J. Schramm, *Freight Forwarder's Intermediary Role in Multimodal Transport Chains*, Contributions to Management Science, DOI 10.1007/978-3-7908-2775-0_3,

3.1 New Institutional Economics

As there is an ongoing battle between advocates of Institutionalism (old and new) and their counterparts favouring (Neo)classical Economics (NCE), a viable starting point of discussion about NIE is to highlight the differences between the NCE and the institutional approach to economics.[2]

Since the introduction of comparative-static analysis by David Ricardo, the world of NCE comes along with a lot of over-simplifying assumptions, like zero transaction costs, full information structures, full rational, profit maximizing individuals acting on markets, which always reach a general equilibrium.[3] Furthermore, as institutions are only considered as some exogenous given constraints, there is a heavy abstraction from contractual relations occurring. Therefore capital structure, ownership structure and the division between ownership and control is regarded to be somehow irrelevant.[4]

3.1.1 Ancedents of the New Institutional Economics

Following authors like Erlei et al. (1999, p. 28), Martiensen (2000, pp. 77–79) or Göbel (2002:48), the roots of Institutional Economics can be even traced back to the classics of economic theory like Adam Smith and David Hume. But thinking of institutions as a central point of departure is better dated back to the mid of the nineteenth century, when in 1843 the Older German Historical School was founded by Wilhelm Georg Friedrich Roscher, later headed and further developed as the Younger German Historical School by Gustav von Schmoller.[5] Both German Historical Schools were the first formulating a comprehensive critique on the NCE and proposed an alternative historical approach in order to derive inductively scientific theory in general economic coherence to solve concrete problems in economics. Another stream of Institutionalism originated in Europe is the Austrian School founded in 1871 by Carl Menger with a long line of successors from Eugen von Böhm-Bawerk, Friedrich von Wieser, Ludwig Edler von Mises, Friedrich

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[2]According to Aspromourgos (1991), the term "neoclassical" was first introduced by Veblen (1900) in connection with the work of Alfred Marshall (as the dominant neoclassical economist at that time, see e.g. Yonay (1998, pp. 29–35). Later on, all formal and marginalist theories in economics were subsumed under this label. In the following, "(neo)classical" is used to subsume nonformal classical as well as formal neoclassical economic theory as the great counterparts of Institutionalism without going in too much details.

[3]See Hutchison (1984) or Kaulmann (1987:1–12) with further references.

[4]Cf. Richter (1991, pp. 398–401) and Richter and Furubotn (2003:7–10).

[5]For this and the following see Hutchison (1984), Backhouse (1985, pp. 85–93, 218–235), Schinzinger (1991), Fusfeld (1991), Erlei et al. (1999, pp. 27–42) or Martiensen (2000, pp. 75–93).

August von Hayek to Israel M. Kirzner and Andrew Schotter.[6] The main focus of their research was on the origins and functioning of institutions. Doing this, they followed a merely theoretical grounded research conception drawing their conclusions by deduction, which resulted in the so-called "Methodenstreit" between Carl Menger and Gustav von Schmoller. Beginning in the late nineteenth century, a quite heterogeneous movement with leading figures like Thorstein Veblen, Wesley Mitchell and John R. Commons evolved in the United States under the label "Institutional Economics," first introduced by Hamilton (1919).[7] Veblen (1898, 1899) was the first social scientist who attempted to develop a theory of economic and institutional evolution essentially along Darwinism lines and provided e.g. with his hard criticism of NCE much of the intellectual inspiration for the US-American Institutionalism (especially in Veblen (1909, 1919)).[8] Mitchell (1913, 1927) concentrated on empirical studies on cyclical fluctuation and aggregate disequilibrium in a money economy and promoted in Mitchell (1925) quantification and empirical measurement as the main methodological aim or criterion.[9] Thinking that there is always a struggle for scarce resources, Commons (1924, 1931, 1934) focused his research mainly on the legal framework of collective economic activity with working rules governing individual behaviour and transactions as the basic unit of analysis.[10]

Although their overwhelming presence in economic research in Germany or Austria in the second half of the nineteenth and the early twentieth century as well as their widespread influence in the United States in the interwar period, the impact of the now called "Old Institutional Economics" (OIE) declined heavily afterwards because of various reasons.[11] Certainly, Institutionalism as a field of economic research was not extincted at all, but their later protagonists like the Freiburg School

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[6] Cf. Kirzner (1991) or Vanberg (1998a).

[7] See Backhouse (1985, pp. 221–235), Samuels (1991), Hodgson (1998), Yonay (1998, pp. 50–76) or Rutherford (2000, 2001) focusing on the US-American stream of Institutionalism. Remarkably, some of these early US-American institutionalists have been heavily influenced by the Younger German Historical School, because they spend some or almost all of their time during graduate studies in Germany, see Backhouse (1985, p. 127), Samuels (1991, p. 864) or Rutherford (2001, pp. 176–177).

[8] Cf. Hodgson (1998, pp. 166–169), Rutherford (2001, pp. 174–176) or Martiensen (2000, p. 87).

[9] Cf. Backhouse (1985, pp. 181–183), Rutherford (2001, p. 177) or Martiensen (2000, p. 88).

[10] Cf. Rutherford (1983), Hutchison (1984, p. 21), Backhouse (1985, pp. 230–235), Rutherford (2000:176, 2001:293) or Martiensen (2000, pp. 88–89).

[11] First, Institutionalism in Germany as well as in Austria was mainly settled in single schools of thought rather than being a broad movement, and the American institutionalists failed to agree apon, let alone develop a systematic theoretical core. Second, their logic underpinnings were partially disabled by a combined result of profound shifts in social science from instinct psychology and pragmatist philosophy to behaviorist psychology and positivist philosophy and a rise of mathematical modelling methods in NCE as well as econometrics for empirical studies, outdating the institutionalism movement as a mainstream of economic thought. Further, more and more extensions to NCE followed later on, like the wide field of Industrial Organization Theory (IOT) reflecting not fully competitive markets as well as Game Theory modelling individual information

around Walter Eucken, the Austrian economists Friedrich August von Hayek, Israel M. Kirzner and Andrew Schotter as well as Clarence E. Ayres and John K. Galbraith in the United States played merely a niche role.[12]

In order to briefly sum up this historical review it can be asserted, that the OIE moved from general ideas concerning human agency, institutions and the evolutionary nature of economic processes to specific ideas and theories, related to specific economic institutions or types of economy.[13] The core ideas of Institutionalism concerning institutions, habits, rules and their evolution was facilitated by a specific and historically located approach to economic analysis.[14] Moreover, as Williamson (1981:550–552, 1985:2–7) showed, startling insights into the nature of economic institutions like Frank Knight, John R. Commons, Ronald Coase, Karl Llewellyn and Chester Barnard were made in the interwar period, which will be discussed briefly in the following section.[15]

3.1.2 Common Assumptions of New Institutional Economics

At least four assumptions can be identified, which crucially matter the contemporary institutional approach to economics, namely (1) individuals are forming institutions as the main focus of interest (2) property rights and other contractual relationships have economic impacts, (3) positive transaction costs are always present and (4) imperfect information structures and bounded rationality have to be taken into

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structures and actions en detail. See Hutchison (1984), Hodgson (1998), Yonay (1998, pp. 184–195), Rutherford (2000:298–301, 2001:182–185) or Hodgson (2003) for further discussion.

[12]See especially Vanberg (1998b), Erlei et al. (1999, pp. 35–38) or Martiensen (2000, pp. 90–93) for the Freiburg School and Backhouse (1985, pp. 373–380) for the Austrian School as well as US-American Institutionalism after 1945.

[13]Cf. Hodgson (1998, p. 168).

[14]Hodgson (1998, pp. 173–174) further summed up the institutional approach as follows:

"First, there is a degree of emphasis on institutional and cultural factors that is not found in mainstream economic theory. Second, the analysis is openly interdisciplinary, in recognizing insights from politics, sociology, psychology, and other sciences. Third, there is no recourse to the model of the rational, utility-maximizing agent [...]. Fourth, mathematical and statistical techniques are recognized as the servants of, rather than the essence of, economic theory. Fifth, the analysis does not start by building stylized facts and causal mechanisms. Sixth, extensive use is made of historical and comparative empirical material concerning socio-economic institutions. In several of these aspects, institutional economics is at variance with much of modern mainstream economic theory."

[15]Notably, only John R. Commons and Ronald Coase can be regarded as "real" institutionalists, while the others have a different background and can be at best regarded as peripheral figures despite their proximity to OIE: Frank Knight was merely a (neo)classical economist, Karl Llewellyn a lawyer and Chester Barnard an organization theorist.

consideration.[16] In the following, this common core of NIE will be discussed along its roots and main initial contributions contrasting NCE.

3.1.2.1 Methodological Individualism and Institutions

A basic assumption of NIE is methodological individualism[17] and therefore, institutions (like societies, states, communities, firms or other forms of organizations) are formed by individuals with different preferences, goals, intents or ideas.[18] As there is a long scientific history of thought dedicated to institutions and their various outcomes, a myriad of definitions and interpretations of institutions were raised, which provide at the same time a demarcation line between NCE and the different streams of Institutionalism.[19] Following e.g. Rutherford (1983, p. 722), (neo)classical economists usually treat institutions as "[. . .] having the role of given *constraints*. On the other hand, institutionalists have tended to be more concerned with questions of institutional change and many have emphasized the *instrumental* role of institution." Furthermore Williamson (1998a, p. 88) asserted, that "[t]he institutions of principal interest to the NIE are the institutional environment (or Rules of the Game – the polity, judiciary, laws of contract and property [North (1991)]) and the institutions of governance (or play of the game – the use of markets, hybrids, firms, bureaus)."

In a more recent contribution defining institutions as sanctionable expectations in reference to behaviour of one or more individuals, Picot et al. (2002:11–25) provided a conceptual framework of superior and subordinate institutions forming a hierarchical structure. For them, the highest level of this institutional hierarchy

[16]Notably, Hamilton (1919, pp. 312–317) proposed quite similar five characteristics an economic theory must be able to meet, namely (1) it should unify economic science, (2) it should be relevant to the modern problem of control, (3) the proper subject-matter is institution, (4) it is concerned with matters of process and (5) it must be based upon an acceptable theory of human behavior, and to him, all these propositions are met by Institutional Economics.

[17]The term "methological individualism" was originally defined by Schumpeter (1908a:88–98, 1908b), see Erlei et al. (1999, p. 6) or Furubotn and Richter (2003:3) with further explanations.

[18]Following e.g. Furubotn and Pejovic (1972:1137), "[t]he organization [sic!] *per se* is no longer the central focus; rather, individuals are assumed to seek their own interests and to maximize utility subject to the limits established by the existing organizational structure."

[19]See Erlei et al. (1999, pp. 23–27), Göbel (2002, pp. 1–21), Martiensen (2000, pp. 10–20) or Richter and Furubotn (2003:7–8). Some of the very prominent definitions are as follows: According to Veblen (1899), institutions are "[. . .] settled habits of thought common to the generally of men." For Commons (1931, p. 648), institutions are problem solving instruments or mechanisms through which collective control is exercised and therefore he defined them as "[. . .] collective action in control, liberation and expansion of individual action." Schotter (1986:117, as cited in Erlei et al. (1999, p. 23)) considered that "institutions are seen as a set of rules that contain individual behavior and define the social outcomes that result from individual action." And last but not least, Furubotn and Richter (2003:7) defined institutions as a system of mutually bounded explicit (formal) or implicit (informal) rules (norms) including their enforcement.

consists of human rights, basic social rules and norms, language and money which all result from an evolutionary process and therefore cannot be influenced or altered. The lower level institutions are derived ones like law, court judgements, contracts and organizational rules which can be established to restrict individual behaviour. Finally, there are constitutional institutions in between, which arise out of social contracts closed between individuals codifying common rules and norms. These mutually recognized rules and norms allow then individuals to live together in one society, because they oppose rights and duties on individual behaviour.

3.1.2.2 Property Rights and Other Contractual Relationships

As already indicated in the last section, important topics of contemporary Institutionalism are the existence of specific property right structures and their economic impacts, which led to alternative institutional arrangements with different rights to use (or abuse) given resources.[20] In contrast to this notion of NIE, NCE regards them as a "datum" or something given and therefore they are not of interest.[21]

As various more or less incomplete as well as context-specific approaches can be found in economic literature to define the term "property rights," it seems to be quite useful to start with a merely legal approach.[22] Following Hume ([1739/40] 1978:484–534) and his individualistic view of "human society," there are three "fundamental laws of nature" on whose strict observance the peace and security of such a human society entirely depends: (1) the stability of possession, (2) its transfer by consent, and (3) the performance of promises. Transferring this in more contemporary terms, the legal system of a civil state has to rule at least (1) ownership rights, (2) freedom of contracts and (3) obligations or liabilities from promises as well as illegal actions.[23] According to Richter and Furubotn (2003, pp. 95–105), property rights can be divided into three distinct groups: (1) absolute property rights, (2) relative property rights and (3) other forms of contractual relationships which will be discussed in the following.

[20] Cf. De Alessi (1980, p. 2).

[21] Cf. Demsetz (1967) or Richter and Furubotn (2003, p. 88). De Alessi (1980, p. 2) further asserted, that

"in the process of developing a rigorous statement of the formal theory [. . .] economists gradually eliminated institutional constraints from considering by assuming either explicitly or implicitly, that all rights to the use of resources were fully allocated, privately held, and voluntarily exchanged at zero information and transaction (negotiating, contracting, and policing) costs."

[22] See Kaulmann (1987:14–15), Tirole (1999, pp. 742–742), Martiensen (2000, pp. 221–223), Richter and Furubotn (2003:16–18) citing some definitions from economic literature.

[23] Cf. Richter and Furubotn (2003, pp. 16–18). Moreover, Posner (1998, p. 35) showed a similar view of things, as he divided Anglo-Saxonian Common Law into three main parts, namely (1) the Law of Property, (2) the Law of Contracts, and (3) the Law of Torts.

Absolute Property Rights

First, there are absolute property rights, or ownership rights, which are a permission to use, enjoy and dispose of things fully and freely subject to the limits and conditions for doing so determined by law, like clearly stated in the case of § 903 DBGB.[24] This imposes, as Posner (1998, p. 38) asserted from an economic point of view, "that if every valuable (meaning scarce as well as desired) resource were owned by someone (the criterion of universality), ownership connoted the unqualified power to exclude everybody else from using the resource (exclusivity) as well as to use it oneself, and ownership rights were freely transferable, or as lawyers say alienable (transferability), value would be maximized." Furthermore, not only material but also immaterial goods can be subject to such absolute property rights, and this is well reflected in contemporary intellectual property law (including patents, copyrights, trademarks, trade secrets and privacy) or human rights.[25]

However, as already indicated above, the term "absolute" does not implicate, that such property rights are totally unrestricted.[26] There are a lot of legal regulations set to the execution of property rights in order to prevent harm to others or provide resolution in the case of conflicting property rights, so that a holder of a property right has always to obey not to offend his "neighbourhood."[27] As such conflicts are often not easily solvable just by referencing legal rules, extensive court trials are not unusual, if the costs of specification and enforcement of these property rights in question are not too high. From an economic point of view, such restrictions imposed on property rights in connection with incomplete specification and costly contracting lead to a decrease of their value, commonly called "attenuation" of property rights.[28]

Moreover, property rights can be shared among several individuals leading to a common ownership.[29] One example of such shared property rights are common or public goods which lead to the well known "tragedy of the commons" because

[24]Cf. Göbel (2002, p. 68) or Richter and Furubotn (2003, pp. 95–96). In Anglo-Saxon literature like Alchian (1965, p. 818–819), Furubotn and Pejovich (1972, p. 1139), De Alessi (1980, p. 4) or Alchian (1991, p. 1031), the term "private property rights" is often used, indicating a private ownership of goods by individuals.

[25]Cf. Posner (1998, pp. 43–50), Richter and Furubotn (2003, pp. 97–99) or Göbel (2002, pp. 66–67). Following Göbel (2002, pp. 66–67), even reputation of a firm or a person as well as human capital (e.g. special knowledge) and social capital (e.g. a personal network of contacts) can be regarded as property rights in a wider sense.

[26]See Göbel (2002, pp. 68–71), Richter and Furubotn (2003, pp. 96–97) going into much more detail concerning German Law.

[27]See Coase (1960) with some real legal cases showing clearly the problems occurring in execution of absolute property rights.

[28]Furubotn and Pejovich (1972, pp. 1146–147) seem to be the first authors who used this term. See further Tietzel (1981:211–218), Schoppe (1995, pp. 140–142) or Picot et al. (2002, pp. 55–58) for more discussion about this topic.

[29]Cf. Alchian (1965, pp. 819–823), Demsetz (1967), De Alessi (1980, pp. 5–9), Erlei et al. (1999:280–287), Göbel (2002, pp. 71–77) or Martiensen (2000, pp. 230–253).

there is always a tendency to underinvest in preservation (e.g. of wild animal stock) or maintenance (e.g. of commonly owned assets), paired with their overusage until extinction, breakdown or total destruction.[30] Closely related to this problem is the pooling of several privately held resources in an organization with team production where a final product resulting from such a joint production has a non-decomposable and non-attributable value so that it is not possible to identify how much of the final product comes from each resource input.[31]

Another aspect overlooked so far is the possibility of partitioning of property rights.[32] More specifically, an absolute property right can be split into:[33]

- The right to use the property (Lat. “ius usus”).
- The right to dispose the property (Lat. “ius abusus”).
- The right to take and keep fruits or revenues produced by the property (Lat. “ius usus fructus”).
- The right to transfer some or all rights on the property to someone else (Lat. “ius successionis”).
- The right to exclude others from usage of the property.

By augmenting this, a transaction of goods can then be considered as a transfer of bundles of property rights connected with these goods and some of them can be given up and transferred from one to another with the other property rights still held by the first individual. Straight forward examples are lending, renting, leasing or chartering goods from an original owner to another individual, coming along with a temporary divergence of ownership and possession.[34]

Relative Property Rights

The second group of property rights are relative ones, which are either contractual obligations or all sorts of liabilities, especially in connection with a contractual relationship.[35] The very difference to the absolute property rights discussed above is

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[30] Cf. Demsetz (1967), De Alessi (1980, pp. 6–7) or Alchian (1991, p. 1033).

[31] This idea was first developed in Alchian and Demsetz (1972). According to them, a viable solution is to assign a team leader, (1) being the central party common to all contracts of the jointed resources, (2) having rights to renegotiate any input’s contract independently of contracts with other team members, (3) holding the residual claim and (4) being allowed to sell his central residual status. See Alchian (1991:1032), Richter (1991, pp. 401–406), Schoppe (1995, pp. 142–146), Erlei et al. (1999, pp. 70–74) or Martiensen (2000, pp. 255–262) for further discussion.

[32] This aspect of property rights was first explored by Coase (1960) and Alchian (1965), see also Göbel (2002, pp. 66–67,78).

[33] Cf. Alchian (1965, pp. 819–820), Furubotn and Pejovich (1972, pp. 1139–1140), Tietzel (1981:210–211), Schoppe (1995, p. 137), Wolff and Neuburger (1995, pp. 79–80) or Göbel (2002:66).

[34] Cf. Göbel (2002, p. 67).

[35] Cf. Richter and Furubotn (2003, pp. 100–102, 145–172).

that relative property rights are subject to a single or a certain group of individuals. Most of them come along with the partition and transfer of absolute property rights, where an original owner of a good obtains a relative property right towards the borrower, lessee or charterer in form of a claim like a promise to pay interest, rent, lease or charter.[36] Another sort of relative property rights are liabilities growing out of damage or loss of goods as well as hurt or even death of individuals arising from their own fault.[37] Two of many examples are (1) the contractual liability of freight forwarders in Germany for any damage resulting from loss of or damage to the goods occurring during the time between taking them over and their delivery as stated in § 425 HGB or (2) the liability rule valid for Austrian freight forwarders according to the provision in §§ 407–415 UGB in connection with §§ 388–390 UGB, which considers them to be only liable in conducting their activities to the extent that they are at fault.[38]

In the context of relative property rights, special interest are synallagmatic contracts relying on the principle "do ut des" (Lat.), where a sequence of mutual exchange of goods and/or property rights takes place, based on law–specified contractual duties and obligations.[39] Examples are sales contracts of goods as well as property rights, labour contracts and so on.[40]

Other Forms of Contractual Relationships

In addition to these absolute and relative property rights clearly defined by law, there are "other" forms of contractual relationships not fully backed by legal measures.[41] Furthermore, as every transaction is essentially driven by some contractual relationship, various forms of either legal or non-legal contractual relationships have to be considered as means with economic impact.[42] An important early contribution

[36] Demsetz (1967, p. 347) referred to this situation as follows: "When a transaction is concluded in the marketplace, two bundles of property rights are exchanged. A bundle of rights often attaches to a physical commodity or service, but it is the value of the rights that determines the value of what is exchanged." But he left open, what sort of property rights are exchanged.

[37] Cf. Richter and Furubotn (2003, p. 102).

[38] For a formal economic interpretation of these quite different rules of liability in general see Erlei et al. (1999, pp. 287–295) with further references. Further, it has to be noted, that in both cases there are more provisions for exclusion or limiting maximum liability as well as full liability in the case of intent or gross negligence, but describing this en detail is beyond of the scope of this work.

[39] Cf. Richter and Furubotn (2003, pp. 151–153). The term "synallagmatic" itself is derived from "synallagma" (Gr.), which refers to developing actions on written promises, see Llewellyn (1931, p. 740).

[40] See Göbel (2002, pp. 79–92) or Richter and Furubotn (2002:165) discussing some examples from German Law.

[41] Cf. Richter and Furubotn (2003, pp. 102–105 and 165–171).

[42] Llewellyn (1931, pp. 707–708) even regarded the term "contract" itself as "[...] an ambiguous concept, ambiguous particularly when more is concerned than unmixed legal doctrine. (1) The word is used especially to indicate business agreements-in-fact, as such, irrespective of their legal

in this direction is Llewellyn (1931), who distinguished between "iron rules" and "yielding rules" in contracting, and proposed a concept of "self-government" supporting relationships between parties involved therein, which is not necessarily guided by conventional law measures.[43] At the same time, he shared a mutual commitment with Common's (1924) legal approach to economics.[44]

In an empirical study of non-contractual relationships in the manufacturing sector, Macaulay (1963) observed actual contracting practice in every-day business transactions. Doing this, he drew the conclusion, that "businessmen often fail to plan exchange relationships completely, and seldom use legal sanctions to adjust these relationships or to settle disputes. [. . .] Transactions are planned and legal sanctions are used when the gains are thought to outweigh the costs" (Macaulay (1963, p. 55)). But often, contracts are not needed, because products are standardized with a well accepted specification or can be tested to check them against what was ordered originally.[45] Furthermore, there are many effective non-legal ways to sanctioning with commitments to be honoured in almost all situations and product quality to be ensured out of self-interest. Another important reason not to stick on well defined contracts is, that they come along with a loss of "flexibility." Therefore, "relative contractual practices" are often employed in order to e.g. avoid problems occurring from complexity of agreed performance over a long time. These rather vague propositions inspired law scholars like Summers (1969) and Macneil (1974, 1978, 1980, 1983) to explore the legal side of such contractual practice apart from the ordinary system of (neo)classical contract law with the later developing a legal theory of relational contracting.

Macneil (1974, 1978) thoroughly discussed the differences between transactional (classical or neoclassical) and relational contracting, whereas in Macneil (1980, 1983) he further developed his notion in a much broader context along a system of common contract norms as well as other, supracontractual norms.[46] His analysis

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consequences – irrespective indeed of whether they have legal consequences. [. . .] (2) – Or the word is used to indicate agreements-in-fact with legal consequences. [. . .] (3) Again, the word indicates the legal effects, if such there be, of promises [. . .]. I shall endeavor to reserve "promise" for the promise-in-fact, "contract" for the legal effects of such a promise. (4) A fourth current meaning of the word, the writing embodying an agreement (commonly assumed to be one with legal consequences) may here be disregarded."

[43]Cf. Llewellyn (1931, pp. 727–734). More specifically, he imposed that "[. . .] the major importance of legal contract is to provide a framework for well-nigh every type of group organization and for well-nigh every type of passing or permanent relation between individual and groups [. . .] – a framework highly adjustable, a framework which almost never accurately indicates real working relations, but which affords a rough indication around which such relations vary, an occasional guide in cases of doubt, and a norm of ultimate appeal when the relations cease in fact to work." (Llewellyn (1931, pp. 736–737). See also Richter and Furubotn (2003, pp. 165–166) for further discussion.

[44]Cf. Llewellyn (1931, p. 706).

[45]See for this and the following Macaulay (1963, pp. 62–65).

[46]Following Macneil (1980:40–59, 1983:347), there are ten common contract norms: (1) role integrity, (2) mutuality (as in Macneil (1980)) or reciprocity (as in Macneil (1983)), (3)

of contracts is based on the recognition of the fact that contractual relationships are conducted within a "social matrix."[47] Exchange is only possible within a society that provides at the minimum (1) a means of communication so the parties can understand each other, (2) a system of order so that the parties use exchange rather than force to get what they want, (3) a payment mechanism, and (4) a mechanism to enforce promises if some performance has to take place in the future.[48] Since a contract can only be made against such a social background, all contracts have to be considered relational to some degree, in the sense of involving social relationships and being embedded in a much broader social context. Some contracts are, however, less relational than others in the sense that they emphasize "discreteness" (a one-off transaction between the contract parties involved) and "presentation" (detailed propositions stipulating all the contract parties' expectations and remedies for breach) so that there exists a spectrum of contractual behaviour with highly relational contracts at one end and merely discrete transactions at the other:[49]

- At the discrete end of this spectrum are discrete transactions based on *classical contracting*, which comes along with (1) treating the identity of the contract parties as irrelevant to the transaction, (2) commodifying as much as possible the subject matter of contracts, (3) limiting strictly the means employed in establishing the substantive content of the transaction, (4) limiting the contract remedies available, so that e.g. the consequences from non-performance are relatively predictable from the beginning and are not open-ended, (5) drawing clear lines between being in and not being in a transaction, (6) discouraging the introduction of third parties into a contractual relation, (7) equating of the legal effect of a transaction with the promises creating it, (8) supplying a precise, predictable body of law to deal with all aspects of the transaction not encompassed by the promises and (9) stressing on expectation remedies, whether specific performance or damages measured by the value of performance, tends to bring the future into the present, since all risks, including market risks, are thereby transferred at the time the "deal is made."[50]
- *Neoclassical contracting* provides some remedies to alleviate the strict limitations of pure classical contracting in long-term relationships, as it allows planning

implementation of planning, (4) effectuation of consent, (5) flexibility, (6), contractual solidarity, (7) restitution, reliance, and expectation interests, (8) creation and restraint of power, (9) propriety of means (added to the list in Macneil (1983)), and (10) harmonization with the social matrix. Further, social and political norms being not particularly contractual but have to be taken into account in contractual relationships are subsumed under the label "supracontract norms," see Macneil (1978:898, 1980:70, 1983:350).

[47]Cf. Macneil (1974:710–711, 1980:11, 1983:344).

[48]To some extent, this notion resembles very much to the conceptual framework of superior and subordinate institutions forming a hierarchical structure proposed by Picot et al. (2002, pp. 11–25) as already shown above.

[49]Cf. Macneil (1974:735–805, 1978:862–865).

[50]See Macneil (1978, pp. 863–863), where he considered (1)–(6) as ways to implement discreteness and (7)–(9) merely focusing on presentation.

flexibility by (1) proposing contract adjustment tied to external standards, direct third-party determination of performance, one-party control of specific contract terms, compensation schemes based on costs or simply agreements to agree on (re)negotiation about contract details later on, (2) deviation of original planning in existing contractual relations by actual realized (non)performance as well as additions, subtractions or terminations based on mutual agreements or unilateral concessions by one of the contract parties, (3) implementing non-disruptive dispute settlements like mediation or arbitration and (4) proposing clear rules for termination.[51] But, as Macneil (1978, p. 885) asserted, "neoclassical contract law can free itself only partially from the limitations posed by obeisance to the twin classical goals of discreteness and presentation. This obeisance is imposed by adherence to an overall structure founded on full consent at the time of initial contracting."

- In *relational contracting*, social relationships and their preservation, harmonization of relationship conflicts as well as the influence of supracontractual norms play a significant role, whereas discreteness and presentation aspects are of minor importance.[52] In order to illustrate this radical departure from the (neo)classical contracting approaches, Macneil (1974, pp. 744–805) compared in depth differences between discrete transactions and relational contracts along 12 categories and took the process of dispute resolution as an example in Macneil (1978, pp. 891–892). Regarding (neo)classical contracting, "this process is rather like the discrete transaction itself: sharp in (by commencing suit) and sharp out (by judgment for defendant or collection of a money judgment by plaintiff)" (Macneil (1978, p. 891)). In the world of relational contracting, however, (1) the scope of such a dispute is not exogenously given by contract terms but is shaped by both contract parties, some third-party arbitrator and by the entire relation in the past, the present and the future, (2) the contractual relationship is not strictly bilateral but sprawling and amorphous, (3) the fact inquiry is not only historical and adjudicative but also predictive and legislative, (4) relief is not conceived primarily (or sometimes at all) as compensation for past wrong doing in a form logically derived from the substantive liability and confined in its impact to the immediate parties, (5) the remedy is not imposed but negotiated and mediated, (6) the award will require continuing administration by the arbitrator, (7) he is further active, with responsibility not only for credible fact evaluation but also for organizing and shaping the dispute processes to ensure a justified and viable outcome, and (8) the subject matter of the dispute is not between private individuals about private rights but is a grievance about the operation of policies of the overall contractual relation.

[51] See Macneil (1978, pp. 865–883) with a more detailed description of neoclassical contracting measures and their impact on long-term contractual relationships.

[52] Cf. Macneil (1978:883–886, 1980:64–70).

It were then Goldberg (1976a,b) and Williamson (1976), who first introduced this concept of relational contracting as developed by Macneil (1974) into the economic field.[53] Furthermore, Richter and Furubotn (2003:187–191) recently provided an extensive list of enforcement mechanisms for such contractual relationships: (1) self-enforcing mechanisms (Telser (1980), Kronman (1985)), (2) embeddedness of actors in a social network context (Granovetter (1985, 1992), Uzzi (1996, 1997)), (3) "tit-for-tat" strategies from game theory (Axelrod (1984)), (4) enforcement of contracts with the help of third-parties (Williamson (1985)), (5) governmental regulation (Goldberg (1976a)) as well as (6) forming a union or a unified, vertical integrated organization, (Williamson (1975, 1985), Kronman (1985)). Especially the first category is worth to explicate shortly, because the other enforcement mechanisms are either self-explicable or will be thoroughly discussed later in subsequent sections: Telser (1980) laid ground for a formal theory of self-enforcing contracts on the principle of "honesty pays"[54], whereas Kronman (1985) summarized more practical concepts of contractual self-enforcement in cases of non-legally enforceable agreements, like exchange of hostages, collaterals or hands-tying agreements.[55]

3.1.2.3 Positive Transaction Costs

One of the most crucial departures of NIE from (neo)classical thoughts seems to be the presence of positive transaction costs. Commons (1931, p. 662) first advanced the proposition that "[...] a unit of activity – a transaction with its participants" must be the basis unit of economic analysis. Furthermore he asserted, that "transactions are the means, under operation of law and customs, of acquiring and alienating legal control of commodities, or legal control of the labour and management that will produce and deliver or exchange the commodities and services, forward to

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[53]Cf. Schoppe (1995, p. 157) or Furubotn and Richter (2003:207).

[54]More concrete, Telser (1980) drew three important conclusions: (1) Self-enforcing agreements are not feasible if the sequence of occasions for transactions has a definite known last element, (2) for a given sequence of gains the expected horizon must be long enough or there can be no self-enforcing agreement and (3) parties would not enter a self-enforcing agreement expecting the other parties to violate it. Further see Martiensen (2000, pp. 432–438) or Richter and Furubotn (2003:276–284) for alternative formal explanations of self-enforcing contracts.

[55]See Richter and Furubotn (2003, pp. 182–185). Following Kronman (1985), a hostage is anything (or anyone) of value to a promissor handed over temporarily to a promissee in order to get it back after performing his promise, whereas a collateral is an asset given as a hostage with a direct use or exchange value for the promissee so that is a direct substitute for performance. In the case of hands-tying, a promissor takes actions like public observable commitments to performance making his promise more credible, because if he does not perform successfully, he automatically harms himself e.g. by loosing his reputation. Remarkably, he is not the first author describing these concepts initially (as indicated by his references to Schelling (1956), Klein and Leffler (1981) and Williamson (1983)), but he brought them into a wider context.

the ultimate consumers."[56] Relying on a classification based on both legal and functional criteria, he distinguished between three major types of transaction, namely bargaining, managerial and rationing transactions, and was aware of the substitutability between the first two.[57]

Another early contribution is the break-through seminal article by Coase (1937), where he argued transaction costs to provide a way of understanding "the Nature of the Firm."[58] Specifically, he asserted that the characteristic feature of the firm is, that within it, decisions about the allocation of resources could be made administratively, rather than through the market. For him, the main reason for this are simply transaction costs and therefore he formulated a common transaction cost economizing framework to derive optimal size and boundaries of a firm.[59] Almost half a century later, Coase (1960) highlighted again the need to take positive transaction costs explicitly into consideration as he observed "the Problem of Social Costs" with a focus set on "[. . .] those actions of business firms which have harmful effects on others" (Coase (1960:1)). Discussing several legal cases, he came to the conclusion that in a world of zero transaction costs, the allocation of resources would be independent from a given legal environment since people can always costless negotiate, subdivide and combine property rights whenever this would be favourable to them.[60] Therefore, all actions "[. . .] that could be taken which cost less than the reduction of damage they would bring, and they were the least costly means available to accomplish such a reduction, they would be undertaken" (Coase (1990, p. 175)). But taking positive transaction costs into account, property rights matter, because then the allocation of property rights among individuals has decisive economic impacts.[61]

Within a few years after Coase (1960), the concept of transaction costs evolved to be a well respected general approach to assess theoretically frictions in real-world economy.[62] Accordingly, Arrow (1969, p. 48) defined transaction cost as "the

[56]Commons (1931, pp. 656–657).

[57]See Commons (1931, pp. 662–663). According to Rutherford (1983, pp. 724–726), he provided another classificatory scheme, where he draws a distinction between "strategic" and "routine" transactions, with the first giving control over an otherwise "limiting factor" and the second dealing with "complementary factors," after the first being under control.

[58]Several years later he asserted that in Coase (1937) he showed that "[. . .] in the absence of transaction costs, there is no economic basis for the existence of the firm" (Coase (1990, p. 14)). Notably, Coase (1937) initially did not use the term "transaction costs" but called them "the cost of using the price mechanism," "the cost of carrying out a transaction by means of an exchange on the open market" or simply "marketing costs," see Coase (1990, p. 6) or Spulber (1999, pp. 232–233).

[59]See Cheung (1983, pp. 3–10), Coase (1990, pp. 5–7), Spulber (1999, pp. 233–234) or Richter and Furubotn (2003:80–81).

[60]Later on, Stigler (1966, p. 113) restated this as the "Coase Theorem," see Casson (1990:10–16 and 157–185), De Meza (1998) or Richter and Furubotn (2003, pp. 111–116) with further comments.

[61]See Coase (1990, pp. 174–179) for further discussion.

[62]Cf. Williamson (1985, pp. 15–16).

costs of running the economic system"[63], whereas Williamson (1985, pp. 18–19) considered them to be "the economic equivalent of friction in physical systems" and have to be distinguished from production costs. Furthermore, Williamson (1985, pp. 20–22) asserted, that there should be a distinction drawn between ex ante (before contracting) and ex post (after contracting) types of transaction costs.[64] The first are costs of drafting, negotiating, and safeguarding an agreement, whereas the second include (1) maladoption costs incurred when transactions drift out of alignment, (2) haggling costs incurred if bilateral efforts are made to correct ex post misalignments, (3) setup and running costs associated with the governance structures to which disputes are referred and (4) bonding costs of effecting secure commitments.[65] Especially Oliver E. Williamson as one of the leading figures in contemporary transaction cost economics literature refined and extended these early treatments of Commons (1931) and Coase (1937, 1960) on transaction costs in many ways, which will be shown later on in Sect. 3.1.3.1.

3.1.2.4 Imperfect Information Structure and Bounded Rationality

After defining the role of institutions, property rights and transaction costs in Institutional Economics, there is still one important point of criticism left against NCE: an overwhelming discrepancy between (neo)classical assumptions of full rational, profit maximizing individuals with perfect information structures and the empirical evidence from real world economy. Acknowledging the importance of studying "human nature as we know it" (Knight (1921:270)), he was one of the first authors challenging these simplifications of full knowledge, expectations and rationality in NCE and exploring the impacts of risk and uncertainty on profits as well as on individual behaviour:

> "The facts of life [...] are in a superficial sense obtrusively obvious and are a matter of common observation. It is a world of change in which we live, and a world of uncertainty. We live only by knowing *something* about the future; while the problems of life, or conduct at least, arise from the fact that we know so little. [...] If we are to understand the workings of the economic system we must examine the meaning and significance of uncertainty; and to this end some inquiry into the nature and function of knowledge itself is necessary" (Knight (1921:199)).

There are two aspects, which are worth to be further elaborated: (1) the presence of imperfect information structures which rise from the unavailability of full

[63] See Williamson (1985:18, 1999:5), Schoppe (1995, p. 149), Erlei et al. (1999, p. 42) or Martiensen (2000:272).

[64] See further Picot (1982, p. 270) for a quite similar definition well reflected in German transaction cost literature or Richter and Furubotn (2003, pp. 57–71) with a recent, more detailed definition distinguishing between market, firm and political transaction costs.

[65] Moreover, these costs of contracting are interdependent and therefore, they must be addressed simultaneously rather than sequentially.

information about all states of nature (or common knowledge) as well as each individual's private knowledge and (2) the fact of bounded rationality as individuals cannot be regarded as a fully rational calculator taking all this information available to him into consideration.

Imperfect Information Structures

Talking about imperfect information structures, a distinction has to be drawn between (1) adverse selection, (2) moral hazard, (3) hold-up and some combinations of these first three basic information problems as shown later on in Sect. 3.1.3.2. Despite economists having long recognized all these information problems and their impacts on economics and markets, modern theoretical treatment providing solutions to alleviate them began in the 1960s.[66]

- *Adverse selection* as a pre-contractual information problem was first explored explicitly by Akerlof (1970), who investigated a stylized market for used cars and showed, that there is a "Lemon's Problem" regarding their quality which led to a market breakdown. It was further generalized by Wilson (1980), taking different price-setting mechanisms into account.
- Conversely, *moral hazard* is the technical term for a variety of post-contractual information problems arising from opportunistic behaviour with individuals maximizing their own utility to the detriment of others in situations where they do not bear the full consequences or enjoy the full benefits of their actions.[67] One of the first explicit treatments of moral hazard problems was made by Arrow (1963a), who showed the impacts of medical insurance policies on health care incentives.[68]
- In a *hold-up* problem situation, an information problem arises from the timing of unobservable investments done by individuals in connection with closing a contract. These investments are sunk at least to some extent, because they are not fully rewarded by their counterparts. This hold-up problem was first introduced in the field of economics by Goldberg (1976b).

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[66]One prominent earlier example is Knight (1921), who discussed in his treatment about risk and uncertainty problems of adverse selection and moral hazard on insurance markets and principal–agent relationships, but did not recognize that these problems can be alleviated or eliminated with properly structured contracts, see Hutchison (1984, pp. 24–26), LeRoy and Singell (1989), Langlois and Cosgel (1993) or Laffont and Martimore (2002:19).

[67]Cf. Kotowitz (1990).

[68]Following Lafont and Martimort (2002:13), it was again Arrow (1963b) who first adopted the idea of moral hazard to principal–agent situations.

Bounded Rationality

Apart from Knight (1921) already cited above, other early contributions coping with limited information processing capabilities of individuals are Commons (1924, 1931, 1934) considering them constrained by working rules and merely directed by habits, instincts and passions than by reason or Barnard (1938) and Simon (1945) concerning with the intended rationality of individuals inside given formal organizational structures.[69]

It was then Herbert A. Simon, who wrapped up and explicitly formalized these initial concepts of individuals suffering from somehow "constrained" rationality and formulated a principle of bounded rationality, widely accepted today in the field of NIE (and even beyond):[70]

> "The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behaviour in the real world – or even for a reasonable approximation to such objective rationality." (Simon (1957:198–199))

More explicitly, his concept of bounded rationality shows the limitation of a decision maker along three dimensions: (1) He has an imperfect or limited knowledge of his environment, (2) he is unable to anticipate and consider all options to solve his problem due to limited abilities of calculation and (3) he is not able to process all available data, because of his limited skills of attention.[71] Furthermore, this imperfection of individuals leads to a limited search under possible alternatives, accepting the first satisfactory one instead of an exhaustive search to find the very best, so that the goal of "maximizing" has to be replaced by the goal of "satisficing" or finding an alternative that is "good enough."[72]

3.1.3 Building Blocks of New Institutional Economics

As the NIE is an ever evolving field of research, it is subject to a steady further development and nearly every new contribution attempting to develop a framework of NIE brings in another view of things. But most authors agree, that NIE has (at least) three building blocks, namely property rights theory (PRT), transaction cost theory (TCT) and agency theory (or principal–agent theory (PAT)), which form a

[69] Cf. Forest and Mehier (2001, pp. 591–597) and Williamson (1985:5–7, 1999:29–44).

[70] Of course, as contributions by Conlisk (1996), Kreps (1998) or Rubinstein (1998) clearly showed, this conception of bounded rationality is not the only one but it is the most prominent.

[71] Cf. Simon (1991a), Forest and Mehier (2001, pp. 593–595) or Martiensen (2000, pp. 179–191).

[72] Cf. Simon (1957, pp. 204–205), Simon (1991b), Erlei et al. (1999, pp. 9–12) or Conlisk (1996, p. 675–767).

"theoretical core" of NIE.[73] But this is not the one and only possible classification of the economic side of NIE:

- Williamson (1985, p. 29) proposed a "cognitive map of contract," where an efficiency branch of contract is split into two parts with the incentive alignment literature (PRT and PAT) on one side and TCT with the measurement branch as well as the governance approach on the other.
- Nilakant and Rao (1994) divided NIE in an incentive alignment stream with PRT and PAT emphasizing ex ante side of contracts which safeguard the parties involved against all possible contingencies and another stream with TCT focusing merely on ex-post side of contracts.
- Erlei et al. (1999) initially saw the economic part of NIE split in PAT and TCT, but in the following they subsumed team production from PRT and PAT under the label of transaction costs named "Transaktionskosten I," while "Transaktionskosten II" was dedicated to the measurement branch of TCT and a more formal treatment of the governance approach centering around incomplete contracting. Furthermore, PRT was placed in another chapter, discussing the institutions of law.
- Martiensen (2000) started with PRT followed by TCT and a chapter about economic contract theories, where he discussed explicitly not only PAT but also theories of incomplete, self-enforcing as well as relational contracts.
- Richter and Furubotn (2003) regarded NIE as a conglomerate of TCT, PRT and contract theory with the later consisting of PAT, incomplete, self-enforcing and relational contracts added by the theory of implicit contracts and the management theory of the firm.[74]

For the purpose of the study, (1) TCT with the organization failure framework as well as the governance approach to contractual relations and (2) PAT including adverse selection, moral hazard and hold-up problems are briefly described, because especially these two streams of thought in NIE add useful insight to intermediary relationships discussed later on in this piece of work.

3.1.3.1 Transaction Cost Theory: Organization Failures Framework and Governance of Contractual Relations

As already indicated above, contemporary TCT is closely connected with the ongoing research agenda of Oliver E. Williamson well documented in three monographs

[73] See Wolff and Neuburger (1995, pp. 75–83), Göbel (2002, pp. 60–65), Picot et al. (2002:54–156) or Richter (2005:166–174).

[74] Following Rosen (1985), the theory of implicit contracts goes back to Knight (1921) and copes mainly with labour market exchanges in terms of contracts. The managerial theory of the firm originates in a management study by Berle and Means (1932) and focuses on manager preferences and opportunistic behavior, see Richter and Furubotn (2003, pp. 220–224).

(Williamson 1975, 1985, 1996), where he developed an interdisciplinary theory of transaction cost economics (TCE) from a law, economics and organizational perspective.[75] For him, "[t]ransaction cost economics (1) eschews intuitive notions of complexity and asks what the dimensions are on which transactions differ that present differential hazards. It further (2) asks what the attributes are on which governance structures differ that have hazard mitigation consequences. And it (3) asks what main purposes are served by economic organization. Because, moreover, contracting takes place over time, transaction cost economics (4) inquiries [sic!] into the intertemporal transformations that contracts and organizations undergo. Also, in order to establish better why governance structures differ in discrete structural ways, it (5) asks why one form of organization (e.g., hierarchy) is unable to replicate the mechanisms found to be efficacious in another (e.g., the market)" (Williamson (1999, p. 13)).

Organization Failures Framework

Williamson (1975, pp. 20–40) proposed an organization failures framework as a general approach to economic organization ordering. To him, markets as well as more hierarchical forms of organizations are alternative instruments for completing a related set of transactions, and their employment depends on the relative efficiency of each mode. Human behaviour (namely bounded rationality and opportunism) as well as environmental factors (more specifically uncertainty, task complexity and small numbers bargaining) can explain when individuals may decide to by-pass the market environment and resort to more hierarchical modes of organization (and vice versa). These key elements of the organization failures framework can be described as follows:

- As already shown above, *bounded rationality* means that individuals may intend to make a rational decision but their capacity to evaluate accurately all possible decision alternatives is physically limited. To him, this fact poses a problem in situations when transactions have to be managed under *complexity* and/or *uncertainty* conditions. Then the given ability of individuals to make fully rational decisions is impeded, because the sheer complexity of a task and/or unforeseeable contingencies avoids them to develop a complete decision tree needed to design fully specified contracts.
- Second, *opportunism,* or "self-interest seeking with guile," has profound implications for choosing between alternative instruments.[76] He recognized that

[75]Cf. Williamson (1985:387–388, 1999:6–11). Further, Williamson (1999, pp. 18–20) considered these three monographs to form a trilogy. But looking more closely on their theoretical contents, Williamson (1996) seems to be merely a restatement of the theoretical framework in Williamson (1985) so that in the following, a focus is set on the first two.

[76]See Williamson (1975:26–30, 1979:131, 1985:47–50). Further Williamson (1998b) with a focus set on hazards borne out of opportunism.

individuals will sometimes seek to exploit a situation to their own advantage by making self-disbelieved promises. This does not imply to them that all those involved in transactions act all the time opportunistically, rather, it considers that the risk of opportunistic behaviour by someone is just present. Following Williamson (1975:26–29), it is greater when there exists a *small numbers bargaining* problem, where the counter parties are able to act in a merely strategic manner.[77]

- Furthermore, if uncertainty and opportunism is present, *informational asymmetry* as already discussed above influences heavily small numbers bargaining situations, too, in two ways.[78] The first is called *ex ante opportunism* and refers to situations where information is hidden prior to a transaction, which leads to an adverse selection problem. The second informational asymmetry is *ex post opportunism* which occurs after a transaction and leads to problems of moral hazard, because individuals may have the incentive to act opportunistically to increase their economic welfare when their actions are not directly observable by their counterparts.

All these elements of human behaviour and environmental factors occasionally lead to a market failure, because market transactions are unable to be safe-guarded by fully specified contracts and therefore contracting parties tend to prefer more hierarchical modes of organization. But more hierarchical forms of organizations like a vertical integration can suffer to some extent from the same key elements, too, which was further discussed in detail in Williamson (1975). Revising and broadening this organization failure framework, he focused in later contributions like Williamson (1975, 1975) on the topic of transaction costs and the efficient governance of contractual relations as the outcome of a transaction cost economizing behaviour, which will be discussed in the following.[79]

Characterization of Transactions

According to Williamson (1979:246–254, 1981:555–556, 1985:52–61, 1999:58–61), transactions principally differ in the dimensions of (1) asset specificity, (2)

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[77]In Williamson (1985, pp. 61–63), he referred to this fact as the "fundamental transformation," where a "large numbers" bidding condition by competing rivals on a market is effectively transformed into one of a "small numbers" bilateral monopoly by establishing some contractual relationship.

[78]Williamson (1975, p. 31) initially called this a derived condition of "information impactness."

[79]Strictly speaking, "[. . .] the object is to economize on the *sum* of production and transactions costs" (Williamson 1975:245). Further, for this and the following see Schoppe (1995, pp. 48–70), Erlei et al. (1999, pp. 175–193), Göbel (2002:135–149), Martiensen (2000, pp. 271–302) or Richter and Furubotn (2003, pp. 193–199).

uncertainty and (3) frequency, with the first being the most important one.[80] Regarding *asset specificity*, there are at least four different types to distinguish:[81]

- *site specificity*, highlighting the immobility of transaction-specific investments.
- *physical asset specificity*, stressing on the non-redeployability of transaction-specific investments.
- *human asset specificity* in connection with training efforts undergone to reach specialized skills and working experience through learning-by-doing.
- *dedicated assets* which are investments in assets undertaken for dedicated usage in the prospect of doing business with a certain customer.

The main reason for asset specificity being critical seems to be, that the value of investments done in advance for other usage is much smaller than for which they have been intended, so that there occurs a lock-in effect. Next, there are two basic sources of *uncertainty* to consider, which were already discussed in the preceding section: (1) overall state-contingent environmental uncertainty and (2) relation-specific behavioural uncertainty. In both instances, increasing uncertainty usually leads to closer ties between the contracting parties. In addition to this, there are some "interaction effects" occurring in connection with asset specificity. Referring to *frequency* of transactions, it is quite clear that economies of scale or scope arising from learning-by-doing, division of labour force and/or pooling firm resources are usually considerable high to allow decreasing transaction costs with an increasing amount of transactions.

Governance of Contractual Relations

Assuming, that a sufficient degree of uncertainty is present to pose an adaptive, sequential decision requirement, Williamson (1979:245–254, 1985:72–79) focused on the transaction characteristics of frequency and asset specificity (expressed as the degree of investment idiosyncrasy) to develop a typology of efficient governance structures for contractual relations.[82] Doing this, he discovered a striking

[80]Discussing merely influences on transaction costs, Picot (1982, pp. 271–273) provided an alternative view by distinguishing between situational ambiguity, environmental uncertainty and frequency of transactions as well as transaction infrastructures offered by law and technological progress.

[81]Cf. Williamson (1983:526, 1985:55–56). Masten et al. (1991, p. 9) added this classification "temporal specificity" in connection with tight time schedules, where "[. . .] an opportunistic supplier may be tempted to seek a larger share of the gains from trade by threatening to suspend performance at the last minute." Further, "[e]ven though the skills and assets necessary to perform the task may be fairly common, the difficulty of identifying and arranging to have an alternative supplier in place on short introduces the prospect of strategic holdup." Later on, Williamson (1991:281, 1998b:707) added a sixth type called "brand name capital," centering around the problem of maintaining reputation as described by Göbel (2002, p. 140).

[82]Other simplifying assumptions are (1) individuals dealing with each other intent to be in business on a continuing basis, (2) there is no ex ante monopoly of ownership in specialized resources,

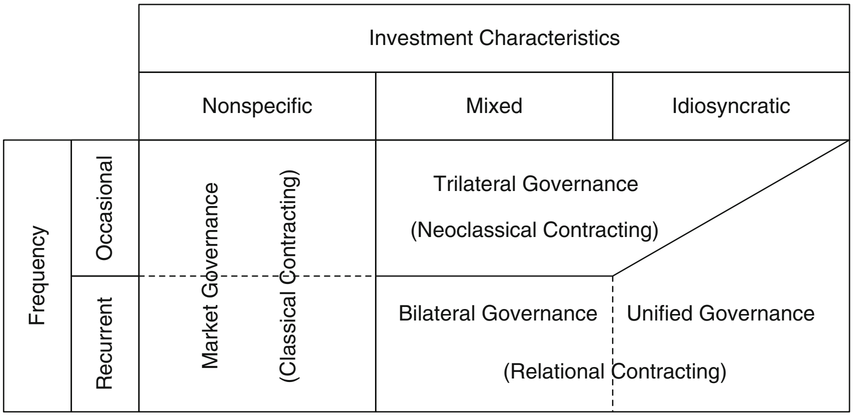

Fig. 3.1 Illustrative commercial transactions
(Source: Williamson (1979:247, 1985:73))

correspondence between these six types of illustrative commercial transactions (see Fig. 3.1) and Macneil's (1974, 1978) three-fold classification of contracting as already discussed in Sect. 3.1.2.2 and matched them with four governance structures of contractual relations as shown in Fig. 3.2:

- First, there is *market governance* as the most efficient one for non-specific transactions of both occasional and recurrent contracting backed by classical contract law. Transactions are discrete, highly standardized, intensify presentiation, and there is no need for safe-guarding relationships against opportunism as long as there are enough alternative contracting partners present.
- Second, *trilateral governance* based on neoclassical contracting is recommended for occasional transactions in connection with mixed or highly specific investment characteristics, because once the principals of such transactions have entered into a contract, they have strong incentives to see the contract through completion. Specialized investments done in advance, unsatisfactory market alternatives and/or switching cost considerations are the main reasons that force contract partners to stick on neoclassical contract law, which allows to relax the strict limitations of discreteness and presentation in order to provide planning flexibility. Quite often, third-parties are engaged in evaluating performance and/or resolving disputes through arbitration so that this governance structure is called a trilateral one.
- In *bilateral governance*, the non-standardized nature of transactions in connection with a medium degree of asset specificity makes primary reliance on

(3) the frequency dimension refers strictly to buyer activity in the market and (4) the asset specificity dimension refers to the characteristics of investments made by suppliers, see Williamson (1979:246–247, 1985:72).

		Investment Characteristics		
		Nonspecific	Mixed	Idiosyncratic
Frequency	Occasional	Purchasing Standard Equipment	Purchasing Customized Equipment	Constructing a Plant
	Recurrent	Purchasing Standard Material	Purchasing Customized Material	Site-Specific Transfer of Intermediate Product across successive Stages

Fig. 3.2 Efficient governance structures
(Source: Williamson (1985, p. 79))

market governance hazardous, while their recurrent nature permits the costs of specialized governance structures to be recovered so that relational contracting between otherwise autonomous contracting parties seems to be an efficient mode of governance structure. Furthermore, both parties have always an incentive to sustain their usually tight social relationships through discrete adjustments rather than to terminate it immediately.

- In the case of a *unified governance*, highly idiosyncratic transactions are organized within an internal organization structure under relational contracting, because human and physical assets needed for production are extensively specialized and mostly dedicated to a single use. Hence, these assets are less transferable to other uses and the choice of organizational mode turns to favour a governance structure with superior adaptive properties like vertical integration under a single (unified) ownership.

While in this section a focus was set on commercial transactions, Williamson (1979) indicated that these general considerations can be applied to other types of transactions, too – at least after some modification. Moreover, Picot (1982, pp. 273–277) developed a quite similar transaction economizing framework, where he classified transaction characteristics again in three dimensions (frequency, uncertainty and degree of ambiguity), but ended in twelve distinguishable types of transactions matched with a continuum of contractual forms as well as governance structure between market and hierarchy.

Some Applications of Transaction Cost Theory

Many authors were attracted by the TCE framework of Williamson (1975, 1985), so that in the following these Williamsonian ideas were adapted to clarify various real economic situations in the field of transport and logistics.[83] Their applications of TCE can be divided into three broad categories: (1) guideline of contractual governance or industry governance structure descriptions, (2) support of outsourcing or make-or-buy decisions, and (3) deliver theoretical background for diverse treatments.

One of the very first applications of TCE in the field of transport and logistics were detailed descriptions of contractual governance like Palay (1984) in the rail freight sector, Jones and Pustay (1988) in the US airline industry between World War I and II, Rahman (1989) in interorganizational vertical relationships between shippers and freight forwarders in international shipping or Pirrong (1993) in bulk shipping markets. These were closely followed by Stahl (1995a, 1995a) discussing corporate governance structures in international transport networks established by German freight forwarding companies or Lunnan and Reve (1995) about the corporate governance structure of Laboremus, a small Norwegian industrial shipping company. Furthermore, surveys of industry governance structure like Casson (1986) focusing on the UK shipping industry or Ojala (1994, 1995) about shipping companies from Finland, Sweden and Norway were conducted, too. Later on, Hubbard (1999, 2001) as well as Lafontaine and Masten (2002) explored contractual governance considerations between carriers and their truck drivers in the US trucking industry. Moreover, Pfohl and Large (1992), Hobbs (1996) as well as Skjøtt-Larsen (1999a, 1999a) discussed contractual governance in third-party logistics relationships and/or freight forwarding and Panayides (2002) offered a transaction cost approach for assessing the effectiveness of appropriate governance structures in organizing intermodal transport systems including a leg by sea. Another contribution is Lopez (2003) conducting a field study among ocean carriers and intermodal transport providers in the United States to map their diverse governance structures in organizing empty container relocation operations. Recently, Halldórsson et al. (2004, 2005) as well as Wathne and Heide (2004) employed TCE as a theoretical base to assess relationship governance issues in supply chain management. All authors found the Williamsonian governance approach to be a viable tool for describing contractual relationships and/or governance structure in the field of transport, logistics and/or supply chain management.

The second category are quite popular applications of TCE to outsourcing and make-or-buy decisions in transport and logistics, like Bretzke (1989, 1998), Kleer (1991, pp. 69–96), Aertsen (1993), Maltz (1993, 1994), Andersson (1997, pp. 87–127), Hanna and Maltz (1998), Bienstock and Mentzer (1999) or Panayides and Cullinane (2002) – only to name a few topical contributions.[84] Furthermore,

[83]See Masten (1995) for a collection of early empirical studies and Ménard (2000) or Shelanski and Klein (1995) for general overviews.

[84]See Rindfleisch and Heide (1997) for a broad overview mainly focusing on marketing literature, but some of these above mentioned authors were included, too. Further, Hobbs (1996), Stock (1997) as well as Skjøtt-Larsen (1999a) considered make-or-buy decsions as being the foremost application of TCT in the field of logistics or supply chain management.

Stapleton and Hanna (2002) applied TCT to sales force operations in ocean liner shipping, where they explored, whether a technological innovation such as the availability of double stack train hinterland connections impacts the business decision of maritime shipping companies to provide their sales force function internally or rely on third-party intermediaries.

The last category consists of a group of very heterogeneous treatments employing TCE as a theoretical background for further investigation. In a survey about future prospects of small and medium seaports in the Hamburg-Antwerp Range, Hinricher (1993) employed TCT to determine occurring asset specificity and derive an efficient firm size for them. Silverman et al. (1997) analysed the mortality of large motor carriers in the US-American for-hire trucking industry after deregulation on basis of the Williamsonian organization failures framework, whereas Nickerson and Silverman (2003b) focused on inappropriate governance, performance and adoption of motor carriers in the same context. Furthermore, other authors used the theoretical framework of TCE to explain cooperation in institutional arrangements like Becker (1999) observing strategic alliances of air cargo freight forwarders engaged in consolidating shipments.

3.1.3.2 Agency Theory: Agency Costs, Adverse Selection, Moral Hazard and Hold-Up

Agency theory copes with agency costs of firms or other organizations consisting of principals on one side and agents on the other, which arise through the presence of asymmetric information structures. Mainly, there are two distinct approaches to principal–agent problems: a positive and a normative one.[85]

The positive, less formal approach is closely connected with the works of Jensen and Meckling (1976), Fama (1980) and Fama and Jensen (1983a,b) and can be regarded as a direct answer to the questions raised by Alchian and Demsetz (1972).[86] Considering firms to be a "nexus of contracts"[87], they focused on the broad problem of separating ownership from control as well as its impact on organizational design and emphasized how managers can be disciplined by incentive schemes, external labour markets and capital markets.[88] According to Jensen and Meckling (1976, p. 308), agency costs are "[. . .] the sum of the monitoring expenditures by the principal, bonding expenditures by the agent costs, [and] the residual loss."

[85]Following Richter and Furubotn (2003:290), the term "principal–agent problem" was first introduced by Ross (1973).

[86]According to Schoppe (1995, p. 181) or Richter and Furubotn (2003:205) the term "positive agency theory" was first introduced by Jensen (1983) in order to distinguish his work from the "normative agency theory".

[87]Cf. Jensen and Meckling (1976, pp. 310–312) or Richter and Furubotn (2003, p. 201).

[88]See Nilakant and Rao (1994). Further Erlei et al. (1999, pp. 76–106) or Richter and Furubotn (2003, pp. 176–180) for a brief overview.

Table 3.1 Contributions to normative principal-agent theory

Hidden information Moral Hazard	Hidden action Moral Hazard
Contributions	
Ross (1973), Stiglitz (1974, 1975a), Mirrlees (1976, 1999), Border and Sobel (1987); Dye (1986); Grossman and Hart (1983); Harris and Raviv (1979); Holmström (1979); Shavell (1979a); Townsend (1979), Jewitt (1988), Laffont and Martimort (2002)*	
Hidden characteristics adverse selection	Hidden intensions hold up
Contributions	Contributions
Guesnerie and Laffont (1984); Mirrlees (1976); Rees (1985b); Salanié (1990); Theilen (1996)*, Laffont and Martimort (2002)*	Alchian and Woodward (1987); Grossman and Hart (1986); Klein (1980); Klein et al. (1978); Klein and Leffler (1981), Hart and Moore (1988, 1990), Aghion et al. (1994); Chung (1991); Edlin and Hermalin (2000); Laffont and Martimort (2002); Nöldeke and Schmidt (1995); Rogerson (1992)*
Generalized principal agent problems	
Double Moral Hazard	Moral Hazard and adverse selection
Contributions	Contributions
Agrawal (2002); Bhattacharya and Lafontaine (1995); Cooper and Ross (1985); Demski and Sappington (1991); Dybvig and Lutz (1993); Emons (1988); Gupta and Romano (1998); Kambhu (1982); Lal (1990); Lutz (1995); Mann and Wissink (1988); Romano (1994)	Baron (1982); Baron and Besanko (1987); Baron and Holmström (1980); Guesnerie et al. (1988); Myerson (1982); Picard (1987); Sappington (1991); Theilen (1996)*, Faynzilberg and Kumar (2000); Laffont and Martimort (2002); McAfee and McMillan (1987) *

*Indicates that a contribution falls in more than one category.

Therefore Jensen and Meckling (1976) and Fama and Jensen (1983a) focused on the relationship between agency costs and capital structure whereas Fama (1980) and Fama and Jensen (1983b) focused on the relationship between agency costs and organizational design.[89]

The normative, more formal stream of PAT takes ownership and allocation of firms as given and concentrates on the design of ex ante fully specified contracts and/or dedicated ex post monitoring or reporting systems. This is a flourishing field of research activity as shown in Table 3.1, where some of the main works on several aspects of normative PAT are depicted.[90] It seems to be the best way to classify this myriad of contributions by dividing them into works on:[91]

- Hidden characteristics leading to adverse selection.

[89]Cf. Eisenhardt (1989, pp. 59–60) or Erlei et al. (1999, pp. 168–169).

[90]An asterix "*" indicates that a contribution falls in more than one category. Further there exists a bulk of reviews on normative PAT like MacDonald (1984), Rees (1985a,b), Arrow (1986), Spremann (1987, 1988, 1990), Levinthal (1988), Eisenhardt (1989), Breid (1995), Kah (1993), Theilen (1996), Saam (2002) or Laffont and Martimort (2002).

[91]Cf. Spremann (1990), Breid (1995), Wolff and Neuburger (1995, pp. 81–83), Saam (2002, pp. 28–35), Picot et al. (2002:85–148) or Göbel (2002, pp. 100–123).

- Hidden action leading to moral hazard.
- Hidden information leading again to moral hazard.[92]
- Hidden intentions leading to hold-up.

Furthermore, more generalized principal–agent problems like double moral hazard, the occurrence of moral hazard and adverse selection at the same time and multiple principal and/or agent situations were modelled, but to discuss them here is beyond the scope of this work.[93] But some of these more generalized principal–agent problems will be discussed in Sect. 3.2.4.

Adverse Selection

Focusing on ex ante information asymmetry, there is an adverse selection problem, because the principal cannot observe contract-relevant characteristics of his agent and so he is unsure upon contracting with him at all. Remedies like signalling by the agent (Spence (1973, 1974)), screening by the principal (Stiglitz (1975b)) and the establishment of self-selection mechanisms (Ross (1973), Arrow (1986)) are usually proposed to alleviate the given ex ante information asymmetry. Furthermore, an alternative approach to adverse selection is the alignment of interests of the agent to the principal's ones like in the case of retailers providing guarantees or restitutions to their customers.[94]

Moral Hazard

Moral hazard of the hidden action type occurs if there is an ex post information asymmetry, where the principal can observe some outcome of his agent, but he cannot see the actual effort level of him. The information asymmetry can be costly alleviated either by extensive monitoring efforts by the principal or reporting efforts by the agent. Other approaches are closing contracts including incentive schemes and/or self-selection mechanisms or the agent makes a hands-tying agreement in advance (Schelling (1956), Kronman (1985)).

In the case of moral hazard of the hidden information type, there is an ex post information asymmetry about the state of nature which comes together with resource plasticity and opportunistic behaviour of "shirking" agents (Alchian and

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[92] Notably, Arrow (1985, pp. 38–40) provided in a quite influential contribution a somehow puzzling taxonomy mixing up the problem of (ex post) hidden information with (ex ante) adverse selection.

[93] In addition to this, Göbel (2002, pp. 105–109) or Richter and Furubotn (2003, pp. 290–294) named other variants and extensions of simple principal–agent problems including alternative incentives, more agents and relative outcome measurement, multi-task problems, common agency, hierarchical structures or dynamic modelling.

[94] Giving such a promise, the agent's self-interest is then delivering performance as expected by the principal with his reputation being at risk, see Picot et al. (2002, pp. 92–93).

Woodward (1987)). The agent is considered to have more information about the state of nature after contracting and therefore he can adjust his effort level accordingly. Again, costly monitoring by the principal or contracts with incentive schemes and hands-tying agreements by the agent are viable solutions.

Hold-up

In a hold-up situation, (1) ex ante commitments like initial investments are made by the agent non-observable by the principal result in an ex post dependency situation for the agent and/or (2) not fully specified contracts closed between an agent and a principal raise opportunities for the agent to extract specialized quasi rents.[95] Until recently (e.g. Laffont and Martimort (2002) or Gibbons (2005)), this sort of principal–agent problem has been widely negated in Anglo-Saxon PAT and therefore mostly unrecognized in mainstream literature there.[96] Some authors like Breid (1995, pp. 824–825) argued that these hold-up problems arise from a mix between ex ante hidden characteristics and ex post hidden information, whereas others like Picot et al. (2002, pp. 89–90) saw no direct information asymmetry between principal and agent at all but against third-parties which lead to non-sanctionable opportunism. Remedies for the first situation of hold-up are signalling by the agent, building up reputation (Klein and Leffler (1981)), exchanging hostages (Williamson (1983), Kronman (1985)), developing renegotiating schemes (Chung (1991), Aghion et al. (1994), Nöldeke and Schmidt (1995), Edlin and Hermalin (2000)) or a vertical integration solution (Klein et al. (1978)).[97] Principally, there are three viable solutions in the second hold-up situation as described above: (1) reconstruction of a corresponding complete contract by court, (2) transformation in a complete contract by assignment of residual claims to one party, which undergoes transaction-specific investments or (3) designing of self-enforcing contract schemes.[98]

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[95] Cf. Rogerson (1992). Laffont and Martimort (2002, pp. 370–372) label the first "non-verifiability and contracting" and the second "non-verifiability and bargaining." Further, Klein (1998) considered three factors necessary for the occurrence of a hold-up, namely (1) specific investments done in advance, (2) an imperfect contract not covering every possible contingency and (3) engaging in a hold-up is wealth-maximizing, because short-run gains outweigh long-run costs when doing so.

[96] See e.g. reviews by Arrow (1986), Spreman (1986), Levinthal (1988), Eisenhardt (1989), Kah (1993, p. 21–23), Petersen (1993), Barney and Hesterly (1996, pp. 124–129) or Theilen (1996, pp. 1–4). But contributions like Klein et al. (1978), Alchian and Woodward (1987, 1988), Chung (1991) or works under the label "incomplete contracts" (Grossman and Hart (1986), Hart and Moore (1988, 1990)), essentially describe such hold-up situations in principal–agent relationships, despite they are commonly not considered to be part of PAT.

[97] Cf. Picot (2002, p. 95).

[98] Cf. Martiensen (2000, pp. 361–367) or Schmitz (2001). This stream of literature is often subsumed under label of "incomplete contracting" initially assessed by Grossman and Hart (1986), Hart and Moore (1988, 1990), who later proposed to provide a 'property rights theory of the firm'. See also Schwartz (1998), Tirole (1999), Schmitz (2001) or Richter and Furubotn

Some Applications of Agency Theory

Although so many and diverse treatments of principal–agent problems exist in other fields of economic activity (like insurance markets[99], real estate brokerage[100], professional services[101] or marketing[102]), only quite a few recent contributions dedicated to the field of transport and logistics are known to the author.[103]

First, some authors assessed to integrate TCT and PAT in order to cope with principal–agent relationships. Kowtha (1997) suggested performance ambiguity and employee skill level to be significant predictors of control in employing crews from different nationalities in merchant shipping, Fernández et al. (2000) discussed quasi-integration (subcontracting of owner-operators) versus vertical integration (employing own vehicles and drivers as employees) in European LTL-trucking, whereas Nickerson and Silverman (2003a) explored the trade-off a US-American for-hire trucking carrier makes in its choice between contracting owner-operators and employing company drivers on company-owned vehicles. All three come to the conclusion, that agency as well as transaction costs matter in the trucking industry. Furthermore, Logan (2000) as well as Halldórsson and Skjøtt-Larsen (2003) focused on long-term outsourcing relationships in transport and/or logistics and proposed that there is a need to look from both sides of the contract which helps to provide and support an environment of trust, whereas Schüller (2003) employed PAT (as well as TCT and PRT) to derive managerial implications for integrated transport chains in the air cargo industry.

Second, Hubbard (1998, 2000) as well as Baker and Hubbard (2000, 2002, 2003) observed the impact of on-board information technologies like trip recorders and electronic vehicle management systems on monitoring driver's performance, job design and asset ownership patterns in the US-American trucking industry.

Moreover, Mitroussi (2003) discussed third-party ship management as a separation of ownership and management in the shipping context from a PAT point of view. Within his theoretical framework, he examined the relevant factors contributing to the recent emergence and evolution of a third-party ship management sector.

(2003, pp. 301–305) with recent reviews about contributions dedicated to their formal models of incomplete contracting. Further, they provided some conceptual criticism.

[99] See treatments on moral hazard and/or adverse selection in insurance markets e.g. by Spence and Zeckhauser (1971), Wilson (1977), Shavell (1979b) or Arnott and Stiglitz (1988, 1991).

[100] See contributions e.g. by Anglin and Arnott (1991), Arnold (1992) or Yavas (1995).

[101] See e.g. Sharma (1997) or Saam (2002).

[102] See Eisenhardt (1989), Bergen et al. (1992) or Lassar and Kerr (1996) with extensive reviews about this topic.

[103] See Zenios (2004, p. 118), considering PAT to be generally underrepresented in the operations management literature. Stock (1997) provided some evidence to this, reviewing four major peer-refereed journals with a logistics focus from 1980 to 1996. He found no contribution applying directly to PAT, but he considered it to provide further insights in principal–agent relations on the basis of contractual agreements.

Last but not least, a growing stream of contributions considered PAT to be a good theoretical base to approach interorganizational relationships in supply chain management. Discussing principal–agent problems in supply chain management, Kaluza et al. (2003) developed a taxonomy of principal–agent relationship problems, agency costs connected with them and workable solutions as shown in Table 3.2. For them, it seems to be straight forward, that different types of agents cause different principal–agent problems and therefore different approaches have to be followed. Furthermore, Halldórsson et al. (2004, 2005) employed PAT (together with TCT) to develop an institutional perspective of supply chain management in order to "[. . .] explain and understand this particular form of inter-organizational arrangement" (Halldórsson et al. (2004:248)) and authors like Zsidisin and Ellram (2003) or Agrell et al. (2004) used PAT to model explicitly information asymmetry in multi echelon inventory problems.

3.1.4 Conclusions and Some Comparisons

As it was suggested in the last sections, TCT and PAT are distinguishable theory approaches of NIE, but closely interrelated in their theoretical core.[104] Basically, although telling different stories they aim to solve quite the same sort of problems: TCT focuses on transaction costs and the ways to economize on them by choosing efficient governance structures in a discriminating way whereas in PAT, the object of interest are agency costs borne out of information asymmetry between contracting parties that have to be resolved by special incentive-compatible arrangements. In TCT, the problems causing costly distortions are called opportunism (ex ante and ex post), whereas in PAT they are considered as problems of adverse selection, moral hazard and/or hold-up. First, it is evident, that ex ante opportunism can be easily restated in terms of an adverse selection problem because both deal with likely the same pre-contractual situation. Second, Alchian and Woodward (1988, p. 67) claimed that the various PAT situations of moral hazard or hold-up are subsumed under the label of ex post opportunism in Williamsonian TCT without making further distinction between them.[105] But the very difference between these two concepts is, that PAT usually employs a neoclassical rationality concept that allows to write ex ante full specified contracts whereas bounded rationality and subliminal opportunism of individuals prevent them to do this in TCT. Furthermore, TCT can be regarded as a more comprehensive approach than PAT, because it is not only centred around the impact of imperfect information structures, but takes other transaction characteristics into consideration like asset specificity having the

[104]For this and the following see Barney and Hesterly (1996, p. 124), Kowtha (1997, pp. 54–55), Martiensen (2000, p. 353–355), Göbel (2002, pp. 64–65 and 133–138) or Picot et al. (2002, p. 64).

[105]See Alchian and Woodward (1988, pp. 67–70) criticizing exactly this in their book review of Williamson (1985).

Table 3.2 Principal-agent problems in supply chains (adapted from Kaluza et al. (2003:62))

	Cooperative relationships		Non-cooperative relationships		
Agent type	Parts producer	Network partner	Employees	Anonymous supplier	Technology specialist
Description	Outsourcing, subcontracting	System or supply chain partnership	In-house Production	Arms-length-buyer-supplier relationship	Independent specialist, not interested in cooperation
Dominant problems	Hidden action	Hidden characteristics, action, intensions	Hidden action	Hidden characteristics	Hidden action, hidden intension
Dominant agency costs	Monitoring costs	Bonding and monitoring costs	Monitoring costs	Residual loss	Residual loss
Dominant solutions	Monitoring	Incentive schemes	Monitoring and incentive schemes	Monitoring, abandoning of relationship is sub-performing	Monitoring, holding contact, always searching for alternatives

most decisive impact, even in absence of asymmetric information.[106] Moreover, both incentive (measurement and specification) as well as coordination (searching and matching) problems occurring in an imperfect world with extensive division of labour are covered by TCT at the same time. Another rather technical aspect is that PAT (especially the normative part) relies heavily on mathematical exposition, but Williamson (1991:281–286) later restated his initial solely verbalized reasonings of TCT in a more formal way, too. In addition to this, some authors considered the theory of incomplete contracts (in the sense of Grossman and Hart (1986) or Hart and Moore (1988, 1990)) as another formal expression of transaction costs economizing behaviour, but Holmström and Roberts (1998) as well as Williamson (2000, p. 604–607) provided striking arguments against such a comparison.

3.2 Market Microstructure and Intermediation Theory

In the previous sections, several facets of actual business like the governance of contractual relationships, the role of transaction costs and the consequences borne out of information asymmetries (namely adverse selection, moral hazard and hold-up) were theoretically reflected from an institutional point of view and some applications in the context of transport or logistic chains were given. But despite all these theories giving useful insights how economic environment imperfections affect business operations, establishment and running of markets to allocate goods and/or services or the important economic role played by intermediaries on markets seem to be rather unsolved. Therefore in the following, a closer look on market structure and intermediaries' role in markets is provided, based on MMT and ITF.

MMT itself can be shortly defined as the study of intermediation and the institution of exchange on financial markets.[107] Daniel F. Spulber recently expanded this approach of MMT on financial markets to other market institutions, leading to an "intermediation theory of the firm" backed by theoretical findings from NIE, IOT as well as NCE.[108] Following Spulber (1999:xiii),

> "[t]he intermediation theory of the firm provides an explanation for why firms exist. Firms are formed when intermediated exchange provides greater gains from trade than direct exchange between consumers and suppliers. The theory also helps to explain how markets work. Markets reach equilibrium through strategic pricing and contracting by intermediaries."

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[106] See Göbel (2002, pp. 134–136) for a more detailed discussion.

[107] Cf. Spulber (1996b). A more elaborated definition was provided by O'Hara (1995, p. 1): "Market microstructure is the study of the process and outcomes of exchanging assets under explicit trading rules. [. . .] Market microstructure research exploits the structure provided by specific trading mechanisms to model how price-setting rules evolve in markets."

[108] See Spulber (1999, pp. 13–21) for a comparison of his intermediation theory approach with NIE, IOT and NCE.

More precisely, he considered intermediaries to offer specific advantages over direct exchange like (1) reducing transactions costs, (2) pooling and diversifying risks, (3) lowering costs of searching and matching, (4) alleviating adverse selection, (5) mitigating moral hazard and opportunism and (6) supporting commitment through delegation.[109] Some of these advantages are derived from some superior coordination abilities, others are borne out of economies of scale and/or scope or stem from their interest in longevity of relationships and economic incentives to build up reputation.

Reviewing the literature in the field of MMT and ITF, at least four basic functional roles of an intermediary can be distinguished (see Tables 3.3 and 3.4

Table 3.3 Contributions about intermediaries: Part 1

Market makers, specialists, dealers, marketers or merchants (Dyadic relationships)	Matchmakers or Brokers (Triadic relationships)
Contributions focused on Financial Intermediation:	Contributions focused on Financial Intermediation:
Gurley and Shaw (1955, 1956), Baumol (1965)*, Demsetz (1968)*, Garman (1976); Stoll (1978); Tinic (1972), Bryant (1980), Ho and Stoll (1980, 1981), Amihud and Mendelson (1980); Bryant and Wallace (1980); Copeland and Galai (1983); Diamond and Dybvig (1983); Glosten and Milgrom (1985); Grossman and Miller (1988); O'Hara and Oldfield (1986), Gorton and Pennacchi (1990), Easterwood and Morgan (1991); Laffont and Maskin (1990)*, Beneviste et al. (1992); Bhattacharya and Yavas (1993), Freeman (1996a, 1996b), Holmström and Tirole (1998); Yavas (2001)*	Baumol (1965)*, Demsetz (1968)*, Easterwood and Morgan (1991)*, Yavas (2001)*
Other Contributions:	Other Contributions:
Garella (1989); Hackett (1992); Lim (1981); Spulber (1985); Stahl (1988); Wernerfelt (1988)*, Yavas (1992)*, Gehrig (1993), Havila (1993a, 1993b, 1996)*, Spulber (1996a), Fingleton (1997a, 1997b), Agrawal and Seshadri (2000), Johri and Leach (2002), Rust and Hall (2003)*	Anglin and Arnott (1991); Myerson and Satterthwaite (1983); Rubinstein and Wolinsky (1987); Yinger (1981), Yavas (1992, 1994, 1996a)*, Hackett (1992)*, Havila (1993a, 1993b, 1996)*, Bloch and Ryder (2000); Cosimano (1996); Gehrig (1996); Margolin (1993); Rauch and Watson (2002); Rust and Hall (2003); Yavas et al. (2001)* Cummins and Doherty (2006)

*Indicates that a contribution falls in more than one category.

[109] Cf. Spulber (1999:xiii).

Table 3.4 Contributions about intermediaries: Part 2

Hidden Action/Hidden Information Issues	Hidden Characteristics Issues
Delegated Expertise	Information Producers
Contributions	Contributions
Demski and Sappington (1987); Melumad and Reichelstein (1987); Taylor (1995); Wolinsky (1993)	Campbell and Kracaw (1980); Chan (1983); Etgar and Zusman (1982); Leland and Pyle (1977); Ramakrishnan and Thakor (1984), Millon and Thakor (1985), Boyd and Prescott (1986), Admati and Pfleiderer (1986, 1990)
Delegated Bargaining	
Contributions	
Fershtman and Gneezy (2001); Fershtman and Kalai (1997); Friedman (1992); Katz (1991); Schelling (1956) Kockesen and Ok (2004) Bond and Gresik (2006)	
Delegated Contracting	Guarantors or Certificators
Contributions	Contributions
McAfee and McMillan (1995)*, Melumad et al. (1995, 1997)*, Laffont and Martimort (1998)*, Baliga and Sjöström (1998)*, Macho-Stadler and Pérez-Castrillo (1998)*, Faure-Grimaud et al. (2003)*, Mookherjee and Tsumagari (2004)*	Biglaiser (1993); Chu and Chu (1994); Marvel and McCafferty (1984), Biglaiser and Friedman (1994, 1999); Li (1998), Lizzeri (1999), Garella and Peitz (2000)
Delegated Monitoring	
Contributions	
Diamond (1984, 1996), Krasa and Villamil (1992); McAfee and McMillan (1995); Williamson (1986)*, Melumad et al. (1995, 1997)*, Laffont and Martimort (1998); Strausz (1997); Yanelle (1997)*, Baliga and Sjöström (1998)*, Macho-Stadler and Pérez-Castrillo (1998)*, Hellwig (2000), Faure-Grimaud et al. (2003)*, Mookherjee and Tsumagari (2004)*	

*Indicates that a contribution falls in more than one category.

for a list of selected contributions in chronological order, an asterisk indicates contributions fitting to more than one category):[110]

- A *market maker* (specialist, dealer, marketer or merchant) in dyadic relationships, purchasing goods and/or services from market takers (sellers, suppliers or producers) for resale to their customers (buyers).
- A *matchmaker* (broker) in triadic relationships, helping buyers and sellers to get together for executing market transactions.

[110]Of course, this enumeration is by far not complete, but these contributions can be regarded as the most topical ones providing original thoughts and ideas. Most of the contributions not cited here fall in the main categories of unpublished working papers, replications and/or extensions to existing ideas initially presented by other authors.

- An *information producer*, *guarantor* and/or *certificator*, generating a business out of information asymmetry of the adverse selection type.
- An *agent* employed for specific tasks like *delegated expertise*, *bargaining, contracting* and/or *monitoring*.

In the following, the focus is set first on each of these four categories one after another presenting a selection of topical contributions, before again some applications in the field of transport and logistics are given.[111] For brevity in explanation, only basic assumptions, stylized facts and major conclusions for all of these more or less theoretical treatments as shown in Tables 3.3 and 3.4 are provided.

3.2.1 Market Makers, Specialists, Dealers, Marketeers and Merchants

Following Spulber (1996a), there are at least three types of individuals acting on a market: customers (buyers), market takers (sellers, suppliers or producers) and market makers (specialists, dealers, merchants or marketeers).[112] Market takers take price signals and market institution as given, whereas market makers create and/or run markets either as firms setting prices in a given market institution or being itself the market institution by coordinating transactions between all participants of a particular market.[113] Furthermore, they always take title on goods and/or services bought in from their suppliers and resell them to their customers. Doing this, they make a bargain out of the bid-ask spread between their purchase and their selling prices. These intermediaries are usually named specialists or dealers on financial markets and operate as marketeers or merchants like retailers, wholesalers or used car dealers on product markets. But apart from this simple price setting and intermediate trading function in dyadic relationships between both sides of the market, market makers offer even more service to markets, as will be shown in the following.

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[111] A more detailed overview of these contributions taken into consideration for this work and others not mentioned explicitly here can be found in reviews of Stoll (1985), Gertler (1988), Yanelle (1989), Yavas (1994b), O'Hara (1995), Easley and O'Hara (1995), Allen and Santomero (1998), Spulber (1999), Benjamin et al. (2000a,b), Madhavan (2000), Gorton and Winton (2002) or Stoll (2003).

[112] See O'Hara (1995, pp. 8–12) for a quite similar view, but she includes brokers as a fourth main type and asserts that some individuals acting on a market can belong to two of these categories at the same time.

[113] Other authors like O'Hara (1995) use the term "trading mechanism" instead of "market institution," which "[. . .] can be viewed as a type of trading game in which players meet (perhaps not physically) at some venue and act according to some rules." (O'Hara (1995, p. 8)).

3.2.1.1 Early Contributions on Financial Intermediation

Looking at existing financial markets, the assumption from NCE of competitive markets where a fictitious Walrasian auctioneer allows suppliers to sell and customers to buy any amount they desire at a given market price resulting from a tâtonnement process is in fact quite unrealistic.[114]

Probably one of the first contributions highlighting the role of financial intermediaries is Gurley and Shaw (1955, 1956). Looking the saving-investment process supported by financial markets, they defined the business of a financial intermediary as lending at one stratum of interest rates and borrowing at a lower stratum which allows individuals to obtain external financing.[115] Furthermore, they draw a distinction between these sort of non-monetary intermediaries engaged in borrowing and lending money and banks as monetary intermediaries offering bank deposits and money transaction systems as a mean of payment.

Baumol (1965) and Demsetz (1968) explored the business of specialists as market institutions at stock exchanges. To Baumol (1965, p. 14), "[t]he specialist's basic function is to bring buyers and sellers together." Furthermore, he distinguished between (1) the specialists's brokerage function facilitating market transactions between buyers and sellers and (2) the specialist as a dealer trading for his own account if needed.[116] Serving this second function, a specialist sets market prices and acts as a residual buyer or seller on demand in order to reach a market clearing equilibrium. Moreover, the specialist stabilizes financial markets by providing a continuous source of supply and a continuous demand in times of low market activity or trading against temporary upward or downward swings of market prices. Demsetz (1968) investigated empirically effects of trading volumes on transaction costs at the New York Stock Exchange. Doing this, he observed that "the ask-bid spread is the mark-up that is paid for predictable immediacy of exchange in organized markets; in other markets it is the inventory mark-up of retailer and wholesaler."[117] In another contribution, Tinic (1972) focused on liquidity service issues, adding structural determinants of demand for liquidity services and the economics of the specialist function to Demsetz's (1968) transaction cost approach.

All in all, these shown above and many other early contributions to financial intermediation were rather descriptive in nature and therefore failed to model

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[114]See Baumol (1965, pp. 10–12), Yavas (1994b), O'Hara (1995, pp. 3–5) or Spulber (1996a). According to O'Hara (1995, p. 7), the price fixing process at the London Gold Market resembles in many ways to such a Walrasian price mechanism with a series of preliminary auctions until demand equals supply at some equilibrium price, but actually no trading occurs there.

[115]Cf. Gurley and Shaw (1956, pp. 259–260).

[116]Cf. Baumol (1965, pp. 14–16). Further Demsetz (1968, pp. 37–38) for a similar description of the specialist's intermediary role.

[117]Demsetz (1968, pp. 35–36).

explicitly the underlying market mechanism.[118] But they laid ground for further, more formal investigation of financial markets as a micro economic phenomena.

3.2.1.2 Transaction Cost Reduction, Risk Bearing and Immediacy Service

Closely after a pioneering study conducted by Garman (1976), researchers focused on matching problems in financial market processes where a market maker sets prices to balance supply and demand of goods or services traded across time which in turn leads to a reduction of transaction costs to all market participants.[119] Furthermore, as such a market maker usually takes title on goods or services traded, he bears risks and offers at least some immediacy service, so that these sort of MMT models are often also called inventory models.[120]

Garman (1976) focused on the nature of order flow in determining equilibrium market prices on financial markets by introducing market uncertainty due to a Poisson process of buy or sell orders. Based on this stochastic market process approach, he modelled a risk-neutral monopolist intermediary setting prices in a dealership market for securities and contrasted it with a double auction market model of a stock exchange where market maker trades on temporarily fluctuations of supply and demand. Although his approach was considered in the following to be too mechanistic and full of simplifying assumptions to be applicable to actual market settings, it had a great influence on preceding work in the field of MMT.[121] Amihud and Mendelson (1980) developed Garman's (1976) dealership market model further and considered a specialist adjusting his price-setting based on inventory levels to maximize his profit per unit of time in a continuous-time, multiperiod setting.[122] Deriving an optimal policy, they showed, that prices set by the specialist are monotone decreasing functions on the stock at hand and the resulting bid-ask spread is always positive. Furthermore, the optimal policy of the specialist implies the existence of a preferred inventory position.

Another, more detailed dealer-based approach to market maker modelling was provided first by Stoll (1978). He analyzed directly the dealer's price-setting problem where he or she is one out of several risk averse traders in a financial market, who is willing to alter his own portfolio away from desired holdings to accommodate the trading desires of other market participants. The resulting bid-ask spread reflects then the elasticity of demand and supply and the dealer's degree

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[118] For a review of these early contributions, see Benston and Smith (1976), Cohen et al. (1979) or Stoll (1985).

[119] See Benston and Smith (1976), Cohen et al. (1979), O'Hara (1995, pp. 13–55) for a more comprehensive overview of the literature about market making on financial markets.

[120] Cf. O'Hara (1995, pp. 13–14) or Yavas (2001).

[121] See O'Hara (1995, pp. 14–23) for further critical comments.

[122] Further, see Spulber (1999, pp. 31–58) for some other extensions to the original dealership market model of Garman (1976).

of risk aversion. Ho and Stoll (1981) extended this original two-stage model of Stoll (1978) to a multi-period setting in which both order flow and portfolio returns are stochastic. There, the dealer faces demand following a continuous time Poisson process and is subject to return risk on his stock as well as the rest of his portfolio. The bid-ask spread then tends to increase with longer planning horizon of the dealer because adding more periods provides him more opportunities for price adjustment. But at the same time, his risk position increases, which leads to a need for greater compensation and therefore the bid-ask spread is widened. Furthermore, Ho and Stoll (1980) outlined the problem of determining the reservation prices of dealers operating in a competitive multiperiod market environment who are subject to return and transaction uncertainty. One of their results is, that each dealer's pricing strategy in this market setting depends not only on his own current and expected inventory position as well as his other characteristics, but also on the current and expected inventory and the other characteristics of his competitors.

Furthermore, O'Hara and Oldfield (1986) considered the dynamic pricing policy of risk averse dealers receiving both market as well as limit orders and facing inventory value uncertainty in a discrete-time, multiperiod trading environment.[123] Doing this, they showed, that the resulting bid-ask spread can be decomposed into three parts: (1) a portion for the known limit orders, (2) risk-neutral adjustment for expected market orders and (3) a risk adjustment for market and inventory uncertainty. Therefore, a risk-averse dealer may set a smaller bid-ask spread than a risk-neutral specialist with his inventory position affecting both the placement and size of the spread.

Bhattacharya and Yavas (1993) considered a dealer to be a "trader of the last resort" if traders can bypass him and trade directly with each other. There, potential traders approach him only when they cannot find a better match somewhere else. An increase in the quoted bid-ask spread intensifies search among traders and may result in more order imbalances which in turn attracts other dealers even with lower inventory holding costs to rise their bid-ask spread, too. Yavas (2001) developed this idea further studying explicitly the coordination role of a specialist in a simple search market model in which traders can either conduct direct search for each other to trade or go to the specialist. The coordination role of the specialist is due to the fact that he provides an immediacy service, with traders not dealing with him only if they expect to get a higher payoff from their own search efforts. However, he noted, that in the market equilibrium, the specialist never has a nonzero inventory position, thus he never has to execute his ability to sell (buy) a unit without having to buy (sell) another one and therefore the sheer presence of his ability alone is enough to induce coordination. And this result is robust to many relaxations of assumption as long as the specialist can provide such an immediacy.

[123] Market orders are orders to buy and sell for immediate execution and limit orders are orders to buy or sell at some prespecified price. As O'Hara (19995:37) notes, models with a stochastic order flow like Amihud and Mendelson (1980) or Ho and Stoll (1981) allow only market orders.

3.2.1.3 The Impact of Asymmetric Information on Market Making

Another stream of contributions on financial market intermediation regarded the trading process as a game involving traders with asymmetric information leading to problems of adverse selection.[124] Bagehot (1971) first proposed to discuss the economics of market making by introducing three kinds of traders: (1) informed traders possessing insider information, (2) liquidity-motivated traders who have no special information but merely want to trade cash against securities (or vice versa) and (3) traders acting on information which they believe has not yet been fully discounted in the market but which in fact has. To him, a market maker always bears losses in trading with informed traders which have to be recovered from trading with the other two forms of uninformed traders.

Following Bagehot (1971), Copeland and Galai (1983) and Glosten and Milgrom (1985) examined formally how market makers establish rational bid and ask prices, taking into account that some traders have superior private information.[125] The basic principle is that the bid price and ask price should reflect all available market information, including past, current and pending transactions. Thus the bid price (ask price) is a rational price conditional on a sale to (on the purchase from) the intermediary. Since a sale to the intermediary has a higher probability of being placed by an informed trader (insider) with superior private information in order to make profit than by a liquidity trader (outsider) who has no further private information and trades only for liquidity reasons, it implies a signal to an increased probability of a stock price decline. Conversely, a purchase from the intermediary might be a signal to an increased probability of a stock price increase. In this environment, the market maker establishes a bid-ask spread based on the average information contained in a sale to him or a purchase from him.[126] Doing this, he suffers losses from trading with informed traders, which have to be recovered by trading with liquidity traders. Therefore, the profitability of a market maker depends heavily on the returns from his immediacy service to liquidity traders, which must be sufficient to offset losses from dealing with informed traders.

Laffont and Maskin (1990) examined a model where a market maker possessing considerable market power is an informed trader while all other traders are uninformed so that he can set a bid-ask spread based on his private information.[127] If the possible variation of returns to a risky asset privately known to him is not

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[124]See O'Hara (1995, pp. 53–178) for a comprehensive overview on intermediation issues on financial markets with asymmetric information, including strategic trader modelling first introduced by Kyle (1984, 1985).

[125]See Stoll (1985:78), O'Hara (1995, pp. 53–66) or Spulber (1999, pp. 203–211) for a more comprehensive review of these models.

[126]In Copeland and Galai (1983), this bid-ask spread depends on the relative proportion of insiders and outsiders in a one-period model whereas Glosten and Milgrom (1985) model a dynamic setting of bid-ask spreads, where the market maker updates his beliefs and adjusts his bid-ask spread accordingly.

[127]See Spulber (1999, pp. 215–219) for a brief overview.

too large, the market maker has always an incentive to conceal that information rather than revealing it through his price setting, leading to a pooling equilibrium. Although this uninformativeness of price setting by the market maker, all other traders are better off than in any separating equilibrium, where equilibrium prices aggregate information effectively.

Beneviste et al. (1992) showed that long-standing relationships between floor brokers as traders and risk-neutral specialists can mitigate the effects of asymmetric information.[128] Moreover, a specialist who actively attempts to differentiate between informed and uninformed traders and has the power to sanction traders exploiting private information can achieve separating equilibria that pareto-dominate pooling equilibria. So they come to the conclusion, that a specialist system can be regarded as a market mechanism that improves both the welfare of market participants at the stock exchange and the terms of trade by reducing incentives to exploit informational asymmetry.

3.2.1.4 Liquidity Service and Consumption Smoothing

According to Grossman and Miller (1988), market liquidity is determined by the demand and supply of immediacy, which is provided by market makers through their continuous market presence and their willingness to bear risk by acquiring and holding stock during the time between the arrival of selling and corresponding buying orders.[129] Doing this, the market maker charges a risk premium to a trader who wants to sell immediately to him by offering him a price that is not uncertain, but on average lower than the seller could expect from a postponed sale. This margin can be regarded as the cost of liquidity service provision.

Focusing on banks as financial intermediaries, Gorton and Winton (2002) motivated three other forms of liquidity service provision: (1) establishing a payment system for spatial separated buyers and sellers which cannot meet each other face to face and transact at a central place, (2) offering bank deposits reducing trading losses for liquidity traders faced by other traders with private information or (3) providing credit lines as a form of contingent liquidity if moral hazard limits the effectiveness of transactions on financial markets between traders with excess liquidity and traders that need liquidity.

The first view of banks as liquidity providers concerns the non-monetary role of banks in the payment system. Freeman (1996a,b) set up a model where transaction partners are spatially separated and the timing of transactions is such that they

[128]In this context, floor brokers are agents acting on behalf of their customers and represent therefore market orders driven either by liquidity needs or private information.

[129]See also O'Hara (1995, pp. 216–223). Another explanation of market liquidity is asserted by Pagano (1989) considering liquidity not to be a measure of the cost of tasking risk and waiting, but rather a function of the scale of trading. For him, liquidity arises endogenously as a result of individual trader's decisions to trade more likely in markets that have more traders than in markets that have fewer traders, see O'Hara (1995, pp. 223–233).

cannot simultaneously trade at a central location. The real problem is, that buyers wish to obtain goods from sellers, but have neither goods they want to offer them in barter-like exchange nor any money for instant payment, though later they might be able to sell their goods in exchange for money. So, buyers issue IOU's – promises to pay at a central location later on with fiat money – to the sellers.[130] Fiat money is used to settle this debts, but money and private debt coexist. At the central clearing location it may happen that all creditors and debtors (or their respective agents) arrive simultaneously, in which case clearing occurs directly. If arrival is not simultaneous, however, payment can take place through a clearing house.[131] The clearing house accepts money in payment of IOU's and pays off immediately IOU's presented. However, if creditors arrive first, then the clearing house must have some liquidity stock to pay them before the debtors arrive. Furthermore, a basic point of the author is to develop the notion of the clearing house issuing its own IOU's like private bank notes, that can circulate and be redeemed for fiat money later.

Gorton and Pennachi (1990) provided another rationale for liquidity provision by banks showing that bank deposits can mitigate losses of uninformed traders associated with information asymmetry on financial markets. They argue that splitting the cash flows of an underlying portfolio in order to create debt and equity can create a liquid security, namely the debt, which can be used by uninformed traders to sell securities to satisfy their liquidity needs. If the debt provided is riskless, then there can be no information advantage that other traders could possess. These characteristics allow uninformed traders to trade without systematically loosing money to informed ones. Finally, financial intermediaries are the natural entities to create such securities, as they hold diversified portfolios of assets.

In Holmström and Tirole (1998), a bank creates a security called credit line, which is valuable because it is state contingent. Instead of holding cash or securities from other firms at stock as a liquidity reserve a firm might open a credit line at a bank in advance, which is only drawn on when there is a sudden need for liquid financial resources at once. Capital market securities cannot replicate such state-contingent payoff, so that they can make a business out of this third form of liquidity provision.

Building on previous work by Bryant and Wallace (1980) and Bryant (1980), Diamond and Dybvig (1983) developed the idea, that liquidity provision and consumption smoothing are important intermediation aspects of banking services.[132] For them, bank liabilities do not only function as a medium facilitating financial transactions. Moreover, banking firms offer some special insurance coverage to

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[130] The abbreviation IOU stands for "I owe you" and IOU's can be either promissory notes with the buyer as the debtor being drawer and drawee at the same time backed by an aval credit or banker's cheques issued by the buyer's bank on behalf of them, see Shubik (1991) or Kummer et al. (2010, pp. 227–235) with further references.

[131] See Freeman (1996a, pp. 106–111) for a detailed treatment of the clearinghouse function.

[132] See also Gorton and Winton (2002, pp. 16–21) an overview of other consumption-smoothing related models of banking and financial intermediation.

their customers against temporarily running out of liquidity. Individuals are facing uncertainty consumption needs which are often inconsistent with payoffs from irreversible investments done before, but banks offering demand deposits give them flexibility over the timing of withdrawal from deposits in endowment opened beforehand. Offering such transformation services from illiquid assets into more liquid liability payoffs, banks are always in danger of going bankrupt in case of bank runs.[133] This exemplifies the importance of strict governmental regulations in the banking sector, like minimum reserve holding obligations, coverage of deposit insurances and the role of state-owned central banks as a "lender of the last resort."

3.2.1.5 Market Making on Product Markets

On product markets, intermediaries actually reduce risk of market transactions borne from a high volatility of demand by holding inventories of goods on stock, which in turn allow them to offer an immediacy service to their customers.[134]

According to Lim (1981), retail and wholesale intermediaries serve another important role – beside offering immediacy service and lowering transaction costs as already shown in the case of financial intermediaries – which is diversifying supplier risks by purchasing and reselling not only one but a variety of products. The gains from trade with intermediaries as risk bearers do not necessarily require that the intermediaries have better information regarding consumer demands or less costly retailing technologies. Rather, risk pooling via product diversification done by them is sufficient to provide a profit incentive for intermediation. Furthermore, price discounts offered to intermediaries' bulk orders can then be regarded as a form of risk premium for his insurance service provision.

Spulber (1985) showed, that manufacturers and wholesalers pool common inventories in central warehouses to counter market volatility, smoothen demand across their customers and reduce the risks of excess or insufficient inventories. Furthermore, they often enter into additional financial risk sharing arrangements with retailers like consignment or repurchase contracts. Moreover, large retail chains achieve important advantages through their ability to diversify demand risk across individual retail stores.

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[133]Reasons to bank runs are manifold, see Gorton and Winton (2002, pp. 63–77). According to Diamond and Dybvig (1983), a bank run occurs in an undesirable equilibrium with preference shocks, where all depositors of a bank panic and withdraw immediately, including even those who would prefer to leave their deposits in if they were not concerned about the bank to fail. Chari and Jagannathan (1988) give another reason to bank runs by modelling informed depositors, who withdraw because they get information that future returns are likely to be low followed by uninformed depositors just observing this, inferring their bank is about to fail and precipitate a bank run. Jacklin and Bhattacharya (1988) even characterized information-based bank runs with two-sided asymmetric information, where banks cannot observe the true liquidity needs of their depositors while depositors in turn are uncertain about bank asset quality.

[134]Cf. Spulber (1999:xviii–xix).

Stahl (1988) examined the effects of winner-takes-it-all Bertrand price competition for inputs and market making of homogeneous goods, where intermediaries set prices sequentially, competing first for suppliers and then for customers (or vice versa).[135] This leads at least to a partial equilibrium model, in which the Walrasian price arises not from a fictitious auctioneer, but from price-setting behaviour of market making intermediaries. Sticking to the fact that supply and demand in competing markets are usually interdependent, Fingleton (1997a) extended Stahl (1988) to the case where direct trade between suppliers and consumers is possible.[136] He found Stahl's (1988) results are robust, because direct trade lowers but does not eliminate the monopoly rent, leaving a possible incentive for intermediaries to corner the market.[137]

Garella (1989) showed that a market making intermediary is able to improve market functioning in Akerlof's (1970) Lemon's Problem even if neither signals nor quality screening is available. By proposing a random pricing scheme to potential suppliers for sale of the units they own, the intermediary obtains an improvement of average quality if he is a monopolist or the suppliers do not have the possibility to meet more than one intermediary.

Spulber (1996a) examined market making by competing heterogeneous intermediaries with consumers searching for the lowest ask price and suppliers searching for the highest bid price. In order to highlight the role of time as one form of transaction costs, they consider search for a transaction partner as time consuming and suppliers, customers as well as intermediaries discount future returns with a common discount rate. This assumption makes it possible that buyers may settle for a higher price and sellers may accept for a lower price than expected instead of continuing search in the case of non-zero transaction costs.[138] The market making intermediaries post constant bid and ask prices to maximize their present discounted value of profits before a search process begins. The results are contrasted with the standard Walrasian supply and demand framework leading to the following conclusions: (1) For any rate of discount, the market is cleared so that supply equals demand, (2) the range of ask prices is above the Walrasian price and the range of bid prices is below it, and total output is less than the Walrasian output, (3) as the discount rate goes to zero, thus lowering the time-costs of search, the market

[135] Notably, this winner-takes-it-all competition in the first stage with the inputs divided equally among the competing intermediaries or all allocated to one intermediary cause the second stage either to be a duopoly with equal capacities or a monopoly.

[136] Direct trade is modelled as a bilateral matching market with a centralized price coordinator, who is not at the same time an intermediary. See also Spulber (1999, pp. 61–80) for some other extensions like differentiated products and purchases or non-zero consumer switching costs.

[137] In a companion contribution, Fingleton (1997b) focused on a diminishing welfare effect of introducing the possibility of direct trade with a common price scheme and the threat for the intermediaries to be disintermediated by direct trade.

[138] In addition to this, different willingness to pay among the customers and different opportunity costs among the suppliers are assumed which lead to different cost of search in both groups of market participants.

equilibrium with price-setting intermediaries approaches the Walrasian equilibrium and (4) as the discount rates become large, thus raising the time-costs of search, the market equilibrium output falls reaching the monopoly solution in the limit.

Agrawal and Seshadri (2000) showed, how an intermediary such as a purchase group or a sourcing agent can reduce the financial risk faced by risk averse retailers with uncertain customer demand in a single-period inventory (newsvendor) problem. Due to their risk aversion, retailer's order quantity is usually smaller than the profit maximizing order quantity for a single product from a common vendor under a special newsvendor contract.[139] According to the authors, a risk neutral intermediary can eliminate this loss of efficiency by purchasing goods from the vendor under the original newsvendor contract and sell them to the retailers through mutual beneficial risk sharing contracts by offering a menu of risk reducing pricing schemes with a fixed and variable component.

3.2.2 Matchmakers and Brokers

Beside the Walrasian auctioneer, neoclassical assumptions of perfect competitive markets include full information on both sides.[140] But considering real existing markets, it is more realistic to assume, that buyers and sellers usually have imperfect information about location, reservation prices and the preferences of their potential transaction partners. The unknown location of potential transaction partners implies that sellers as well as buyers have to invest search efforts in order to find each other. This search process then comes along with two sources of inefficiency. The first source is an uncertainty about finding a satisfactory match, which can be split into two components: (1) the uncertainty about finding a transaction partner and (2) given that such a transaction partner is found, the uncertainty about the buyer's reservation price (e.g. his willingness to pay) is above the seller's reservation price (e.g. his opportunity costs) and bargaining between them results in an agreement. The second source of inefficiency associated with such a search process are externalities involved therein. It is quite clear that an increase in seller's search efforts might increase buyer's gains from search (and vice versa), leading to positive externalities. If potential transaction partners do not take these positive externalities into account when choosing their personal search effort, there will be too little or too much search, depending on the magnitude of these opposing externality effects. Furthermore, such search economies might exhibit multiple

[139]Under such a newsvendor contract, each retailer purchases a certain quantity at a regular purchase price, which is the same for all retailers. If the realized demand is greater than the quantity ordered, the retailer has the option to purchase the units that are short at an emergency purchase price higher than the regular one. Conversely, if the demand is less than the order quantity, the retailer has the option to get the remaining inventory at a salvage price lower than the regular one.

[140]See Yavas (1994b) or Spulber (1996b) for this and the following.

equilibria, where pareto-dominated could occur leading to a so-called coordination failure.[141]

Introducing now matchmakers, usually called "brokers," in such a search market to coordinate market transactions by matching sellers and buyers might alleviate some if not all of these above mentioned market inefficiencies. Furthermore, matchmakers reduce at the same time transaction costs for buyers and sellers by centralizing exchange, because they are not only engaged in matching one but many transactions at the same time. Many forms of such matchmaking intermediaries exist in real-economy markets focused on stocks, real estate, insurance, labour force, travel and tourism, marriage and dating, transportation and so on. The very difference between them and the market makers already discussed before is, that they all just match buyers and sellers in triadic relationships without taking title on goods or services being traded. Furthermore, they get a commission for their matching service, whose source and amount depends on the market institution or results from bilateral agreements closed in advance. Remarkably, all these matchmakers have always to compete with decentralized search and bargaining of goods and/or services, where suppliers and customers try to find each other and negotiate prices directly.

3.2.2.1 Matchmaking on Financial Markets

As it can be clearly seen in Table 3.3, matchmaking on financial markets does not seem to be very common and therefore it is only sparsely reflected in literature. Although Baumol (1965) as well as Demsetz (1968) saw a brokerage function of financial intermediaries, they thought that their ordinary business is market making. But following Grossman and Miller (1988, pp. 619–620) or Yavas (2001), specialists as well as floor traders on stock exchanges not offering immediacy and/or liquidity services can be regarded as matchmakers on financial markets. This situation occurs especially in thin markets with low trading activity where continuous presence and willingness to buy and sell at any time most likely is not profitable. In addition to this, possible asymmetric information about true values of assets lead financial intermediaries to provide brokerage, but no immediacy and/or liquidity services.

3.2.2.2 Matchmaking on Other Markets

Starting with a classic study of Yinger (1981) explaining the business of real estate brokers and the value of multiple listing services (MLSs), research on real estate brokerage seemed to mushroom.[142] In his model framework, real estate brokers

[141] Cf. Diamond (1984).

[142] See Margolin (1993, pp. 8–14), Yavas (1994b) or Benjamin et al. (2000a,b) for reviews especially dedicated to this stream of brokerage literature.

must consider uncertainty. First, they search for buyers of houses on one side and collect listings of houses for sale on the other, but they neither can be certain about the number of buyers asking for houses nor the number of sellers listing with him during any given time period. In addition to this, matching of buyers with listings of houses is also uncertain because houses have many attributes and tastes of potential buyers vary widely. Simultaneously taking these three uncertainties into account, Yinger (1981) constructed a formal model of the search-and-match behaviour of real estate brokers. Furthermore, he introduced the possibility that a real estate broker might share his pool of buyers and sellers with other brokers in form of a MLS and share the commission obtained for a successful match.[143] He compared his results with and without MLS, coming to the conclusion that too much resources are devoted to brokerage service in both cases although the creation of an MLS increases overall market efficiency.

In a more general market model by Rubinstein and Wolinsky (1987), buyers, sellers and intermediaries are randomly matched. The matching process is assumed to be time-consuming and all market participants discount future benefits so an intermediary can reduce the time-preference losses that occur when buyer and sellers must search for their counterparts for matching. The intermediaries are considered to increase the number of market participants that can buy or sell a good traded, as long as the likelihood of a buyer's or a seller's encountering an intermediary whom they can trade with is at least as great as the likelihood of exchanging directly with each other. Analysing gains from trade for all market participants, they explored two cases how the intermediary takes part in the matching process. First, he might facilitate the matching process by setting a bid-ask spread, which leads to a market equilibrium biased in favour of the buyers because the price paid by the intermediary to the seller is sunk when he meets the buyer and the following bargaining is over the full surplus from intermediation. If the intermediary works for the seller based of a consignment agreement, the asymmetry disappears and the surplus is divided symmetrically among the three participants, because the consignment also strengthens the position of the seller against the intermediary, since price concessions made by him will partly be rolled over to the buyer.

While analysing brokerage contracts, Margolin (1993) developed a theory of brokerage formation based on TCT. For him, brokers provide uniquely efficient solutions in markets where particular patterns of strategic behaviour interact with stochastic demand and costly information. There, brokers do not solve informational problems but solve problems associated with the exchange of information.

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[143] Following Yavas (1994b, pp. 176–177), such a MLS can be considered as a market mechanism that eliminates trade friction resulting from imperfect information, bringing the housing market closer to a perfect competitive market outcome. Because there are economies of scale in a matching process, the quality and quantity of matches increases with the size of such a pool of buyers of sellers. For them, a MLS means in turn a higher probability of a match and lower search costs, because it eliminates the need for a buyer (seller) to visit several real estate brokers in order to ensure a sufficient coverage of (exposure to) the market.

Furthermore, commission compensation systems applied by them provide unique governance of free riding and resale problems in line with overcoming informational pricing problems. More specifically, brokers price their services on a value-of-service basis, the pricing method most commonly associated with simple, spot-market exchanges of ordinary goods and services.

In Gehrig (1993), suppliers and customers can choose between using intermediaries to trade at a known price and the risky option being randomly matched on decentralized matching market, because the customers do not know the suppliers' opportunity costs and the suppliers do not know the customers' willingness to pay.[144] The market making intermediary chooses a profit-maximizing bid-ask spread in competition with the decentralized market option and posts common observable prices to suppliers and customers. At the market equilibrium, customers with a willingness to pay above a critical level (greater than the ask price) purchase from the intermediary, whereas suppliers with opportunity costs below a critical level (less than the bid level) sell to him. Consumers and suppliers with values between these two critical levels enter the matching market. If there is only one monopoly intermediary, both markets are active and if there are competing intermediaries, the bid-ask spread collapses to the Walrasian price and all customers and suppliers transact through intermediaries.

Cosimano (1996) presented a matching model where trading through an intermediary being more efficient in matching buyers and sellers lowers the probability of an unsuccessful trade. By posting a bid-ask spread at which sellers and buyers are guaranteed a successful trade, the intermediary may increase the expected gain from trade. Market participants with extreme valuations of the good choose to buy from (sell to) the intermediary and experience thereby an increase in their welfare since the expected net gain to trade is higher relative to the benefits of direct trade. However, there is also a harm imposed on direct traders and those market participants who are indifferent whether to trade or not at all. These traders are worse off because on average they will be dealing with counterparts who expect a lower gain from trade. The direct sellers (buyers) have a lower expected gain since they trade with direct buyers (sellers) who place a lower (higher) value on the product relative to the market participants trading through the intermediary. Furthermore, a market for homogeneous goods will have a lower bid-ask spread since the demand faced by the intermediary is more elastic and more direct trades will occur while a market with heterogeneous goods tends to have a high bid-ask spread and will be dominated by intermediated trade.

Gehrig (1996) analyzed island economies with intermediating matchmakers, who invest in information networks allowing them to inform other market participants

[144] Yavas (1996b) further generalized Gehrig (1993) by endogenizing intermediaries's search intensities, by allowing the buyers and sellers to become an intermediary even if they have engaged themselves on the matching market, and by enabling the intermediary to provide the service of immediacy. See also Spulber (1999, pp. 118–130) for some further extensions to the original model framework by altering the bargaining process and introducing additional types of transaction costs.

on spatial dispersed islands about their price offers in a homogenous market with fixed costs of entry.[145] Larger networks allow them to reach more markets and a larger set of potential clients so that the probability of successful matching enhances which leads to a more efficient brokerage service. He showed that the number of intermediaries active in a symmetric equilibrium is bounded independently of the size of the market as long as investments in information networks are costly. The market structure itself resembles then to a natural oligopoly market structure with a small group of large intermediaries with similar network size and a competitive fringe of much smaller ones occupying niche markets.

Taking marriage markets as an example, Bloch and Ryder (2000) analyzed the provision of matching services in a bilateral search environment with infinite horizon, but without transferable utility. The matchmaker sets up a centralized matching procedure and proposes to match his clients according to his scheme based on an exclusive brokerage contract. The most interesting results of their study are that a matchmaker charging a uniform participation fee (like marriage brokers or travel agents) only services the upper part of the market, leaving potential clients of low quality apart. On the other hand, a matchmaker charging a commission on the matching surplus (like real estate agents or head hunters) only attracts clients of lower quality.

Rauch and Watson (2002) constructed a simple general equilibrium model of entrepreneurship in international trade, where individuals first accumulate deep knowledge of buyers and sellers by working as employees and then leave their jobs in order to provide then brokerage services on own account, based on their existing network of business contacts. They showed that in equilibrium, there can be too much or too little intermediation in a pure matching market, depending on their bargaining power and technology of intermediation.

Finally, Cummins and Doherty (2006) analyzed the economic functions of independent insurance intermediaries (brokers and independent agents) with a special focus on the commercial property and casuality insurance market in the US. As the market process and product offers are complex and multidimensional, such intermediaries help buyers to identify their coverage and risk management needs and match them with appropriate insurance companies. Furthermore, they help to alleviate adverse selection problems of the insurer because they are usually better informed about the risk of their clients than the insurer. Moreover, they increase market competition by providing access to a wider range of possible products and help their clients to select insurers on the basis of price, coverage, service and financial strength.

[145] According to Gehrig (1996), this model applies to corporate activities of bank in Continental Europe, real estate brokers, marriage brokers, head hunters or even computer reservation systems in the airline industry, where the perception of product quality is maintained by service networks of different sizes.

3.2.2.3 The Impact of Asymmetric Information on Matchmaking

Again, asymmetric information seems to have a decisive impact on intermediation and market microstructure outcome. A first example are Myerson and Satterthwaite (1983), who showed that an intermediary can replace direct bargaining with an incentive-compatible and individual rational trading mechanism for a buyer and a seller who are exchanging on a single indivisible object.[146] Such a trading mechanism determines the payment and the likelihood of trade given truthful announcements from the buyer and the seller of their respective private information to the intermediary. Furthermore, it represents the outcome of such bargaining procedures as first-and-final offers by either the buyer or the seller as well as alternating offers and encompasses double auctions, in which the good is exchanged at some average of buyer and seller bids, as long as the buyer's bid exceeds that of the seller. Doing this, the intermediary can overcome the present asymmetric information structure which allows him to tax the intermediated buyer and seller exchange by setting a profit-maximizing bid-ask spread.

Yavas (1994a) examined the role of matchmakers in a one period bilateral search economy with private information about goods valuation of buyers and sellers and showed that the introduction of such a monopolistic intermediary will narrow the set of buyer and seller types who search for a match on their own.[147] More specifically, sellers with a high reservation price and buyers with a low willingness to pay will immediately drop out of the search market and trade through him. Moreover, the presence of a matchmaker leads to a decrease of equilibrium search intensities for those market participants who are still engaged in searching. Therefore, the matchmaker improves welfare by affecting search behaviour of market participants, if search is very costly and inefficient (and vice versa).

Furthermore, Yavas (1996a) examined the optimality of matching strategies employed by real estate brokers under different commission structures, namely percentage commission, flat-fee and net listing systems.[148] In order to shift the focus away from search and resource allocation issues of brokerage towards a matching problem, he assumed that the intermediary has already a pool of buyers and sellers to match under asymmetric information. Specifically, the buyers and sellers know their own reservation price but do not know each other's reservation prices and the intermediary knows (or manages to find out) all reservation prices. He showed

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[146]See Spulber (1999, pp. 173–193) for this basic model of Myerson and Satterthwaite (1983) and some extensions.

[147]Originally the study was dedicated to exploring the role of employment agencies in labour markets. But as Yavas (1994a) noted, that his model can be applied to most bilateral search markets.

[148]Under the percentage commission structure, the intermediary receives a percentage of the transaction price from the sale of each property whereas under the flat-fee system he raises a fixed fee per property sold, regardless of transaction price. If the intermediary and the seller sign a net listing contract, the seller specifies a price the intermediary has to pay upon the sale of the property regardless of the actual transaction price, which is determined through bargaining between him and the buyer, see Yavas (1996a, pp. 103–105).

that the profit-maximizing matching strategy for the intermediary under percentage commission and flat-free systems also maximizes the number of houses sold, but minimizes the buyer's as well as seller's surplus. On the other hand, net listing results in fewer house sales, but yields larger surplus for buyers and sellers.

In another contribution, Yavas et al. (2001) reported experimental evidence on the impact of an intermediary in bargaining over the sale of a single good. Through an experimental analysis, they examined how he affects the price, the likelihood of a successful negotiation and the time it takes to complete a negotiation. Their results show that an intermediary, whether informed about reservation prices of buyers and seller or not, (1) increases the sale price, (2) reduces the likelihood of an agreement and (3) increases time to reach an agreement (though the number of bargaining rounds decline). So they suggested the benefits of brokerage to be predominantly in the matching of buyers and sellers rather than in the facilitation of bargaining.

3.2.2.4 Comparative Studies

After looking on market making on one side and matchmaking on the other in isolation, in this section the findings are summed up and the results of some comparative studies are shown.

Focusing on costs and benefits of intermediation on financial markets for external financing with costly search as well as costly contracting, Easterwood and Morgan (1991) showed the differences between market making and matchmaking types of intermediaries.[149] In this environment, the market maker enters into two costly contracts, one to provide funding for a borrower and another to obtain and repay funds from lenders, whereas the matchmaker enters into a single costly contract with a borrower to search for acceptable lenders for contracting over external financing for a certain investment.[150] Intermediaries of either type operate relative to other intermediaries in a perfect competitive market for their intermediary services offered to the borrowers.[151] The model allows for three modes of external financing: (1) direct financing between borrowers and lenders without an intermediary, (2) indirect financing through a matchmaker and (3) indirect financing through a market maker. Considering the level of search cost on one hand and contracting cost on the other, Easterwood and Morgan (1991) showed that a matchmaker will be employed by a borrower, if search costs are high and cost of contracting is low. Furthermore, direct financing will always occur for very low search costs but with increasing search

[149]Throughout their paper, they denoted market makers as "depository financial intermediaries" and matchmakers as "brokerage financial intermediaries".

[150]Due to the project of the borrower seeking for external funding is assumed to have a certain outcome, risk considerations of leding and borrowing are not considered in this study.

[151]Easterwood and Morgan (1991) noted, that their results are robust to alternative specifications of the degree of competition among the intermediaries, because they have the same necessary and sufficient conditions for market participation in their cost-benefit comparisons.

costs, a shift towards the market maker happens, who is the dominant intermediary type in case of high search as well as high contracting costs.

Using a bilateral search model with a monopolistic intermediary, Yavas (1992) compared both forms of intermediation. Referring to an earlier paper (Yavas (1991)), he asserted that market making yields to more profits and higher welfare than matchmaking when the valuations of the market participants are common knowledge. But introducing a bilateral search framework, where two market participants (a buyer and a seller) with private information about their value are searching for each other or opt for trading through an intermediary, profit and welfare results depend heavily on market characteristics.[152] Comparing expected profits for both forms of intermediation, they came to the conclusion that when the valuations of the market participants are private information, market making might yield higher or lower profits and welfare effects than matchmaking, depending on the efficiency, the cost of search and the valuation distribution of the market participants.[153] The intermediary in question prefers e.g. to be a market maker, if search is efficient and costless. Conversely, if search is relative inefficient and sufficiently costly, matchmaking leads to higher profits and welfare. Furthermore, they noted that there are many other reasons for an intermediary to be a matchmaker like the inability to perform market making on labour or marriage markets or there are intermediaries who provide both market making and matchmaking services like specialists on stock markets.

Hackett (1992) provided a comparative analysis of merchant and broker intermediation contracts on product markets with uncertain demand, highlighting the differences in ownership patterns and compensation structures as a key source of different performance. He set up a model framework where the intermediation process starts with commitment to one of the two contractual forms, then the intermediaries take actions (like investment in efforts in order to increase expected demand), demand is realized, and trade occurs. Merchants have to commit themselves to a quantity purchase contract with the supplier, take title on intermediated goods in order to be compensated with residual surplus after the demand is realized and goods are sold. On the other hand, brokers are intermediaries who facilitate exchange without buying and selling goods and their compensation consists of a revenue sharing commission rate specified in advance. To Hackett (1992), a principal advantage of merchant intermediation relative to intermediation through brokers is that sellers do not have to pay a commission. Furthermore, merchants will provide the expected joint surplus maximizing level of effort, because they are residual claimants. The merchant intermediary form is therefore best suited to conditions in which demand has low variance, but is highly responsive to intermediary's effort

[152] Specifically, the intermediary can be either a market maker setting a bid-ask spread in order to buy or sell on own account or a match maker simply matching two parties on basis of an exclusive brokerage contract, obtaining a percentage commission on the transaction price.

[153] Additional results are that both lead to smaller price dispersions (at least of the matches facilitated in the case of the matchmaker) and decreasing equilibrium search intensities.

level. Brokers never take title on goods, and providing investments to increase demand for a seller as the owner of the good leads to a less than expected joint surplus maximizing level of effort. Therefore, brokerage through intermediaries most likely occurs when demand variance is high and independent of intermediary's effort level.

Extending Spulber (1996a), Rust and Hall (2003) presented a model in which the microstructure of trade in a commodity or asset is endogenously determined. Suppliers and consumers of a commodity (or buyers and sellers of an asset) who wish to trade can choose between two competing types of intermediaries: brokers and market makers. Market makers post publicly observable bid and ask prices, whereas the prices quoted by brokers with heterogeneous transaction costs are private information that can only be obtained through a costly search process. Starting from an initial equilibrium search model where are no market makers but free entry of brokers and all trade is intermediated by them, they analyse the effect of a market entry by a single market maker. The post-entry relative share of trade intermediated by brokers rather than the market maker depends on three parameters: (1) the intertemporal discount rate, (2) the per unit transaction costs of the market maker and (3) the per unit transaction costs of the most efficient broker. If the market maker's per unit transaction costs exceed that of the least efficient broker already operating on the market, then an entry by the market maker is not profitable and therefore only brokers will operate in the post-entry equilibrium. For a broad range of parameter values, the market maker coexists with a competitive fringe of brokers undercutting the market maker's publicly posted bid-ask spread and limiting his market power. If the per unit transaction costs of the most efficient broker are sufficiently high relative to the transaction costs of the market maker, then the entry of the market maker drives all brokers out of business. However, brokers can survive the entry of a market maker even if the transaction costs of the most efficient broker exceeds the transaction costs of the market maker – provided that the gap between them is not too big. Furthermore, they showed that all suppliers and consumers choosing to participate on the market enjoy a strict increase in their expected gains from trade after entry of a market maker and Pareto improvements occur even in cases where the market maker's entry drives all broker out of business, monopolizing the intermediation of trade.

3.2.3 Information Production, Guarantors and Certificators

As buyers (customers, lenders or investors) on one side and sellers (suppliers, producers or borrowers) on the other are usually subject to asymmetric information, there are opportunities for intermediaries to help and fill this gap by collecting and supplying information for both sides of the market.[154] Reviewing

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[154]Cf. Spulber (1999, pp. 147–148).

the intermediary-related literature, at least three different situations of such intermediary action can be identified: (1) Intermediaries undergo investments or sample information to get informed and give credible signals to their customers, (2) they sample information in order to sell it to everyone who is interested in it or (3) they provide certificates and guarantees on product quality.

3.2.3.1 Information Production and Signalling

Leland and Pyle (1977) suggested that an intermediary can signal his informed status and credibly produce information by investing in assets about which he has private knowledge. The starting point of their chain of argumentation is that a single intermediary has private information about an investment opportunity, but insufficient resources to undertake the necessary investments on his own. Since other potential investors do not observe his private information, there is an adverse selection problem. To alleviate this, the intermediary signals his private information by the fraction of equity put into a project whose quality is known only to him and sells the remaining fractions to other investors. This idea was further reinforced and generalized by Campbell and Kracaw (1980). According to them, “intermediaries emerge as information producers because the production of information, the protection of confidentiality, the provision of transactions services, as well as other intermediary services are naturally complementary activities” (Campbell and Kracaw (1980, p. 864)).

In another contribution, Boyd and Prescott (1986) modelled agents facing asymmetric information prior to contracting and investing in loans. The adverse selection problem is here, that agents are of different types and this information is private to each agent. Each agent, however, owns a technology to evaluate projects – or better say – determine agent type, allowing him to produce ex ante information about the projects. This ex ante information production can alleviate the adverse selection problem, so that here an agent evaluates his own project, and then issues securities to investors that promise specified returns. Alternatively, a coalition of agents can offer investors a claim on group returns. Financial intermediaries are then coalitions of agents that evaluate projects, invest in those determined to be high-value projects, and share the returns from the portfolio of projects.

Chan (1983) considered a venture capital market, where entrepreneurs select the qualities of projects and their prequisite consumption, about which investors are imperfectly informed, but can conduct costly search in order to get an informed investor.[155] If all investors have positive search costs, there is a “Lemon’s Problem,”

[155]The entrepreneur selects the quality of project (which depends on time and effort expended on that project) and his perquisite consumption diverted from the return on the project. Although investors have rational expectations regarding the entrepreneurial actions in equilibrium, the actions are unobserved leaving the investors uninformed. However, they can learn about the entrepreneur through search, which can be done at a cost that vary across investors. In turn

because in a market without informed investors the entrepreneurs are always induced to offer only unacceptable inferior projects. In such an undesirable situation, competitive financial intermediaries may evolve, who conduct search for good projects and invest for their clients against a profit maximizing fee per investor. These intermediaries increase the welfare of the investors by inducing the entrepreneurs to offer high return projects.

3.2.3.2 Information Production and Selling

Building on a communication network model in marketing channels first formulated by Balderston (1958) and further extended by Baligh and Richartz (1967), Etgar and Zusman (1982) developed the idea of a marketer as an information seller on product markets. For them, information like conditions of prices and quantities in the supply side or willingness to pay on the demand side carries economic value, so that it becomes a commodity by itself. This allows a marketer to collect information about suppliers and sell it to buyers (or vice versa). Since information collection and transmission is costly, the marketer has to bear communication cost proportional to the channel contacts established by him. Furthermore, information-processing costs occur reflecting the costs associated by encoding, storing, retrieving and organizing information, which raise considerably from a certain level due to diseconomies of organization. Assuming profit maximization by the marketers and free entry, competition will force the price for information to equal average costs. Referring to hierarchical marketing channels, one important implication of this model is, that marketing channels tend to adopt a pyramid-like structure whereby the number of intermediaries at each level is smaller than at the preceding one.[156]

Ramakrishnan and Thakor (1984) observed financial intermediaries producing information in order to sell it. Individual firms issuing new shares to the public can hire such an intermediary to produce information about their quality. As information production is a costly but unobservable effort leading to an ex post noisy indicator, an information producer might think of avoiding these costs without being detected. But being risk averse, information producers would prefer to avoid the risk that the noise in the indicator prevents them from obtaining compensation for their efforts. Furthermore, there are returns to mergers between such intermediaries if they can monitor each other's effort at gathering information within a joint organization. Risk sharing is not sufficient to create gains from such mergers, but if internal monitoring is costless and the joint organization becomes considerable large, the expected costs

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the entrepreneurs take this into account, so that their actions will depend on the distribution of the investor's search costs.

[156]The logic is as follows (see Etgar and Zusman (1982, pp. 513–514)): The profit maximization of information sellers imposes that the price of information must decline as information moves from one channel level to the next one. This gives higher level intermediaries to obtain information for a lower price which in turn allows him to operate at minimum average costs with more information buyers and generates a need for fewer intermediaries at his level.

of monitoring converge to lower limit, indicating that there are benefits from fully centralized intermediation done by a monopolist.

In contribution closely related to Ramakrishnan and Thakor (1984), Millon and Thakor (1985) proposed a theory of information production under asymmetric information and moral hazard, where an information gathering agency acquires and processes reliable information for the purpose of certifying asset qualities, but do not get involved in funding.[157] In their model framework, several screening agents producing reliable information about true values of assets in question choose to form such information gathering agencies, because it enables them to diversify their risky payoffs from screening activities and allows intra-organizational information sharing without any further internal monitoring.[158]

In a series of papers, Admati and Pfleiderer (1986, 1988, 1990) explored the economics of information selling and the payoff of a risky asset by a monopolistic information producer on a financial market with a perfectly competitive noisy rational expectations equilibrium.[159]

Assuming that such an information producer has complete control over the distribution of his product and abstracting from incentive issues, Admati and Pfleiderer (1986) treated two cases of direct information selling: (1) selling the same information to all his clients and (2) selling personalized information to each. They showed that in any instance, the seller may prefer to sell noisier versions of the information he actually has or restrict the fraction of informed traders in order to overcome the dilution in the value of information due to its leakage through informative price setting. Moreover, to obtain higher profits, he may sell different information to different traders, so that the noise realizations do not affect equilibrium prices. One way of doing so is to sell identically distributed, but personalized information to each of a larger number of traders.

Admati and Pfleiderer (1988) discussed the option of selling information versus trading on own account in a model of imperfect competition. They found that if the seller is risk neutral, he never wishes to sell his information to any other and trades on own account, whereas if he is risk averse, it is generally profitable for him to commit not to trade himself and sell the information to other traders on the

[157] Examples to such information gathering agencies are creditrating agencies, financial newsletters, investment counselors or credit bureaus, see Millon and Thakor (1985, p. 1403).

[158] In order to operationalize this, Millon and Thakor (1985, pp. 1405–1412) supposed that there are firms that wish to sell new shares to raise their investment capital. Further, they assumed that the true aggregate value of such new shares depends on firm specific as well as market specific variables unknown ex ante, but precise information about them can be acquired by investing in information production. Therefore, screening agents are employed for information gathering, undertaking appropriate actions in order to obtain the variable values in question after some costly investigation subject to random shocks. The compensation scheme of the screening agent is based on a publicly observable, noisy, ex post indicator of information quality which induces them to produce reliable information.

[159] They employed the model of Kyle (1984, 1985), in which traders submit market orders to a competitive, risk neutral market maker taking into account their effect on the price.

market. Furthermore, they examined another form of selling his information called "indirect information selling." Here, the information seller creates a mutual fund whose portfolio choices are a function of his private information, and the sale of information amounts to selling shares in this fund to traders. With identical traders, selling shares in a mutual fund seems to be better than selling information directly, but observing actual financial markets, the direct selling option dominates.

Admati and Pfleiderer (1990) compared two different strategies of selling information to traders on a financial market. One method involves the direct sale of information as analyzed in Admati and Pfleiderer (1986, 1988) and the other is indirect information selling as introduced in Admati and Pfleiderer (1988). They showed that when information is sold indirectly, it is never desirable to add noise, because adjusting the price for share in the mutual fund is a more effective way to control the usage of information, but may not allow as much surplus to be extracted as it is possible in the case of direct selling.

3.2.3.3 Certification and Guarantee Provision on Product Markets

Asymmetric information about product characteristics like quality can lead to severe market failures like bad-products-drive-out-good-ones-effects as shown in the Akerlof's (1970) well known "Lemon's Problem," that arises when product quality is not immediately observable. But introducing an intermediary certifying products being traded by him may be a viable solution in this context, as it will be shown following.

Marvel and McCafferty (1984) showed that resale price maintenance will be adopted when a manufacturer wishes to obtain quality or style certification for his products from reputable retailers. Moreover, they demonstrated that manufacturers opt for resale price maintenance even when they are permitted to shape the set of stores handling their products through refusals to deal.

Wernerfelt (1988) presented a signalling model in which a multi-product firm can use its reputation as a bond for quality by using a brand name of an established product when it introduces a new experience good. When it introduces the new product under such so-called "umbrella branding," it claims that the old and the new product are both of good quality, and invites consumers to pool their experience with the two products to infer the quality of both. He showed that in equilibrium, only multi-product firms with both goods being of good quality will do so, because if one of the products is of bad quality, it will harm subsequent sales of the other, too.

In a model similar to Wernerfelt (1988), Chu and Chu (1994) explored the case of renting reputation from one agent to another in order to signal quality. Specifically, they showed that in a separating equilibrium, a manufacturer of a high quality product will signal product quality by selling through a retailer with strong reputation, while a manufacturer of a low quality product will sell through retailer with no reputation. Furthermore, the reputable retailer has an incentive to truthfully represent the quality of the product it sells in order to protect his own reputation, so that he can be regarded as a quality certifying intermediary.[160]

Biglaiser (1993) showed that introducing a monopolistic intermediary in a market environment suffering from adverse selection enhances efficiency, because this intermediary has a greater incentive to invest in quality inspection technologies enabling him to distinguish high-quality from low-quality suppliers than an individual customer since he trades more goods. Furthermore, he has an incentive to report accurately the quality of goods, because he wants to build up and maintain a good reputation in order to carry out more and more transactions of this kind. If suppliers and customers have the choice between direct and intermediated trade, high-quality products are traded through the intermediary and low-quality ones are traded without him. This separation of low- and high-quality products alleviates the Lemon's Problem in the intermediated market equilibrium.

Since intermediaries are usually trading more than one product, customers may rely on their reputation without further investigating all the suppliers of these products offered by them, too. Biglaiser and Friedman (1994) referred to this situation, where intermediaries serve as guarantors of product quality for their suppliers through warranties and contract terms. They came to the conclusion that an intermediary in this case trades again only in high-quality products, because selling only one low-quality product suffers loss of reputation. And this may come along with less customers not only for this but all other intermediated products, too. Moreover, if a supplier defects on quality, it will be dropped by the intermediary and he has then lower sales and earns lower profits afterwards when he must sell directly to the customers, because the intermediary is an important source of information for them.

Biglaiser and Friedman (1999) extended this analysis of adverse selection to allow for heterogeneous suppliers as well as customers and a free-entry competition between intermediaries, who can provide three services: (1) to certify quality of a good after costly inspection, (2) to provide information about good's quality to customers by presenting a bid price schedule to suppliers that sorts them in different markets and (3) to eliminate search costs by matching customers and suppliers.[161]

Li (1998) presented a general equilibrium version of Biglaiser (1993) emphasizing the moral hazard problem generated by the producer's ability to produce low-quality goods that cannot be immediately identified as such by the consumers.

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[160] According to Chu and Chu (1994), another example are manufactures with no brand reputation that rent it from a well-known manufacturer or merchandizer, where manufactures from other industries, non-manufacturing companies or associations license their brand names to products but carefully inspect their quality in order to protect their brand franchises.

[161] Further, they assumed the time horizon of the intermediaries to be infinite, whereas customers and suppliers live only one period. Therefore, suppliers lack any natural incentive to truthfully reveal the quality of their goods and customers, living only one period and buying only one unit, have little incentive to become expert judges of product quality. However, intermediaries can learn through experience and benefit from a reputation for truthfulness, because they live more than one period.

In this setting, intermediaries emerge endogenously by acquiring costly the ability to verify quality of goods.[162] Doing this, they are able to sell goods at a higher price than the producers because consumers believe them to sell only high-quality goods, providing the Lemon's Problem is not too severe and the investment in a quality testing technology is not too high.[163]

Lizzeri (1999) discussed the role of intermediaries as certificators who alleviate the causes of asymmetric information by extracting information from privately informed parties and then choose what to reveal to uninformed parties.[164] Doing this, the certificating intermediary sets a fee for his certification service and credibly commits to the disclosure rule to maximize expected profits. Following him, a monopolistic intermediary that certifies a privately informed seller has an incentive to disclose the minimum amount of information necessary to induce efficient exchange. Sometimes this information is a simple minimal quality standard: certification of products with quality above some minimal threshold. Introducing competition among certificators, he showed that there is always an equilibrium in which all information is revealed and the intermediary makes no profit.

Garella and Peitz (2000) showed that in a market suffering from asymmetric information regarding product qualities[165], shared retailing (selling of goods through an intermediary serving several producers) can fully or at least partially replace costly certification of product quality[166] – even if the intermediary is not endowed with some special expertise or reputation effects of intermediation are absent. Since undergoing certification of product quality is a costly activity whereas shared intermediation signalling product quality only implies a redistribution of profits between the intermediary and the producers (and among them), the second is socially preferable to the first.

[162]More specifically, they are producers who give up production of their goods and invest in a quality testing technology in order to buy goods from other producers and sell them to customers after inspection.

[163]This is one of several equilibria in terms of severity of the private information problem and investment costs for a quality-testing technology welfare-improving role for intermediaries, which Li (1998) characterized. In another one with a more severe "Lemon's Problem," intermediaries may not find it profitable enough to trade high-quality goods only, so that they trade low-quality goods, too. Then, the intermediaries cannot be regarded as being trustworthy.

[164]Examples to such certifying intermediaries are laboratories for industrial products or auditors.

[165]More specifically, it is assumed that consumers are imperfectly informed about product quality (being either high or low) while producers retain complete information. Producers choose their qualities and share an incentive to misrepresent low quality, which raises a moral hazard problem. In Garella and Peitz (1999), an alternative modelling approach is discussed, where Nature chooses the state and the producers then decide whether, given the state of Nature, they want to sell.

[166]The authors referred to a partially replacement of certification, if consumers only believe in shared intermediation as a signal of high quality goods with at least one producer undergoing costly certification and the other producers or the intermediary itself give explicit or implicit side payments to him. In the extreme case of fully replacement of certification, there is no certification conducted at all.

3.2.4 *Delegated Expertise, Bargaining, Contracting and/or Monitoring*

Apart from these active roles facilitating market transactions with or without buying and selling goods or information services on own account as shown above, an intermediary can just be an agent of someone else, conducting specific tasks on behalf of his principal. Reasons to this behaviour are at least fourfold:

- *Delegated expertise*, where agents are hired by principals in order to obtain their expertise.
- *Delegated bargaining*, where principals delegate authority to agents, who have to bargain or carry out competition with third-parties instead of them.
- *Delegated contracting*, where principals employ agents to negotiate and close contracts with third-parties on their behalf.
- *Delegated monitoring,* where principals employ agents to monitor the performance of third-parties for them.

3.2.4.1 Delegated Expertise

In a first attempt, Demski and Sappington (1987) extended the standard principal–agent model to study delegation of authority to an expert, who is considered to be uniquely qualified acquiring pertinent knowledge useful for a given decision problem. This expertise is both personally costly to acquire and prohibitively costly to communicate to the principal.[167] Assuming, that (1) the expert conducts two activities (planning followed by implementation)[168], (2) there is no communication from the expert to the principal and (3) the productive outcome is publicly observed after implementation, they showed how best to motivate the expert to acquire and apply his expertise. In a situation of induced moral hazard surrounding the expert's planning activities, the most efficient way to control this may entail a spillover of motivation concerns into the implementation activities.

Wolinsky (1993) investigated expert markets of medical, legal or repair services, where the seller of such a service is at the same time an expert who determines how much of his service is needed. Although the success in performing the expert's service is observable, customers often cannot determine the amount of service that was needed and how much was actually done by the expert. This information asymmetry, of course, creates incentives for opportunistic behaviour on the expert's side. Emphasizing the role of costly search by the principals or taking reputation

[167] According to Demski and Sappington (1987), this situation captures salient ingredients of a number of principal-agent relationships like a home owner and his building contractor, an investor and his financial advisor, a patient and his doctor or a company owner and his product-line manager.

[168] In their setting, planning refers to the costly acquisition of private information and implementation to its use with no personal costs for the expert.

considerations into account, there are several ways to discipline these experts. In the search setting, customers conduct costly search among experts and go to two or more experts who diagnose them and make binding offers afterwards.[169] In equilibrium, the experts find it useful to specialize themselves on a distinct level of treatment which virtually removes all incentives to misrepresent their information. In the reputation setting, experts do not guarantee the cost in advance – customers entrust their problem to an expert who first fixes it and then presents the bill. Here, the experts might be kept honest by their need to maintain reputation and customers minimize their search costs by going only to one expert for diagnostic, but this comes along with higher prices on treatment service.

Taylor (1995) modelled expert markets for diagnostic and treatment services for durable goods subject to random failure, where a diagnostic check is needed prior to any type of treatment. Again, these markets have an asymmetric information structure, because typically an owner of such a durable good never discovers the veracity of diagnosis or even whether the treatment he authorized was performed. Furthermore there are costs of permanent maintenance and terminal costs equal to the loss in utility if the durable good fails. The risk-neutral owner of such a durable good is assumed to minimize the expected present value of all maintenance, diagnostic, treatment and terminal costs whereas the expert needed for all diagnostic checkups or treatment is a risk-neutral profit maximizer. In this setting, Taylor (1995) found support for real world practices in markets for diagnostics and treatment, like offering incentive-compatible warranty contracts, a heavy reliance on contracting after obligatory diagnostic checks, the prevalence of free diagnostic services, consumer procrastination in obtaining checkups and an informational demand for insurance cover.

3.2.4.2 Delegated Bargaining

There are several possible reasons, why a principal sends an agent as a delegated bargainer on behalf of him into a bargaining situation: (1) Agents might be chosen because they have special skills that make them better bargainers, (2) the principal may think, that the agent is more intelligent or more experienced than he and therefore again a better bargainer or (3) delegation may serve as a pre-commitment device.[170] Whereas the first and second reason of delegated bargaining are quite straight forward, the last one, often subsumed under the term “strategic delegation,” needs some more elaborated explanation.

According to Schelling (1956), bargaining has two aspects: an efficiency and a distributional one. The first aspect consists of exploring mutually profitable adjustments, whereas the second occurs in “situation[s] in which more for one means less

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[169] An alternative view proposed by Taylor (1995) is, that experts price diagnostic services at cost and they cannot commit to treatment prices before performing diagnostic checks.

[170] Cf. Fershtman and Gneezy (2001).

for the other" (Schelling (1956, p. 281)). Focusing on this distributional aspect, he pointed out that bargaining power is more than simply skill in debate, obstinacy, misrepresentation, bluffing in connection with financial resources, physical strength or ability to withstand losses. Furthermore, it is the ability to make irrevocable commitments in advance to bind oneself in a way that convinces the other party to a negotiation which creates a real powerful instrument in bargaining.[171] To establish such an irrevocable commitment, a 'bargaining agent' can be employed by the principal enabling him strategic delegation. In first instance, the principal may employ an agent and give him instructions visible to the counterparty that are difficult or impossible to change. Second, an agent can be brought in as a principal in his own right with his own incentive structure after transferring the principal's rights to him against some advance payment.[172]

Katz (1991) showed, that unobservable agency contracts in which principals will give their agents incentives to match their own preferences, perfectly internalize the usual principal–agent externalities and therefore cannot serve as pre-commitments.[173] But in some special cases, unobservable agency contracts indeed affect the outcome of bargaining, especially when they serve to share risk, give the principal itself incentives to act or help to overcome problems of adverse selection.

Fershtman and Kalai (1997) explored the situation of unobserved delegation and distinguished there between (1) instructive delegation, where agents must follow a set of instructions and (2) incentive delegation, where the outcome of bargaining determines the agent's payoff. In the case of unobservable instructive delegation, the principal cannot benefit from an irrevocable commitment through delegation, but unobservable incentive delegation can benefit the principal.

In another recent contribution by Koçkesen and Ok (2004) conditions were analyzed, where delegation may arise solely due to strategic reasons even under unobservable contracts: To the extent that renegotiation is costly and/or limited, strategic aspects of delegation may play an important role in contract design, even if these agency contracts are completely unobservable.

Furthermore, Fershtman and Gneezy (2001) examined strategic delegation in a single ultimatum bargaining experiment, where a proposer gives a make-it-or-leave-

[171] Or better say in the words of Schelling (1956, p. 283): "[I]f the buyer can accept an irrevocable commitment, in a way that is unambiguously visible to the seller, he can squeeze the range of indeterminacy down to the point most favourable to him."

[172] Cf. Segendorff (1998). Transport insurance claims may be a good example for this form of delegated bargaining, where an insurer regulates a loss or damage at once against transfer of claiming rights and then searches to recover his expenses by sueing the responsible party.

[173] Assuming that the principal and the agent have equal capabilities of bargaining, Katz (1991) considers two forms of reaching an alignment of preferences: (1) the case of *perfect control* where the principal's information is detailed enough so that he can offer the agent a contract with a penalty scheme forcing him to play any desirable strategy and (2) the case of *perfect delegation* where the principal can offer a contract making the agent a residual claimant and therefore harmonizing both interests without any need to observe what actually happens.

offer to a responder who can either accept or reject it.[174] One of their results was that when either the proposer or the respondent use a delegate and this delegation is observable, they obtain a considerably higher outcome which shows again the importance of delegates as a precommitment device. Conversely, if delegation contracts are not observable, the proposer obtains a nonsignificant rise in outcome offering the proposal through his agent and the responder using a delegate makes him worse off, despite the average amount of the proposals rising considerably.

Moreover, Bond and Gresik (2006) showed that in a bargaining problem between an informed and an uninformed party, partial delegation (delegating control of bargaining responsibilities to an agent while retaining control of private information) with or without observable agency contracts enable the informed party to promote more efficient agreements with their counterparty while also endogenously improving their bargaining power.

Following Spulber (1999, pp. 332–335), the use of agents as precommitment devices can be further extended to delegated competition, where agents are contracted by their respective principals in order to act on their behalf in a market for goods or services. This situation of delegated competition is usually modelled as a two stage game, where in the first stage agents are contracted by principals who compete with each other in the second stage.[175] But up to now, these theoretical treatments of delegated competition seem to be too explorative to draw further conclusions referring to unobservable precommitments.

Last but not least, there is another aspect of third-party bargaining not reflected in all of these models discussed above: mediation and arbitration. According to Encyclopædia Britannica (2002), mediation is "a practice under which, in a conflict, the services of a third party are utilized to reduce the differences or to seek a solution"[176], whereas arbitration is "a legal method of settling disputes between parties outside ordinary court procedures by deferring to a mutually agreed-upon third party who has the authority to determine an "award," a legally binding decision."[177] According to Johnson and Pruitt (1972), these two kinds of

[174]More strictly speaking, a proposer and a responder negotiate upon the division of a pie, where the proposer offers the responder a share. If the responder agrees to the proposed share, the pie is divided accordingly and both get their shares, otherwise they both get zero.

[175]See Vickers (1984), Fershtman and Judd (1987), Sklivas (1987), Fershtman et al. (1991) or Segendorff (1998) for such two-stage models.

[176]Other definitions are as follows: In a contribution dedicated to labour mediation, Kolb (1983, p. 23–44) asserted, that mediators either play an active role as a "deal maker" or a rather passive one as an "orchestrator." According to Dunlop (1991), mediation typically seeks to persuade contending parties to agree, but has no authority to issue a binding award. Further, Friedman (1992) described the role of a mediator to serve as a link between opposing groups and to provide a buffer between them both to bypass and to maintain differences and conflict.

[177]According to Encyclopædia Britannica (2002), the third party called arbitrator may be a single individual or an institution chosen by the parties and knowledgeable in the area of dispute settlement. In general, awards determined by the arbitrator are based on the existing laws related to the contracts or issues in dispute as they are understood and agreed upon in advance by the

intervention in bargaining situations differ at least in two dimensions: (1) the extent to which the intermediary's recommendations are binding and (2) the amount of information available to the intermediary about the issues negotiated. Following them, a mediator's decisions are usually non-binding and he typically has less access to information than an arbitrator serving normally as a "means of the last resort," whose decisions are always binding.

Bazerman et al. (1992) examined the impacts of delegated bargaining as well as mediation on negotiated prices and the likelihood of impasse in a real estate context by conducting student's experiments.[178] Their results showed that the selling price of a property is higher if an agent is employed than if no intermediary is involved. However, the selling price was not affected by the use of a mediator. Furthermore, the use of an agent tends to increase the rate of impasse, but the empirical evidence was rather insignificant.

3.2.4.3 Delegated Contracting

In the base case of delegated contracting, a first agent (the intermediary) is contracted by a principal in order to establish a contractual relationship with a second agent (or in short the agent).[179] Doing this, the principal wants to make sure that the terms of this contract negotiated by the intermediary are those that would have emerged from direct contracting, so that he must offer him an incentive provision scheme. In order to end in a legally binding contract with the agent, the principal furthermore has to grant his intermediary either explicit or implicit authority.[180] The duties of an intermediary usually incorporated in such an agency contract can illustrate his contracting role: At least, he has to (1) be loyal, (2) protect confidential information, (3) obey instructions, (4) inform the principal, (5) take care and (6) account accurately. In turn, the minimum duties of the principal are (1) reimburse the agent for his service as well as reasonable expenses and (2) indemnify the intermediary against liability. All these legal provisions are usually well defined for various forms of agency contracts in Commercial Codes like the HGB or the UGB in countries with a codified law or generally fixed in the Law of Agency in

parties concerned and by him. According to Dunlop (1991), arbitration is most extensively used in industrial relations or labour disputes between labour and employer's organizations.

[178]Other experimental studies comparing mediation and arbitration in the context of labour disputes are e.g. Johnson and Pruitt (1972), Grigsby and Bigoness (1982) or McGillcuddy et al. (1987).

[179]See Spulber (1999, pp. 324–325) for this and the following. For ease of exposition, the first agent will always be called the intermediary while the second one is just called agent. But one has to keep in mind that there exists a three-tier principal–agent relationship structure: (1) between the original principal (the principal) and the first agent (the intermediary) followed by (2) the principal–agent relationship between the first agent as the second principal against the second agent (the agent).

[180]In Germany as well as Austria, there are legal provisions given for such delegation of authority in §§ 48–58 HGB or §§ 48–58 UGB, defining explicitly "Prokura" and "Handlungsvollmacht".

Anglo-Saxon case law. In addition to this, GT&C's offer viable solutions for other forms of agency contracts as shown in Sect. 2.1.2.

Although there seems to be a need to theoretically reflect this bulk of legal provisions, delegated contracting in isolation has not been explicitly addressed in economic models of agency, as Spulber (1999, p. 325) noted. A reason to this might be the sheer complexity of legal provisions coming from practical experience in every-day business. But considering delegated contracting in connection with delegated monitoring, quite a few theoretical treatments like McAfee and McMillan (1995), Melumad et al. (1995, 1997), Laffont and Martimort (1998), Macho-Stadler and Pérez-Castrillo (1998), Baliga and Sjöström (1998), Faure-Grimaud et al. (2003) or Mookherjee and Tsumagari (2004) can be found as described in the preceding Sect. 3.2.4.2.

3.2.4.4 Delegated Monitoring

Monitoring problems in principal–agent relationships are a well known feature of PAT already addressed in Sect. 3.1.3.2 under the label of "moral hazard." And since monitoring is costly, some principals wish to outsource this task to an intermediary as a hired supervisor. In first instance, this intermediary might be more skilled in monitoring tasks, have lower opportunity costs and/or needs to spend less effort relative to the principal.[181] Another aspect of delegated monitoring is hierarchical contracting, where a principal (employer, purchaser, customer) contracts with an intermediary (manager, first-tier supplier, contractor) who then writes a contract with an agent (employee, second-tier supplier, subcontractor) and supervises the agent's performance on behalf of his principal. Moreover, diversification of risk by delegated monitors provide important reasons to intermediated exchange in comparison with direct one, which will be developed further in the case of financial markets.

Third-Party Monitoring

It is straightforward to see that delegation of monitoring tasks to a supervisor is more efficient, if the principal has lower skills, higher opportunity costs or has to spend more effort doing it by own means. But as Strausz (1997) showed, a principal still prefers to delegate monitoring tasks to a supervisor even when these efficiency gains cannot be reached since signals from monitoring are private information and monitoring itself is non-verifiable and therefore non-contractable. For him, delegated monitoring is then still beneficial for two reasons. First, since monitoring is non-contractable, the principal must create incentives to induce both monitoring and agent's effort. By hiring a supervisor as a third-party monitor he

[181] Cf. Spulber (1999, p. 337).

has an extra contract at his disposal and can therefore better regulate incentives for monitoring and effort, leading to an incentive-effect of delegation. Second, delegated monitoring comes along with an increased possibility of commitment. As the evidence obtained by monitoring is private information and can therefore be concealed, a profit maximizing principal will never reveal information which forces him to reward the agent. When he employs a supervisor for monitoring tasks, such rewards can be made credible and commitment to reward the agent is possible, leading to a commitment-effect of delegation.

Hierarchical Contracting

According to Spulber (1999, p. 335), the cost of writing contingent contracts and monitoring performance can create advantages for hierarchical contracting over centralized one done by the principal.[182] Notably, this situation occurs within hierarchical organizations as well as in an interorganizational context.

McAfee and McMillan (1995) explored organizational diseconomies of scale, where people in a hierarchy are able to exploit bargaining power that their private information gives them. In their model, only the agent has private information with a supervisor designing the contract. The supervisor extracts information rents in return for reporting the agent's information to the principal. As a result, adding layers causes information rents to increase exponentially with the length of the hierarchy. Moreover, because of the costs of incentives the principal's marginal cost of producing output also increases with the length of the hierarchy, thus reducing the overall output of the organization.

Melumad et al. (1995) pointed out that hierarchical contracting can be a means of efficient information processing among members of an organization. But the advantages of overcoming bounded rationality come at the cost of control.[183] Comparing a centralized contracting of two agents with several three-tier hierarchical contracting relationships similar to McAfee and McMillan (1995), they come to the conclusion that hierarchical contracting can serve as a second-best solution and is maybe preferable, if the principal wants to communicate and contract with only one agent. To reach such a second-best solution by hierarchical contracting, the principal must then be able to design a favourable sequence of contracting and monitor the intermediary's contribution to the joint product of him and the agent.

Melumad et al. (1997) showed, that hierarchical contracting may be better than centralized contracting of two agents when formulating contracts is costly, so

[182] Originally, Spulber (1999, p. 335) used in this context the term "delegated contracting" instead of "hierarchical contracting," which is in contradiction to his statements made earlier in Spulber (1999:325). Therefore throughout this section, the term "hierarchical contracting" is employed to indicate, that delegated monitoring issues are added to the original delegated contracting.

[183] Especially, if the principal cannot monitor the intermediary's contribution, he will be able to take advantage of his monopoly power, creating a problem that resembles that of double marginalization of rents usually occurring in vertical relationships (see Tirole (1988, pp. 174–176)).

that the resulting contracts are incomplete in the sense that they are not covering all contingencies. To them, a flexibility gain obtained by hierarchical contracting always outweights the loss of control, if the principal can align his preferences with those of the intermediary in the way as described in Melumad et al. (1995).[184]

It was then Laffont and Martimort (1998) who enriched the discussion about centralized versus hierarchical contracting by allowing collusive behaviour but limited ability of communication between the agents. Under this circumstances, delegation of contracting takes advantage of the conflict between the agents coming from their asymmetric treatment and it dominates a centralized contracting of both agents by the principal.

Another rational for hierarchical contracting was given by Macho-Stadler and Pérez-Castrillo (1998), who showed that centralized contracting is only superior, when the principal is able to contract with the agents simultaneously and can monitor their collusive behaviour of side contracting at the same time. Otherwise hierarchical contracting provides a first-best solution of allocating contracting capacity with the principal appointing agents to contract others who cannot be centrally monitored by him.

Considering a model where agents work in sequence one after another on a project under limited liability (like an architect and a builder), share information not available to the principal and can collude against him, Baliga and Sjöström (1998) showed again that the optimal distribution of surplus can be always achieved by hierarchical contracting.

Recently, Faure-Grimaud et al. (2003) considered an organization with an agent privately informed on his productivity and a risk-averse supervisor getting signals about the agent's type. Comparing contracting both agents simultaneously with a hierarchical solution, where the supervisor is contracted by the principal and then sub-contracts the agent, the latter leads again to the best possible resource allocation. This outcome is again caused by the fact that in the case of centralized contracting both agents are able to collude against the principal.

And last but not least, Mookherjee and Tsumagari (2004) studied three alternative ways a principal can contract two agents supplying distinct inputs allowing him to form a valuable output. Furthermore, the two agents have private information about their costs and can collude with one another in order to establish side contracts not observable by the principal. They showed, that delegating to one agent the right to subcontract with the other always results in lower profits for the principal compared with the centralized contracting solution. Moreover, delegation of contracting to an intermediary who in turn contracts both agents and has superior information about their costs does not improve the situation for the principal, as long as the agent's inputs are substitutes. However, this sort of hierarchical contracting

[184]More concrete, Melumad et al. (1997) explicitly mention a number of conditions, including (1) risk neutrality, (2) an appropriate sequencing of contracts, (3) the absence of collusion between the intermediary and the agent and (4) the ability of the principal to monitor the intermediary's production contribution.

can be beneficial, if the agents produce complements and the loss of control from delegation is not too high.

Delegated Monitoring on Financial Markets

Another stream of literature copes with delegated monitoring on financial markets, where multiple principals as lenders delegate monitoring of debt contracts to intermediaries who may achieve economies of scale of monitoring agents as borrowers by producing information more efficiently.[185]

Diamond (1984, 1996) argued that commercial banks are intermediaries raising funds from many lenders (depositors) by promising them a given riskless pattern of returns in order to lend them to borrowers. Furthermore, they spend resources on monitoring and enforcing their loan contracts which are less costly than those available without monitoring. This task of monitoring and the payments received from the borrowers are both non-observable by the depositors.[186] From a lender's point of view, direct monitoring of borrowers is very costly and so it seems to be efficient to delegate this task to a specialized intermediary, although after this delegation a problem of monitoring the monitor occurs. But lenders to the intermediary reduce their total monitoring costs if the costs of monitoring the intermediary are lower than the monitoring costs of lenders lending directly to borrowers. Reasons to such lower intermediaries' monitoring costs can be found in economies of scale, reputational effects or gains from diversification by subdividing independent risks.

Combining Diamond's (1984) approach to delegated monitoring with the ideas of Stiglitz and Weiss (1981) about credit rationing, Williamson (1986) illustrated how intermediation on loan markets and credit rationing may be interrelated phenomena. In equilibrium, credit rationing may emerge because costly state verification adds a premium to loan rates and intermediation arises simultaneously as a way to minimize this premium and thus minimize rationing by economizing on monitoring costs.

Furthermore, Krasa and Villamil (1992), Yanelle (1997) and Hellwig (2000) extended both model frameworks of Diamond (1984) and Williamson (1986) in different directions. Krasa and Villamil (1992) showed that in an economy with a finite number of lenders and borrowers and costly state verification, two-sided debt contracts referring to the intermediary's contracts with lenders and borrowers occur, given a sufficient number of borrowers. Moreover, such two-sided debt contracts strictly dominate all other types of contracts in this environment. Yanelle (1997) added Bertrand-style price competition between intermediaries on deposit as well as loan rates leading to market asymmetries which induces the intermediaries to corner

[185]Cf. Spulber (1999, p. 337).

[186]Notably, the depositors are indeed not interested in knowing to whom the intermediary actually lends money, because they get a risk-free rent for their deposits.

one market as an attempt to achieve a monopoly position on the other. Hellwig (2000) studied the impacts of introducing risk aversion and concluded that all in all, Diamond's (1984) results are still valid.

3.2.5 Conclusions and Some Applications

After this rather lengthy review of theoretical treatments and some empirical evidence of MMT and ITF, findings are wrapped up now. As already stated at the beginning of Sect. 3.2, intermediaries provide at least six specific advantages over direct exchange and referring to their specific role-sets, they can be divided into four distinguishable categories as follows:

- *Market makers* are intermediaries taking title on goods traded and operating in dyadic relationships. They usually reduce transaction costs, pool and diversify risks. Furthermore, they alleviate adverse selection as well as mitigate opportunism, when there is information asymmetry present. Other, more special services of market makers are immediacy and/or liquidity provision allowing consumption smoothing.
- *Matchmakers* do not take title on goods and operate in triadic relationships in order to match prospective contracting parties. Doing this, they lower costs of searching and matching for market participants as well as other transaction costs of contracting. If there are asymmetric information structures present, they again help to alleviate adverse selection and mitigate opportunism.
- *Information producers*, *guarantors* and *certificators* economize on asymmetric information present before contracting and seek to alleviate adverse selection, which tends to result in transaction as well as search cost reduction.
- *Agents* employed for specific tasks like *delegated expertise, bargaining, contracting* and/or *monitoring* offer diverse advantages to their principals, with supporting commitments through delegation and mitigating moral hazard as the most crucial two. Furthermore, they can help to reduce transaction costs, costs of searching and matching or even help to diversify risk associated with contractual relationships. Moreover they may help their clients to alleviate bounded rationality, limited capacity and collusive behaviour or to build up and maintain efficient incentive and organization structures.[187]

Although MMT and ITF is an evolving field of research as shown in the last sections, the overwhelming number of applications are coping mostly with financial, real estate, wholesale or retail markets up to now. Referring to the context of transport and/or logistics, this strict micro view of market structure and the role of intermediaries therein is rather non-existent. Notable exceptions in this direction are early works of Morash (1986, 1987) or Westfall (1987) describing US-American

[187] Cf. Spulber (1999, pp. 342–343).

freight forwarders as specialized marketing channel participants and Strandenes (2000) or Curti (2003) with recent contributions about ship brokerage issues. Furthermore, Wu (2004) explored the theory of supply chain intermediation based on bargaining theory and gave an outline for further research in this direction.

Morash (1986, 1987) observed freight forwarders as well as other transport intermediaries in the United States from a logistics channel point of view and their interaction with the transactional and promotional channels of their clients. Furthermore, he suggested, that all these transport intermediaries should facilitate reduction of overall transport costs while preserving desired service quality at the same time. More specifically, he considered freight forwarders to be highly involved in transport efficiency functions like assembly, consolidation, distribution, break bulk, sorting, storage and containerization of shipments as well as selecting low cost carrier modes, whereas transport capacity retailing as well as service quality functions of service aggregation, expediting and tracking of shipments or coordination, control and administration tasks are underdeveloped in comparison to transport brokers and shipper's agents.

Westfall (1987) analyzed freight forwarder operations contracted by the United States Air Force in order to determine which freight forwarder service components provide the best measures to evaluate the effectiveness of independent members in an international channel of distribution. His ambitious, well structured measurement approach ended rather inconclusive, maybe caused by the small sampling frame size of 126 freight forwarders resulting in 31 testable observations.

Considering shipbrokers as intermediaries matching sellers and buyers of vessels or transport services, Strandenes (2000) analyzed their contribution to market efficiency. According to her, they (1) help to speed up searching and matching processes, (2) contribute to establish favourable ask-bid prices in bargaining situations and (3) provide risk-reducing expertise in deals with asymmetric information. Furthermore, she pointed out that efficient searching and matching are important in spot freight markets, whereas quality assessments are more important in second-hand and timecharter market. All in all, shipbrokers are important intermediaries for her, who add value to the ship brokerage business by economizing on their special market knowledge and experience.

Curti (2003) discussed the roles of brokers and agents as intermediaries on three markets with a special focus on their legal regulation in Germany. Considering, that shipbrokers, travel agents and real estate brokers all facilitate exchange on markets heavily impacted by information asymmetries, he asked how efficient the legal measures raised in German law to prevent them from opportunistic behaviour are. In the case of the shipping industry, he concluded, that ship brokers acting as agents for one party or on behalf and in the interest of both parties cannot behave opportunistically towards their clients and in addition to this, their business operations are highly regulated by the HGB.[188] Therefore their main task is

[188]Despite ending in a correct conclusion, Curti's (2003:10–11) arguments seem to be somekind short-cut: Regarding vessels and cargos being highly homogenous commodities for all market

matching – not decreasing informational asymmetries – and market-based solutions are the preferred means to contract enforcement.

Employing a bargaining theoretical framework, Wu (2004) set out to examine why supply chain intermediaries exist, in which different forms they operate, and the way they influence supply chain efficiency. He considered such intermediaries to fall in two categories: (1) *transactional intermediaries* improving efficiency in certain supply chain transactions and (2) *informational intermediaries,* who alleviate inefficiencies borne from informational asymmetry. Referring to the first category, he considered each supply chain member to be an intermediary between upstream suppliers and downstream customers, who broadly serve the functions of a market maker as already outlined above.[189] Concerning the informational intermediary, he regarded him to avoid adverse selection by administrating coordination mechanisms to create a trusted institution thereby reducing the needs for direct negotiation and to synthesize dispersed information in order to reduce information asymmetries – intermediary functions who are highly correlated with the role-sets of the other three non-market making intermediaries as discussed in Sect. 3.2.5.

Furthermore, he introduced the role of a *supply chain integrator* as the leader of a more or less vertically integrated supply chain, who decides to use intermediaries or not, depending on intermediated trades are either more profitable than direct exchange or offer some value-added in terms of transaction efficiency and/or information asymmetry reduction. Then he developed a basic theoretical framework for supply chain intermediation based on four basic models with self-interested, profit seeking and risk neutral buyers, suppliers and supply chain intermediaries in between: (1) bilateral bargaining under complete information, (2) bilateral bargaining under incomplete information, (3) multilateral trade with vertical integration and (4) multilateral trade with matching markets. In this settings, a transactional intermediary improves operational efficiency by serving as an intermediate supply chain member or a third-party service provider, whereas an informational intermediary mainly alleviates the effects of information asymmetry by serving as a broker or a delegated bargainer. With this strict intermediary perspective of supply chains, he proposed to expand the view of negotiation and coordination in supply chains and outlined huge research opportunities concerning supply chain coordination, design or microstructure. But it can be clearly seen, that this supply chain intermediation approach is in his very infancy state and further development is necessary.

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participants, he considered asymmetric information structure to be negligible without further discussion after assuming, that brokers should ideally act as fair agents for all parties involved. But his merely legal point of view can be supported, if their specialized market knowledge and reputational effects stemming from long-term market presence are taken into consideration.

[189]More specifically, Wu (2004, p. 71) noted that a transactional intermediary may reduce uncertainty by setting and stabilizing prices, reduce the costs associated with searching and matching, provide immediacy by holding inventory or reserving capacity and aggregating supply of demand to achieve economy of scale.

3.3 A Taxonomy of Intermediaries in Multimodal Transport and Logistic Chains

Having this theoretical framework of market micro structure and intermediation theory in mind, a new intermediary perspective of multimodal transport and logistic chains can be established. As such transport and logistic chains are caused by trade, commercial as well as financial aspects have to be taken into account to provide a full picture of cross-border activities going on between their source (e.g. an original producer) and sink (e.g. an end consumer). Therefore, the following taxonomy of intermediaries along a multimodal transport and logistic chain as shown in Fig. 3.3 includes several layers with different objectives, but the same goal: facilitating trade of goods and/or services in an international trade environment.

First, there must be drawn a distinction between middlemen and service providers. *Middlemen* facilitate market transactions of goods and/or services as brokers or agents without holding stock or even taking title on them whereas *service providers* actually engage in these market transactions or offer means of handling, transporting, storing and warehousing of physical goods being transacted. However, there are several hybrid forms, which engage in both middlemen-like intermediation and actual service provision in order to market this as a bundle to their clients.

Second, looking at the international trade environment, several layers of economic activity can be observed. First, *commercial intermediaries* are focused on

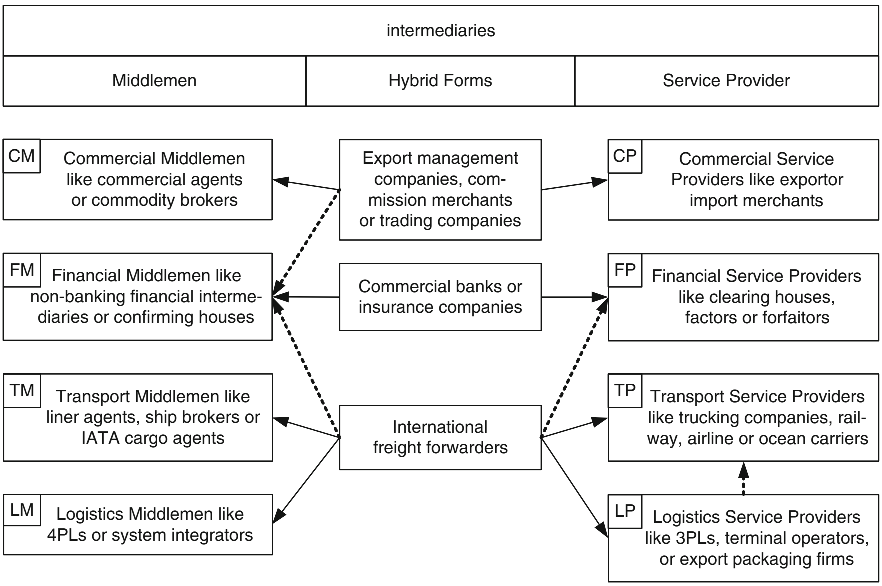

Fig. 3.3 A taxonomy of middlemen and service providers

trading of goods and/or services. Next, *financial intermediaries* allow to overcome simple exchange of goods and offer mitigation of risks coming along with such trading operations. Because goods usually have to be moved physically between spatially dispersed transaction partners, *transport middlemen* play an organizing role with *transport service providers* actually moving goods from source to sink. Furthermore, spatially dispersed economic activities and intertemporal deviations between production and consumption of goods raise an increasing demand for *logistics middlemen* and *service providers*. In addition to this, *infomediaries* and *information service providers* serve all participants of the international environment by offering trade-related information, brokerage, consultancy and/or their special expertise on all levels of economic activity.[190] But as these intermediaries fitting to this last group are myriad and as they can at the same time be regarded to play a rather ancillary role, they will be excluded from further observation.

This grouping of economic activity in several layers clarifies the diverse functions of middlemen and service providers and shows their contribution to marketing channels of cross-border active companies as shown in Fig. 2.2 as well as to the international trade environment as a whole.

3.3.1 Commercial Middlemen and Service Providers

In indirect modes of export–import operations, third-party commercial intermediation is a common feature, because it allows firms of all sizes an easy and reliable way to engage in cross-border business activities without getting too much involved in daily matters in the marketing channels of negotiation, promotion, ordering and documentation. For ease of explication, in the following a focus is set on export operations of an original producer from a country of origin (called home) to a country of destination (called abroad) with the other way around declared in the footnotes, if necessary.[191]

First, a producer may sell his goods directly to an *export merchant* at home, who takes title on goods and actually exports them at own risk and on own account.[192]

[190]Examples for such infomediaries are trade consultancy firms, advertising agencies, trade associations, chambers of commerce, credit rating companies, translators, goods surveyors and many other private as well as governmental organizations supporting a "trade-friendly" environment. Further, information service providers establishing and maintaining information and communication infrastructure all around the world are getting more and more important.

[191]Of course, the actual country of origin status of a good traded can be different from the country where the trade transaction actually takes place and goods even can be traded at remote third countries, directly exporting them to the country of destination. But in this context it makes no difference in exposition, so that such situations of transit or third country trade are not explicitly taken in consideration.

[192]Conversely, an export merchant can buy goods from suppliers abroad in order to resell them at home after importation.

Alternatively, a producer might export goods to the country of destination at own risk in order to sell it directly to an *import merchant* abroad for further distribution.[193] In both instances, their relationships are usually long-term coming along with some exclusivity and these intermediaries can be regarded as pure market makers like merchant wholesalers and retailers as heavily reflected in the US-American marketing channel literature as well as the German "Handelslehre".[194]

Another export mode is assigning *commercial agents* for performing business activities abroad, which are third-parties working as agents on account and behalf of an exporter or importer on a permanent basis.[195] Actually their obligations can vary widely, from being (1) just a broker-like agent searching for potential matches with buyers abroad as a delegated bargainer, (2) a sales representative as a delegated contractor abroad to (3) a factor-like agent, acting as a delegated contractor with holding consignment stocks for his client abroad.[196] Furthermore, *commodity brokers* at home as well as abroad can be engaged in facilitating goods transactions between buyers and sellers on commodity markets as real matchmakers.

In addition to these easily distinguishable middlemen, there are several hybrid modes of commercial intermediation.

First there are *commission merchants*, who buy or sell goods abroad on behalf and account of their clients, but in their own name.[197] Doing this, they can then be considered to be a subcontracted market maker holding inventory, but actually not taking title on it.[198]

Second, a considerable share of world trade is organized by *export trading companies* (ETCs) with a long tradition in most European countries (especially Germany, Sweden, France, the Netherlands and the United Kingdom) and *general*

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[193]Conversely, an import merchant can also buy goods from suppliers abroad after they arrived at the country of destination.

[194]According to Spulber (1996b, pp. 137–138), retailers provide commercial services like pricing, marketing, holding inventory, certificating quality to their customers in the business-to-consumer segment, whereas wholesalers act as intermediaries in business-to-business transactions likely in the same manner by distributing goods, managing inventories, communicating prices and product information, certifying quality and providing credit. Further see e.g. Rosenbloom (1991, pp. 45-52 and 61-65), Kleer (1991, pp. 52–56), Stern and El-Ansary (1992, pp. 547–559), Bowersox and Cooper (1992, pp. 40–42), Bowersox and Closs (1996, pp. 115–117) or Pfohl (2003, pp. 214–216) with a more detailed treatment of typical merchant wholesaler as well as retailer functions.

[195]Other labels are "wholesale agents" or "merchandise agents" – for this and a more detailed description of their obligations see Rosenbloom (1991, pp. 52–54), Bowersox and Cooper (1992, pp. 42–43) or Triebel et al. (1995, pp. 166–180).

[196]The same holds true with a broker-like agent, purchase representative or factor-like agent acquiring goods for supply abroad.

[197]Cf. Rosenbloom (1991, pp. 53–54), Bowersox and Cooper (1992, p. 43) or Bowersox and Closs (1996, p. 117). In export operations, they usually hold consignment stocks whereas in import operations, they run international procurement offices on behalf of their clients.

[198]This seems to be a very strange hybrid not really fitting into this conceptual framework. But actually, a commission merchant e.g. acquires physical possession of goods to be sold with transfer of title being postponed until they are sold.

trading companies (GTCs) or "sogo shosha" (Jap.) from Japan or Brazil, Thailand, Taiwan, China and South Korea.[199] Both engage in cross-border trade as commercial intermediaries with a range from simple export/import brokerage over export/import merchant activities to highly diversified operations by integrating into other fields of international business like production, finance, countertrade, insurance, and even warehousing and shipping.[200] Furthermore, they specialize themselves by trade direction, product and/or region or are engaged in various business activities all over the world, even in third-country trades.[201] A constituting feature of ETCs or GTCs is that they are not only present either at home or abroad, but in both countries (at least through dedicated representatives or agents) in order to have better control of their cross-border shipments.

From an intermediary point of view, the main functions of ETCs and GTCs, albeit from their actual commercial intermediation activity as a matchmaker or market maker, lay in their ability to reduce search, negotiation and transaction costs significantly for their clients, especially in export-import operations coming along with considerable high risks.[202] Furthermore, especially large GTCs engage in countertrade and financial intermediation in a quasi-banking manner or through affiliated commercial banks.[203] Moreover, as both are engaged in their fields of specialization abroad on a long-term basis, they can permanently monitor markets in focus and accumulate useful business knowledge, which can be easily interpreted as a form of information production.[204]

A third hybrid form are *export management companies* (EMCs), which are traditional third-party commercial intermediaries in the United States, organizing virtually all task needed for marketing and exporting physical goods abroad on behalf of their clients with sometimes even taking title on goods traded, if necessary.[205] Therefore, they can be at best described as delegated experts in export

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[199] See Stern and El-Ansary (1992, p. 547), Denis and Mallette-LaFrenière (1987), Mattsson (1986) Balabanis and Baker (1993), Peng and Ilinitch (1998), Jones (1998), Ellis (2003, pp. 1684–1686) and Albaum et al. (2005, pp. 282–292) for a general overview and Sarathy (1985), Cho (1984), Kim (1986), Kojima and Ozawa (1993) with a focus set on GTCs.

[200] Cf. Thomchick and Rosenbaum (1984) or Casson (1998). Notably, this seems to be the main reason why in more recent contributions like Balabanis (2000, 2001), Peng and York (2001) or Trabold (2002), all these commercial intermediaries were subsumed under the label "export intermediaries".

[201] See e.g. Cho (1984), Jones (1998), Casson (1998) and Balabanis (2001).

[202] For this and the following see Ricker Kelly and Lecraw (1985), Kim (1986, pp. 35–36), Kojima and Ozawa (1993) or Casson (1998).

[203] See especially Thomchick and Rosenbaum (1984, pp. 98–99), Kojima and Ozama (1993, pp. 149–151) or Casson (1998, p. 37–44) for a more detailed discussion of countertrade and financial intermediation issues.

[204] See Kojima and Ozawa (1993, pp. 151–152) or Jones (1998, pp. 16–19) for a more elaborated treatment of this topic.

[205] See Brasch (1978, 1981), Williamson and Bello (1984), Bello and Williamson (1985a) or Haigh (1994). With the Export Trading Company Act of 1982 US-American legislation removed most of the legal restrictions which inhibited up to then a development of ETCs and GTCs as mentioned

marketing and management acting on account and in the name of their clients abroad.

3.3.2 Financial Middlemen and Service Providers

Following Cecchetti (1999), financial intermediaries of the twenty-first century generally (1) give access to the payment systems, (2) provide liquidity, either in form of demandable deposits or stand-by line of credits, (3) (re)package and (re)sell risks as part of their traditional banking function, (4) provide information, including quality-certification credit review and possible follow-up and (5) remain a conduit for government guarantees like deposit insurance or governmental bailments.[206] In addition to these basic financial intermediation and banking functions as already discussed in Sect. 3.2, financial intermediaries commonly called *commercial banks* offer other dedicated services for cross-border business operations like documentary collection or documentary credit, which can be regarded as viable means to synchronize financing, ownership and documentation flows in international marketing channels.[207]

Furthermore, there are more specialized financial middlemen on the international trade arena like (1) *confirming houses*[208] as agents specialized on financial and documentary flow matters and (2) a multitude of *non-banking financial intermediaries* (specialists, traders or brokers as discussed in Sects. 3.2.1 and 3.2.2) providing access to financial markets where all kinds of derivatives employable for financial hedging needs are traded. Moreover, highly specialized financial service providers (1) actually process financial and documentary flows like SWIFT[209], IATA-CASS[210]

above but with rather little success, see Thomchick and Rosenbaum (1984), Bello and Williamson (1985b), Howard and Maskula (1988), De Noble et al. (1989) or Perry (1992).

[206]Another contemporary view of financial intermediation was provided by Collin (1997), who contrasted financial intermediation through markets with the banking system. To him, banks are “financial intermediaries with organizational boundaries that create property rights to allocative competence, making offers that are credible as a result, first of internal monitoring by organizational hierarchy and the residual; second, of external monitoring by government and insurance companies; and, third, through signalling, e.g. by conspicuous investments” (Collin (1997, p. 184)).

[207]See e.g. Lorenz (2004, pp. 315–325) or Kummer et al. (2010, pp. 233–235) with further references.

[208]Cf. Triebel et al. (1995, pp. 181–182) or Albaum et al. (1995, p. 288).

[209]SWIFT is the abbreviation for the “Society for Worldwide Interbank Financial Telecommunication,” running a closed data communication network for financial transfer operations among their member companies, see Kummer et al. (2010, pp. 247–248) or http://www.swift.com for further information.

[210]Cf. Sect. 2.2.3.1 about IATA-CASS.

and other *clearing houses* or (2) provide dedicated non-banking financial services like factoring[211] by *factors* or forfaiting[212] by *forfaiters*.

Another field of specialization is the provision of dedicated insurance coverage for physical goods in transit as well as financial flows in connection with them by specialized *insurance companies*. Concerning the physical goods in transit, transport insurance cover against loss or damage can be provided by several private insurance companies upon request directly or through their own middlemen-based distribution systems.[213] In the case of financial flows, export credit insurance provision is usually offered through export credit insurance companies empowered and backed by national state, like the Euler Hermes Kreditversicherungs AG (EHK) in Germany and the Oesterreichische Kontrollbank AG (OeKB) in Austria.[214]

3.3.3 Transport Middlemen and Service Providers

Transport middlemen and service providers are intermediaries dedicated to move goods physically. As they are already described in detail in Sect. 2.2, there seems to be no use to do this a second time but to restate their functional roles from an intermediary point of view.

Regarding transport middlemen as matchmakers, they can be further divided into two basic intermediary roles: agents and brokers. First, transport middlemen offer agency services to the market on behalf and account of their clients *vis-à-vis* their customers like (1) *shipper's agents* for shippers, *(2) ship agents*, *shipping agents* or *liner agents* for shipping companies and (3) *IATA cargo agents* or *general sales agents* for airlines. Second, others are engaged in the transport brokerage business like (4) *transport brokers* for inland transport operations, (5) *ship brokers* in the ocean shipping industry and (6) *air freight brokers* in the cargo segment of the airline industry, offering their service to both sides of the market. In addition to this, some of these transport middlemen engage heavily into information production, too, and

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[211]Following Encyclopædia Britannica (2002), factoring is the selling of accounts receivable on a contract basis by their original holder to an agency known as a factor in order to obtain cash payment of the accounts before their actual due date. The factor then assumes full responsibility for credit analysis of new accounts, payments collection, and credit losses. Factoring differs from borrowing in that the accounts receivable and the responsibility for their collection are actually sold rather than merely offered as loan collateral. Further, see e.g. Kummer et al. (2010, pp. 239–241) with a more elaborated treatment.

[212]Forfaiting is the purchase of credit instruments like letters of credit, bills of exchange, promissory notes, or other freely negotiable instruments on a non-recourse basis. The forfaiter deducts interest (in the form of a discount), at an agreed rate for the full credit period covered by the forfaitor, see Kummer et al. (2010, pp. 246–247) for this and further references.

[213]See e.g. Lorenz (2004, pp. 234–246) or Kummer et al. (2010, pp. 382–384) with further references.

[214]See http://www.hermes-kredit.com, http://www.oekb.co.at, Branch (2000, pp. 231–237) or Kummer et al. (2010, p. 384–386) for further information.

offer then their market expertise to the public in form of market surveys and/or newsletter services.

In first instance, transport service providers like *trucking companies*, *railways*, *airlines* and *shipping companies* are operating carriers actually moving goods physically. But as always relying solely on own transport capacity is too costly in most transport operations, they often are contractual carriers at the same time by subcontracting other transport service providers. Looking at contemporary market practice like liner consortia or strategic alliances in container shipping as well as interlining agreements and cargo alliances in the airline industry already described in Sect. 2.2.3.2, there seems to be a more and more fuzzy line between transportation by own means or contracting it out to other carriers. From an intermediary point of view, they serve the role of a market maker on transport markets buying, transforming and selling transportation service as a non-physical commodity. Furthermore, as service quality seems to be important at least for some shippers, they engage in certification and/or guarantee provision by e.g. offering time-definite transport services.

3.3.4 Logistics Middlemen and Service Providers

While the last group of intermediaries is mainly engaged in spatial movement of physical goods, logistics intermediaries care for goods movement in time as well as other more or less related transformation operations. On the logistics service provider's side, there are *terminal operators* at seaports or *ground handlers* at airports which have already been described in Sect. 2.2.4. Other, more focused intermediaries are *public* or *private warehouses* and *export packaging firms* with special expertise in protective packaging of goods, stuffing or stripping containers. A common feature of all of these logistics service providers is, that they are working either on their own site or at the client's premises.

Third-party logistics providers (3PLs or system providers) integrate all these logistics processes mentioned above in one hand in order to offer them to their clients on a one-stop-shopping basis.[215] According to Sink et al. (1996, p. 40), "third party logistics services are multiple distribution activities provided by an external party, assuming no ownership of inventory, to accomplish related functions that are not desired to be rendered and/or managed by the purchasing organization." Furthermore, they listed 25 logistics activities normally associated with contract logistics, grouped in six distinct logistics functions of transportation, warehousing, inventory management, order processing, information system provision and packaging.[216]

[215]See e.g. Sheffi (1990), Rendez (1992), Virum (1993), Rao et al. (1993), Laarhoven and Sharman (1994), Stank and Maltz (1996), Uhlig (1996), Diehl (1996), Peters et al. (1998), Berglund et al. (1999), Engelsleben (1999), Laarhoven et al. (2000), Murphy and Poist (2000), Logistics Europe (2002), Bolumole (2001, 2003) or Love (2004).

[216]Cf. Sink et al. (1996, p. 41).

Hertz and Alfredsson (2003) went beyond this enumeration of logistics functions and classified 3PLs along their general problem-solving abilities and their ability to adopt to customers' needs in four subgroups: (1) *standard third-party logistics providers* just offering highly standardised contract logistics services to the public, (2) *service developers* offering dedicated logistics as well as advanced value added services to their customers, (3) *customer adapters* usually taking over their customer's existing logistics facilities in order to run them as a subcontractor, and (4) *customer developers* taking over their customers' whole logistics operations. As they are acting merely like a consultant, the last mentioned subgroup of customer developers is quite similar to the business of fourth-party logistics discussed in the following.

Furthermore, there are *fourth-party logistics providers* (4PLs or system integrators), which can be considered as asset-free logistics middlemen offering expertise for the establishment and control of complex logistic systems, including logistics consulting and the organization of information infrastructure, transport, logistics as well as financial services needed.[217] Originally, the term 4PL is a trademark of Accenture (former Andersen Consulting) and was defined as "an integrator that assembles the resources, capabilities and technology of its own organization and other organizations to design, build and run comprehensive supply-chain solutions" (e.g. Bumstead and Cannons (2002, p. 19)). But up to now, there is an ongoing more or less fruitless debate about the definition or the role a 4PL should play in supply chains, coming along with an ever lasting redefinition of the topic without further insights.[218] In addition to this, 4PL in practice seems to be rather fiction than real business practice.[219] Perhaps the most advanced 4PLs are (1) logistics management departments having the ability to offer their in-house services to external clients, (2) transport integrators or postal services widening their range of value added services or (3) so-called lead logistics providers (LLPs), which are, in effect, freight forwarders heavily engaged in dedicated contract logistics backed by heavy usage of modern information processing technology.[220]

Concerning their intermediary functions, both can be regarded as agents taking over all kinds of logistics functions for their clients. Whereas 4PLs focus merely on the organizational side of logistics and supply chain management without getting too much involved in physical goods movement but informational flows, 3PLs actually provide physical and informational infrastructure to perform transport and

[217]Cf. Gattorna (1998), Zadek (2001), Baumgarten and Zadek (2002a,b), Baumgarten et al. (2002), Kühner (2002), Emmermann et al. (2003), Love (2004), Albers et al. (2005) or Fulconis et al. (2007).

[218]See e.g. Foster (1999), Nissen and Bothe (2002, pp. 17–18), Emmermann et al. (2003) or Win (2008).

[219]Cf. Thorby (2001c), Peters (2002), Baumgarten et al. (2002), Love (2004) or Fulconis et al. (2007).

[220]Cf. Baumgarten and Zadek (2002a), Baumgarten et al. (2002), Nissen and Bothe (2002, pp. 19–20), Emmermann et al. (2003) or Albers et al. (2005). Further, Hertz and Alfredsson (2003) regarded them just as a special form of 3PL.

logistics services. As a high degree of service quality is demanded in such usually long-termed outsourcing relationships, they heavily engage in certification and/or guarantee provision in order to feed trust and reputation towards their clients.

3.3.5 Freight Forwarders as a Strange Hybrid

In this conceptual framework, the *freight forwarder* (as well as *customs house brokers* for import and *NVOCCs* or *OTIs* for export operations in the United States) may be described best as a strange hybrid providing transport and logistics services as well as financial intermediation on behalf and account of his clients with the following role-set:[221]

- As organizing shipment of physical goods being somehow the core of freight forwarding business (at least from a legal point of view as shown in Sect. 2.1.1), he can be regarded in first instance as a transport middlemen between shippers and carriers.[222] There, his main intermediary role is to be a matchmaker between shippers seeking for transport service and carriers seeking for cargo offered for transport.
- When dispatching and transporting goods on own account as a contractual or even operating carrier, he is a transport service provider - even from a legal point of view (see again Sect. 2.1.1) and his intermediary role is being a market maker on transport markets.
- As spatial cargo movement is often closely coupled with other logistics activities like packaging, handling, temporary storage or warehousing, a freight forwarder offers them as a logistics service provider, too. Moreover, these logistic activities allow him to offer consolidation of cargoes and groupage service, where an analogy to wholesaling or retailing activities of commercial middlemen can be drawn.
- Offering transport or warehouse insurance coverage, he engages in financial intermediation as a dedicated middlemen on behalf of insurance companies taking risks. At the same time, he serves his client at least temporary credit functions for freight, charges, fees or duties payable at once and offers documentary collection or cash-on-delivery services upon request.

[221] In addition to this, freight forwarders may engage into commercial intermediation, too. But today, commercial activities as an export, import or commission merchant described e.g. by Vadnai (1921, p. 60–61) seem to be very rare.

[222] This, of course, includes contracts of affreightment and completion of documentary paperwork needed for cross-border shipments.

- Last but not least, as already indicated above, a freight forwarder can be regarded as a logistics middlemen, if he offers full service logistics packages in a one-stop-shopping manner as a LLP.[223]

3.4 Summary and Some Criticism on the Intermediary Perspective

As shown at the beginning of this part of the book, NIE give theoretical well-founded insights for various phenomena in economic relationships by clarifying the role of property rights, transaction and agency costs in law and economics. In addition to this, MMT and ITF help to understand, how markets are structured and inter-organizational relationships (with and without intermediaries) are working. For TCT, PAT and intermediation theory, at least some applications were identified within the field of transport and logistics or supply chain management, and a taxonomy of intermediaries in multimodal transport and logistic chains was established. The two dimensions, namely middlemen and service providers and four layers (commercial, financial, transport and logistics) of this theoretical framework gave an impression of the inherent specialization of actors therein. However, some hybrid forms of intermediaries offering more then one kind of service could be identified with the freight forwarder somewhere in between, focused on transport and logistics matters either as middleman or actual service provider.

But especially the theoretical concepts TCT and PAT raised some heavy criticism, which can be grouped along four statements discussed in the following:

- There is an overall narrow focus on single phenomena in isolation.
- The way of modelling economic situations seems to be biased.
- There is often a failure in quantification and validation.
- A limited scope on a few relationships is evident.

A Narrow Focus Set on Single Phenomena

Especially in TCT and PAT, there is always a narrow focus set on single economic phenomena in isolation. TCT is centered around transactions and their characteristics which lead to a set of transaction cost minimizing forms of governance for contractual relations.[224] In PAT, research objects are principals, agents and their

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[223] See Steininger (2000), Lindner and Benz (2002), Rudolph (2002), Peters (2002), Emmermann et al. (2003) or Love (2004).

[224] Cf. Johanson and Mattsson (1987, pp. 42–43), Barney and Hesterly (1996, p. 123), Holmström and Roberts (1998, pp. 91–92), Casson and Wadeson (1998, p. 5–6) or Sect. 3.1.3.2.

actions under the presence of asymmetric information structures.[225] To some extent, this narrow focus seems to be set in order to keep things simple as in the case of normative PAT: finding a phenomena, raising questions to motivate a formal model while securing mathematical tractability to end in clear-cut conclusions.[226] But looking at real-world phenomena, it is evident that (1) the context of a situation and its surrounding environment has to be taken into account, (2) inter-temporal dynamics matter and (3) there is not always a straight-forward, unique and stable equilibrium solution available.

MMT and ITF put the focus of investigation a step further in exploring establishment of market structures and various ways markets allocate goods and/or services as well as the important economic role played by intermediaries on them. But relying to a great extent on existing concepts like NIE, IOT as well as NCE, most of these contributions as described in this part of the book have again a rather narrow focus in giving theoretical explanations to specific problems raised in isolation.

A Biased Way of Modelling Economic Situations

The second statement is a logical consequence of the first: As the focus is set on single phenomena, modelling economic situations can be quite parsimonious but biased. Many critics of TCT as well as PAT argue that both theoretical approaches heavily highlight the negative, selfish side of human behaviour, which results in a merely "undersocialized" view of things:[227]

- In TCT, bounded rationality, asset specificity and an ever present threat of opportunism support a mechanism of economic ordering which results in specific governance structures meeting adapted to specific situations. Doing this, it abstracts away issues like market power, resource dependence, cultural forces and/or social embeddedness.[228]
- PAT builds on the fundamental behavioural assumption that principals cannot trust their agents shirking their duties and always behaving opportunistically if given the chance. The general solution proposed is then to invest in monitoring

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[225]Levinthal (1988), Saam (2002, pp. 52–54) or Sect. 3.1.3.1.

[226]This statement originates out of personal experience as the author holding a master degree in economics from Humboldt-University always heard at the end of a typical lecture a sentence like this: "[. . .] the solution [of our rather endless acrobatics in mathematics] is 1/3 – what does it mean?"

[227]Cf. Granovetter (1992), Nilakant and Rao (1994, pp. 650–651), Sheppard and Tuchinsky (1996, pp. 334–336), Barney and Hesterly (1996, pp. 123–129), Göbel (2002, pp. 343–357) or Richter and Furubotn (2003, pp. 209–210).

[228]Cf. Johanson and Mattsson (1987, p. 43) or Shelanski and Klein (1995, p. 228) as well as Barney and Hesterly (1996, p. 123).

them and/or design "optimal" contract mechanisms offering some monetary rewards.[229]

However, theoretical concepts of mutual trust and/or cooperative behaviour seem to be of great importance in every-day economic transactions, which in turn are heavily negated in TCT, PAT, MMT as well as ITF at the same time.

Moreover, both problem-solving approaches function in well specified environments designed for, but fail in others, so that they cannot be considered as one-fit-all explanations for real-world economic behaviour.[230] Taking Williamsonian TCE as an example and confronting it with real-world economic behaviour, more than the black and white picture of a dichotomy of markets versus hierarchies and a few hybrid exceptions as shown in Sect. 3.1.3.1 can easily be identified:[231]

- Richardson (1972) regarded firms not to be "islands of planned co-ordination in a sea of market relations." Looking at actual business practices in manufacturing and retail industries, he considered firms to coordinate their activities in three ways: by direction, by cooperation or through market transactions.[232] For him, "planned co-ordination does not stop at the frontiers of the individual firm but can be effected through co-operation between firms" so that the dichotomy between markets and hierarchies seems to be misleading.
- Blois (1972) discussed the impacts of uneven size and power of contracting partners in customer–supplier relationships, where the stronger party seeks to extent its influence over the counterpart. Calling this situation "vertical quasi-integration," he asked then how firms are gaining the advantage of vertical integration without assuming the risks or rigidity of ownership.
- MacMillan and Farmer (1979) observed an increasing trend in the 1970s towards closer vertical relationships between buyers and sellers on intermediate industry markets which they called "collaborative dealing." Believing that problems of interorganizational coordination cannot be only solved by vertical integration or exclusive dealing contracts, they see considerable mutual gains through

[229]Cf. Perrow (1986), Petersen (1993, pp. 288–289), Nilakant and Rao (1994, pp. 655–656), Barney and Hesterly (1996, pp. 128–129) or Saam (2002, pp. 54–55). Some of them add the claim, that PAT has an inherent bias towards the principal's interests.

[230]Cf. Barney and Hesterly (1996, p. 123) indicating that transaction cost considerations seem to be of second order or Nilakant and Rao (1994, p. 656–659) showing that situations characterized either by (1) a conflict over outcomes and complete knowledge about effort–outcome relationships or (2) knowledge about effort–outcome is incomplete and multiple preferences about outcome exist are outside of the PAT research domain. Moreover, Saam (2002, pp. 57–59), claimed that models of PAT are always of little robustness to changes in their underlying assumptions.

[231]Cf. Bradach and Eccles (1989), Powell (1990), Siebert (1991, pp. 292–294), Sydow (1992, pp. 62–74), Elg and Johansson (1993, pp. 30–32) or Holmström and Roberts (1998).

[232]According to Richardson (1972, p. 890), *direction* is employed when business activities are consolidated in an organization under a single control and one coherent plan, *cooperation* occurs when two or more independent organizations agree to match their related plans in advance and *market transactions* lead to a spontaneous coordination of business activities based on successive interacting decisions taken in response to changing profit opportunities.

long-term, collaborative relationships between otherwise independently operating firms.

- While not fully questioning the dichotomy of markets versus hierarchies, Ouchi (1980) extended the Williamsonian organization failures framework with a third organizational dimension. He distinguished between markets, bureaucracies and clans as three distinct mechanisms of mediating transactions between individuals and described them along their normative and informational requirements.[233]
- Conducting a field study in the construction industry, Eccles (1981) observed there a common contracting mode somewhere between the relational contracting modes of bilateral and unified governance, where a general contractor and his specialized subcontractors form a stable organizational unit called "quasifirm."

This list of organizational forms being neither markets nor hierarchies can be extended *ad finitum*[234], but already these early contributions from Richardson (1972) to Eccles (1981) showed, that Williamsonian TCE lacks explanatory power in many situations. Moreover, Hill (1990) came to the conclusion, that over time the invisible hand of the market may favour actors who behave less opportunistic but more cooperative so that the general market failure proposed by Williamson tends to be a short-term phenomenon. Saam (2002:51) argued this missing dynamic view, too, which prevents PAT to cover long-lasting and sustainable principal–agent relationships.

A Failure in Quantification and Validation

Another line of criticism is a failure in quantification and validation, which is a main goal of empirical studies confronting theoretical model constructs with real-world situations. Although there are quite a lot of applications to cope with various transport and logistics issues, most of them employ TCT, PAT and intermediation theory solely to support their line of argumentation in a normative way. Looking at the various topics treated in these empirical studies, it seems to be quite evident, that these empirical treatments are often borne out of the chance to observe a phenomena fitting to the theoretical framework and to collect enough concrete

[233]Following Ouchi (1980, pp. 137–139), normative requirements "refer to the basic social agreements that all members of the transactional network must share if the network is to function effectively, without undue costs of performance auditing or monitoring" and informational requirements are prerequisites needed for decision making. Argumenting along these lines, *markets* need only a norm of reciprocity and prices as an informational prerequisite to work efficient whereas *bureaucracies* as a first form of hierarchy rely on a set of rules instead of prices and need, in addition to reciprocity, a norm of legitimate authority to function properly. *Clans*, however, are a second more socialized form of hierarchy governed by traditions as well as common values and beliefs in addition to legitimate authority and reciprocity.

[234]For more contributions of this kind, see Part 4 discussing network forms of economic organization in more detail.

data around it at the same time in order to conduct a case study.[235] Moreover, the empirical findings thereof are often not too convincing as David and Han (2004) or Carter and Hodgson (2006) showed after systematic evaluation of empirical studies based on Williamsonian TCE. The same is valid in the case of PAT as Arrow (1985, p. 49) noted: “in some cases where principal–agent theory seems clearly applicable, real-world practice is very different from the model” and some critics even raised the claim that problems of PAT are not empirically important.[236]

Indeed, attempts to estimate the amount of transaction, agency or intermediation costs are rather rare. Maybe a simple reason to this is, that these costs cannot be measured at all, because their theoretical constructs rest on rather vague, non-measurable conceptions.[237]

A Limited Scope on a Few Relationships

The last point of criticism is one of a limited scope: Whereas TCT and PAT are mainly restricted to dyadic relationships[238], intermediation theory extents its scope to triads, but not beyond.[239] This delimitation seems to either lie in the underlying concept of relationship treatment and/or is again a matter of securing mathematical tractability. But thinking of specific real-world situations and setting the scope solely on relationships of two or three distinguishable actors, all these models shown above are rather stylized and merely tell only an episode of the whole story. Looking at the topic of this work, multimodal transport chains including a leg by sea or air and their participants as presented in Sect. 2.2, it is quite obvious, that they cannot be treated as a conglomerate of isolated bilateral or trilateral relationships. This shows a need for a more integrative approach to multimodal transport chains, which takes explicitly the striking network structure into consideration.

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[235] See e.g. the reviews by Shelanski and Klein (1995) or David and Han (2004) on TCT and Eisenhardt (1989) or Petersen (1993) on PAT.

[236] Cf. Petersen (1993, p. 288) relying on Perrow (1986) or Nilakant and Rao (1994, pp. 659–663) and Saam (2002, pp. 41–52).

[237] See e.g. Masten et al. (1991, pp. 2–8) or Shelanski and Klein (1995, pp. 338–341) for a more detailed discussion of estimation issues in TCT and Schneider (1987), Schmidt (1987) as well as Saam (2002, p. 55) for PAT.

[238] See e.g. Johanson and Mattsson (1987, p. 43) or Elg and Johansson (1993) for TCT and Saam (2002, pp. 50–51) for PAT. Notable exceptions are Wathne and Heide (2004) using TCE to explore interfirm governance in double-dyadic relationships between contractors, apparel companies and retailers forming a vertical supply chain network or Agrell et al. (2004) employing a minimum principal–agent model to analyze three-tier supply chains in the telecommunication industry.

[239] Again with the notable exception of Mookherjee and Tsumagari (2004) already discussed in Sect. 3.1.3.2.

Chapter 4
Models of Network Structure and the Network Perspective

One of the first explicit definitions of networks in the social sciences can be found in Moreno (1934), summing up his results of a structural analysis of groups: "We have found that these [psychological] currents which break group lines, and even community lines, are not lawless. They are related to more or less permanent structures which bind individuals together into complex lines of transportation and communication, large 'networks'." (Moreno (1934), (1953, p. 441)). According to Casti (1995, 5), all kinds of networks "[...] have in common a set of objects [...] tied together in a connective structure by links [...]. What this adds up to is that we can abstractly regard a network as nothing more (or less) than a system: network = objects + connections = system."

A viable way to visualize such network systems consisting of objects and connections between them is the graph theory. As a research subject in its own right it was first formulated in a monograph by König (1936), but it took until 1950 for his pioneering work to be recognized by the international scientific community, after it was republished in the United States.[537] As graph-theoretical descriptions of networks will be heavily employed in the following, a set of basic definitions from graph theory will be outlined in advance:[538]

[537]In addition to this, it was the only monograph dedicated to the subject of graph theory until Berge (1958), see Gallai (1990). Authors like Barnes (1969, p. 217), Deo (1974, p. 10) or Jungnickel (1994, 17–18) date the first graph theoretic treatment back to the mathematican Leonard Euler, who discussed the problem of crossing all seven bridges over the River Pregel at Königsberg in 1736 without crossing each bridge more than once. See e.g. König (1936, pp. 24–25), Deo (1974, PP. 23–30), Nollemeier (1975:12–13), Jungnickel (1994, pp. 31–33) or Casti (1995, pp. 8–10) for a more elaborated discussion of this bridge-crossing problem.

[538]Cf. König (1936, pp. 1–18), Moreno (1953, pp. 719–720), Flament (1963), Harary et al. (1965), Freeman (1979), Knoke and Kuklinski (1982, pp. 37–42), Schenk (1984, pp. 42–46), Scott (1991, 67–71), Ahuja et al. (1993, pp. 23–31), Casti (1995), Johnson (1995), Domschke and Drexl (1995, pp. 1–16), Jansen (2003, pp. 94–97), Brandes and Erlebach (2005) or Knoke and Yang (2008, pp. 45–51).

H.-J. Schramm, *Freight Forwarder's Intermediary Role in Multimodal Transport Chains*, Contributions to Management Science, DOI 10.1007/978-3-7908-2775-0_4,

- A *graph* as a visualization of a network structure consists of a non-empty set of N *points* p_i with $i = 1, \ldots, N$ standing for *actors* or *facilities* (sources, sinks or transhipment points) and a non-empty set of M *lines* q_m with $m = 1, \ldots, M$ called *arcs*, *edges*, *links*, *relations* or *ties* connecting pairs of points.
- The *strength* of a link between a pair of points (p_i, p_j) with $i \neq j$ can be denoted by $z_{ij} = z(p_i, p_j)$ for all $i \neq j$.
- If all possible lines between all points are present and therefore $z_{ij} \neq 0$ for all $i \neq j$, a graph is *complete.*
- If the direction of the link between a pair of points (p_i, p_j) with $i \neq j$, matters so that (p_i, p_j) is not virtually the same as (p_j, p_i), then a graph is called a *directed graph* (or *digraph*) and the linkages between points are expressed as a set of *directed lines* called *choices* or *nominations*. In a digraph, three different types of linkages between two points can occur: (1) *mutual*, with both points linked to each other, (2) *asymmetric* in which one point directs a line toward another that is not reciprocated and (3) *null*, in which no link in either direction between a pair of points exists.
- In a *signed graph*, a linkage between two points can have a positive or negative sign, to represent a positive or negative affection between two actors connected.
- In a *valued graph*, the strength of a link can have different magnitude standing for *intensity*, *capacity* or *costs* incurred.
- In a *binary graph*, a link between pairs of points (p_i, p_j) with $i \neq j$ either exists or not, so that the strength of all links consists of dichotomous relations and therefore $z_{ij} \in \{0; 1\}$ for all $i \neq j$. Each graph can be transformed into a binary graph just by setting $z_{ij} = 1$ for all $i \neq j$ if there is a link between p_i and p_j and 0 otherwise, regardless of strength and direction.
- When two points p_i and p_j are directly connected by an edge they are called *adjacent,* and their link can be denoted by $a_{ij} = a(p_i, p_j)$ for all $i \neq j$.
- A *walk* is an alternating sequence of points and edges where each edge is linked to both the preceding and succeeding point. If every point and edge in a walk is *distinct* (different) it is a *path*.
- Associated with each path is a *distance* $d_{ij} = d(p_i, p_j)$ for all $i \neq j$ equal to the number of edges in that path.
- A *cycle* is a closed path which begins and ends in the same point.
- Given an unordered pair of points (p_i, p_j) where $i \neq j$, one point is *reachable* from another if and only if they are adjacent or they are connected through a path including one (or more) intermediary point(s) p_k between p_i and p_j, like (p_i, p_k) and (p_k, p_j) in a path with $d_{ij} = 2$.
- When every point p_i is reachable from any other point p_j and $i \neq j$, the graph is called *connected*.
- The shortest path linking a given pair of points (p_i, p_j) with $i \neq j$ is called a *geodesic* $g_{ij} = g(p_i, p_j)$ for all $i \neq j$.
- Points p_k falling on the geodesic or on all geodesics linking a given pair of points (p_i, p_j) with $i \neq j$ are said to stand *between* these end points.

As already indicated in the above mentioned definition by Moreno (1934), transportation and communication flows between individuals form networks. Therefore, it seems to be a quite straight forward extension of multimodal transport chains to treat them as networks. In the following, six theory-driven streams of modelling network structures are discussed one after another, before they are compared and their usability in the context of this work is assessed. Of course, in the wide research fields of economics, law and other social sciences there are far more modelling approaches as e.g. Sydow (1992), Grandori and Soda (1995), Powell and Smith-Doerr (1994), Araujo and Easton (1996) or Oliver and Ebers (1998) showed in their extensive reviews on network literature. But only these six approaches are of special interest here, because they seem to be directly applicable to multimodal transport chains including a leg by sea or air.

4.1 Network Modelling in Operations Research and Management Science

According to Pfohl (2003:1-7), all sorts of logistics systems are basically systems of transformation objects between space and time which in turn can be characterized as a sequence of transport and storage processes. Furthermore, these processes can be visualized as a set of points for storage processes, connected with lines as transport processes forming a network structure.[539] A first and foremost approach of modelling such network structures – apart from just visualizing them as a graph - is to quantify these points and their connections in order to describe them mathematically. Historically, this approach to network modelling is closely related to the rapid development of Operations Research (OR) and Management Science (MS) as a distinct field of scientific research starting around the World War II, which will be addressed first, before applications to specific transport and logistics networks of interest in this context are discussed.

4.1.1 Historical and Theoretical Background

Following Koopmans (1951), Brothers (1954), Solandt (1955), Dantzig (1963, pp. 12–14), Glover et al. (1992, pp. 2–3), Fortuin and van Beek (1996), Thomas (1996), Vertinsky (1998), Dantzig (2002) or Weir and Thomas (2008), the subject of OR / MS originates in dedicated operations research departments established by the military forces of the United Kingdom and the United States around World War II. Their purpose was to improve all kind of military operations from artillery fire effectiveness or bombing accuracy over vehicle and crew scheduling, radar usage to staff, supply and maintenance planning by means of mathematical methods.

[539] See Simon (1993:20-31) discussing structural as well as procedural aspects of logistic networks and Jäggi (2000, pp. 88–92) for a detailed typology of network definitions in transport and logistics.

During their work on problems of military operations research, first mathematical programming techniques were founded, which draw heavily on graph theory in connection with matrix algebra, combinatorial analysis, and methods for solving linear equation systems.[540]

After World War II, many of these researchers employed in military operations research departments returned to non-military assignments and developed these mathematical programming techniques further to solve practical problems in business activities like production planning, inventory control and physical distribution.[541] In the 1950s and 1960s, initial contributions to OR/MS modelling and mathematical programming approaches were published like monographs by Morse and Morse and Kimball (1951) and Churchman et al. (1957) on operations research in general, Ford and Ford and Fulkerson (1962) on network flow problems or Dantzig (1963) on techniques in linear programming.[542] In addition to this, a steady stream of articles appeared, with initial contributions e.g. on the warehouse problem (Cahn, 1948 or Charnes and Cooper, 1955), the optimal movement of ships in ballast (Koopmans, 1949; Koopmans and Reiter, 1951; Flood, 1954 or Dantzig and Fulkerson, 1954), the optimal allocation of aircrafts to routes under uncertain demand (Ferguson and Dantzig, 1955, 1956), the warehouse-location problem (Baumol and Wolfe, 1958) or the truck dispatching problem (Dantzig and Ramser 1959).[543] Furthermore, transportation problems already assessed before by Tolstoĭ (1930, 1939), Kantorovich (1939, 1942) or Hitchcock (1941) were treated with the transhipment problem (Kantorovich and Gavurin, 1949 or Orden, 1956) and the traveling-salesman problem (Dantzig et al., 1954; Flood, 1956; Ford and Fulkerson, 1956 or other modelling approaches reviewed by Bellmore and Nemhauser (1968)) as the most prominent ones.[544] During this short time, most standard approaches of mathematical programming in the field of OR/MS like the Simplex Algorithm (Dantzig 1951; 1963, pp. 94–253), the Branch-and-Bound Algorithm (various authors, see a review by Lawler and Wood, 1966), the Primal-Dual Algorithm (Ford and Fulkerson (1957, 1962, pp. 26–30) or the Hungarian Method (Kuhn, 1955) were introduced. Today, the whole subject of OR/MS covers a wide-spread field of theories including mathematical programming, combinatorial

[540]See Koopmans (1951) or Dantzig (1963, pp. 20–24, 2002) for further explanation about the origins of mathematical programming.

[541]Cf. Dantzig (1963, pp. 18–20), Thomas and Biddle (1966a) or Fortuin and van Beek (1996).

[542]Some of these early contributions to OR/MS relied on much former research findings subject to a strict military confidentiality. But later on, they were released after being declassified, like in the case of Morse and Kimball (1951), Flood (1954) or Harris and Ross (1955) with the last one downgraded recently upon request in 1999, see Schrijver (2002, p. 441).

[543]See Avondo-Bodino (1962), Berge and Ghouila-Houri (1962) or Dantzig (1963) for a more detailed overview of these early contributions.

[544]See Avondo-Bodino (1962), Ford and Fulkerson (1962, pp. 93–172), Dantzig (1963, pp. 299–351), Glover et al. (1992, pp. 6–7), Ahuja et al. (1993, pp. 19–20) or Schrijver (2002) for further discussion about early treatments of these transport problems.

analysis, queuing theory, network plan technique[545] and simulation[546], providing problem-solving techniques for various applications not only in the business and military sector, but also e.g. in sports, politics and library management.[547]

From a network point of view, the objectives of OR/MS modelling can be divided into two broad categories: (1) a tactical and an operational level with actual network flow problems in given network structures and (2) a strategic level with network design problems focusing both on prospective network flow and network structure simultaneously.[548] Following Ahuja et al. (1993, pp. 4–9), *network flow models* can be classified further in (1) shortest path (or longest path) problems, (2) maximum flow (or minimum cut) problems and (3) minimum cost flow problems, with the latter consisting of transportation problems, assignment problems, circulation problems and many more generalized forms covering topics like non-linearity, loss or gains in transit or multicommodity flows.[549] The category of *network design models* mainly consists of minimum spanning tree or Steiner tree problems and network location problems.[550]

4.1.2 Applications

As already indicated before, problems from transport and logistics operations are somehow a core field of applications in OR/MS. So, various theory-driven models of network structure can there be found, as it will be shown in the following

[545]Network plan techniques are methods for scheduling, risk assessment, control, capacity and cost planning in projects, see e.g. Noltemeier (1976, p. 219). Well known procedures are the Critical Path Method (CPM), the Programm Evaluation and Review Technique (PERT), the Meta Potential Method (MPM) and the Graphical Evaluation and Review Technique (GERT).

[546]Cf. Heinzl and Brandt (1999).

[547]See Fortuin and van Beek (1996), Vertinsky (1998) or Domschke and Drexl (1995, pp. 7–9). Regarding these last mentioned rather unusual applications of OR/MS see short reviews by Ladany (1996), Hess and Wong-Martinez (1996) or Reisman and Xu (1996) with further references.

[548]Cf. Magnanti and Wong (1984), Magnanti (1996), Diruf (1999, pp. 378–380) or Crainic (2000).

[549]Strictly speaking, assignment (as well as matching problems) generally belong to the group of combinatorial (or discrete) optimization techniques, but there is a close relationship between them and the other network flow models mentioned above, see e.g. Iri (1969, pp. 212–238) or Ahuja et al. (1993, pp. 461–501). Further, authors like Iri (1969, pp. 3–5) or Deo (1974, pp. 400–408) considered network plan techniques as network flow models in activity networks, too. But their basic objective is project planning and scheduling of activities, so that they are excluded in this context.

[550]See Tansel et al. (1983b), Magnanti and Wong (1984), Dejax and Crainic (1987), Teodorović (1988), Glover et al. (1992), Eiselt and Sandblom (2000), Crainic (2000) or Minoux (2003) for extensive overviews of OR/MS network modelling approaches. Further Noltemeier (1976, pp. 133–199) or Ahuja et al. (1993, pp. 510-536) focusing on minimum spanning tree and Steiner tree problems and Tansel et al. (1983a), ReVelle (1996), Domschke and Drexl (1996, pp. 41–161) for network location problems, including the warehouse-location or hub-location problem.

with a special focus set on treatments in the airline as well as ocean shipping industry.[551] Concerning network structures in the field of transport and logistics, three ideal types of network configurations as well as some hybrid forms can be distinguished:[552]

- *Linear networks* which consist of several walks, paths and/or cycles with some points of interchange forming a network. They were a common network configuration in the airline industry from the early beginning of scheduled transport operations up to the time e.g. of the air transport deregulation in the United States.[553] Furthermore, industrial as well as liner shipping companies often operate in this fashion with several subsequent ports of call at both legs of a ship's journey.
- *Grid networks* consist of a complete network with direct point-to-point connections between all sources and sinks. Examples are overnight transport networks on the main haul in groupage service, courier, express, mail or parcel operations on a national scale basis, where virtually every depot is connected with each other due to a tight time schedule.
- *Hub-and-spoke networks* are networks with one or more hubs as transhipment points through which all net flows are routed. They are a dominant network configuration for airline networks in passenger transport operations, where at least one airport serves as a "home base" and transhipment point for each airline. In comparison to the "pure" forms of linear or grid networks, the hub-and-spoke network configuration always comes along with a considerable rise in transport frequency and volumes shipped with less vehicles, ships or aircrafts needed.
- *Hybrid forms* are a mixture of these above mentioned forms of network configuration. Some real-world examples are: (1) linear networks in connection with additional hub-and-spoke network structures at both legs of a journey as in the case of the contemporary container shipping industry, where main ports of call serve as hubs for feeder-services, (2) grid networks with one or more additional hubs to consolidate small shipment volumes between depots as widely common in freight forwarder groupage service operations or (3) hub-and-spoke-networks with feeder-routes and/or stopovers as in the case of integrator or other express service operations.

[551] Of course, OR/MS modeling is not restricted to these two fields solemnly, as e.g. Bramel and Simchi-Levi (1997), Schmidt and Wilhelm (2000) or Daganzo (2005) showed in their mathematical programming approach to various logistics problems, including the formulation of production planning, inventory and distribution modeling. But they are not of special interest in this context and so excluded in the following.

[552] See Kuby and Gray (1993), Jäggi (2000, pp. 105–110), Button and Stough (2000, pp. 50–58), Lohatepanont and Barnhart (2004) and Hanlon (2007, pp. 123–129).

[553] See Graham (1995, pp. 12–13), Wells (1999, pp. 37–40), Button and Stough (2000, pp. 46–47), Jäggi (2000, pp. 109–110) or Mayer (2001, pp. 6–11). In Europe, hub-and-spoke networks outdated linear networks much earlier because of geographical, political and historical factors, see Mayer (2001, pp. 31–34) with further references.

Regarding the *airline industry*, OR/MS modelling approaches got wide-spread application throughout the whole hierarchical process of planning and operations management in scheduled airline services:[554]

- Beginning with the strategic level, there are first decisions to be drawn about the network design, including network configuration, fleet planning as well as service level definitions.[555] In the airline industry, network configuration, as already indicated above, depends heavily on service level defined and objects transported (passenger, cargo, mail, express or parcel service) so that quite different hub location and routing problems have to be addressed at this stage.[556] After a particular network design evolved, initial flight schedule construction, fleet assignment and routing decisions have to be settled.
- At the tactical level, airline scheduling is executed, followed by resource assignments. There, the goal is to find optimal work assignments for a given network design and the initial flight schedule. During the process of airline scheduling, the initial flight schedule is evaluated, given the resources (e.g. aircrafts, personnel and maintenance capacities) expected to be actual available. Then the resource assignment phase starts with aircraft assignment and routing, maintenance planning and crew scheduling, resulting in an operational plan for actual flight operations.
- At the operational level, OR/MS applications are employed as decision support systems for flight operations, including aircraft re-scheduling or fleet re-routing in the case of irregular operations.[557]

In addition to this hierarchical structured planning and operations management, fields of OR/MS modelling in the airline industry are yield management serving as a revenue controlling tool mainly employed in passenger transport operations or efficient cargo load planning for aircrafts and ULDs as well as more general corporate planning problems not explicitly mentioned above.[558]

In the case of *ocean shipping*, OR/MS applications seem to be of less interest in the scientific community, with recent advances in connection with container terminal operations and container fleet management as notable exceptions.

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[554] See Etschmaier and Mathaisel (1985), Teodorović (1988), Rushmeier et al. (1995), Ryan (1996), Mathaisel (1997), Rushmeier and Kontogiorgis (1997), Yu (1998), Lohatepanont and Barnhart (2004), Barnhart and Cohn (2004) or Snowdon and Paleologo (2008) for this and in the following. Relying on Suhl (1995), Mayer (2001, pp. 48–57) mapped the hierarchical planning process for scheduled airline services in four subsequent phases, starting with product planning at the strategic level, followed by production planning at the tactical level and resource planning as well as operations management at the operational level.

[555] See reviews by Lederer and Nambimadom (1998), Bryan and O'Kelly (1999), Mayer (2001, pp. 107–257) and Barnhart et al. (2002) focusing on OR/MS network design models in the airline industry. Further Jäggi (2000) with a resource-based approach to airline network design.

[556] Cf. Kuby and Gray (1993), Hall (1989), Mayer (2001, pp. 107–257) or Barnhart et al. (2002).

[557] Cf. Mathaisel (1996) or Ball et al. (2007).

[558] See. e.g. Richter (1989), Amiouny et al. (1992), Smith et al. (1992), Klampferer (1996), Ryan (1996), Thomas et al. (1998) or Snowdon and Paleologo (2008).

In a series of review articles covering about 120 contributions from 1954 to 2003, Ronen (1983, 1984, 1993) and Christiansen et al. (2004) showed OR/MS modelling for ship routing and scheduling problems may not be so common as e.g. in the case of the airline industry.[559] For them, main reasons are: (1) low visibility, because there are only a few companies operating ships, (2) ship scheduling is a very complicated task due to e.g. fleet variety and different operating environments, (3) shipping operations suffer from much more uncertainty, (4) the shipping market is volatile, international, capital intensive and subject to free entry and (5) the ocean shipping industry has a long tradition, is therefore somehow more conservative and builds on personal expertise.[560] Moreover, other differences supporting this can be added like (6) trip or voyage lengths are much longer, (7) destinations may often change while a ship is under way, (8) affreightment on vessel from other shipping companies as well as chartering of additional vessels is quite common as well as (9) a combination of ownership, ship and operations management is quite unusual.[561]

Focusing on liner shipping, there is a quite similar hierarchical process of planning and operations management as in the airline industry, too, but it is less formalized.[562] It starts at the strategic level with the network design, or better say a long-term decision making in route, schedule and fleet planning. At the tactical level, resource assignment (ship deployment, routing and scheduling) is done after the network design is validated and negotiations are finished with other third-parties like terminal operators involved in the shipping process. Finally, every-day business decisions about ship's sailing dates, cruising speed selection and actual service prices are drawn at the operational level with little use of OR/MS applications.

In the container shipping industry, planning and operations management of container fleets, especially for empty container allocation is another evolving field of OR/MS modelling worth to mention.[563] Concerning terminal operations in container shipping, reviews by Vis and de Koster (2003) and Steenken et al. (2004) showed a rapidly growing interest in a wide-spread employment of OR/MS methods, because they reached such a degree of complexity that it cannot be judged any longer just by

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[559]All in all, they found in industrial shipping most evidence for OR/MS applications with 24 treatments, followed by liner shipping (19), shipping in multimodal transport operations (16) and tramp shipping (11) with the remaining contributions covering various specialized shipping operations including e.g. fishing, cost guard and naval shipping. Furthermore, an update to this can found in Christiansen et al. (2007). In addition to this, Ernst (1982) and Ordemann (1996) are dissertations in German focusing on ship routing and scheduling in the container shipping industry, too.

[560]Cf. Ronen (1983, 1984).

[561]See Christiansen et al. (2004) or Sect. 2.2.4.1 and 2.2.4.2.

[562]Cf. Pesenti (1995) or Christiansen et al. (2007).

[563]See early treatments by Ramcke (1973), Huch (1973), Jarke (1981) or Ernst (1982) as well as overviews by Dejax and Crainic (1987), Macharis and Bontekoning (2004), Christiansen et al. (2004), Maloni and Jackson (2005) or Olivo et al. (2005).

operational expertise.[564] Again, a distinction between three levels of planning and operations management can be drawn:[565]

- At the strategic level, investment decisions about container terminal layout, deployment of handling equipment and their way of operations in the transhipment process are more and more backed by simulation and mathematical programming methods.
- At the operational level, the overall complexity of transhipment operations at container terminals need planning support: berth allocation of vessels, crane allocation for ship-to-shore handling, stowage planning onboard the vessels, storage planning on the container terminal as well as scheduling of on-site container handling equipment and workforce are typical applications of OR/MS in this field.
- At the tactical level, assisting systems play an eminent role today for the organization and the optimization of work flow at contemporary container terminals, especially if on-site container movement is at least partly automated. There, decision problems about container handling equipment moves, scheduling and routing as well as optimal stacking policies have to be solved.[566]

4.1.3 Critical Comments

Concluding this section, it can be clearly seen that there is an ongoing progress in OR/MS research in the airline as well as the container shipping industry with various treatments from strategic network design to operational planning and control. But in the context of this work, a serious problem for this kind of OR/MS modelling approach to network structures is that solely functional aspects are caught with institutional ones considered as being ex ante fixed and regarded not to be of special interest. Furthermore, most decision problems assessed are looked at from a carrier's or a terminal operator's point of view, but not from a freight forwarder's

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[564] Vis and de Koster (2003) reviewed about 55 contributions and the comprehensive literature overview by Steenken et al. (2004) contains about 200 citations, most of them being published within the last decade. Further with Jehle (1981), Kunzmann (1988), Schott (1989), Kasprzak (1997) and Pumpe (2000) there are some dissertations in German about this topic not explicitly mentioned in Vis and de Koster (2003) or Steenken et al. (2004).

[565] See Meersmans and Dekker (2001), Meersmans (2002, pp. 7–27), Vis and de Koster (2003), Steenken et al. (2004), Günther and Kim (2005) or Maloni and Jackson (2005) for a more thoroughly overview with further references. Further, Macharis and Bontekoning (2004) reviewed OR/MS modelling issues in intermodal freight transport operations with a focus on road, rail and inland navigation, where they distinguished between drayage, terminal, network and intermodal operator decision problems on a strategic, tactical or operational level.

[566] In addition to this, container loading problems are adressed e.g. by Dyckhoff and Finke (1992), Bischoff and Ratcliff (1995), Ratcliff and Bischoff (1998), Bortfeldt and Gehrig (1998) or Bortfeldt (2000).

one. In addition to this, modelling of network structures comes along with a high abstraction from the underlying real-world environment in order to manage the inherent computational complexity.

4.2 Strategic Networks: Focal Companies with Cooperative Relationships

Apart from this OR/MS treatments in planning and operations management, in the 1980s a network perspective evolved in strategic management. For a long time, large companies were usually hierarchically structured, vertically integrated and widely diversified with a strict demarkation line between own business operations and the market outside. But during the 1970s and 1980s, deregulation and globalization of markets paired with the revolutionary adoption of new information processing technologies resulted in a tremendous change of the business environment.[567] Many of them downsized their administrative overhead, concentrated their operations around their core competencies and sought for less formal but more adaptive forms in intra- as well as inter-organizational relationships. As one outcome of this restructuring process, more and more neither market nor hierarchy forms of economic organization could be observed.[568] Expanding the Williamsonian governance framework as shown in Sect. 3.1.3.1, a theory of "strategic networks" evolved originating in the works of J. Carlos Jarillo and Jörg Sydow.

4.2.1 Theoretical Background

Defining them as "[...] long-term purposeful arrangements among distinct but related organizations that allow those firms in them to gain or sustain comparative advantage *vis-à-vis* their competitors outside the network" Jarillo (1988) considered the strategic network concept as a distinct form of organization between hierarchies and markets. By categorising different modes of organizing complex economic activities along the two dimensions of legal form and kind of relationship, he proposed four prototypes of organization as shown in Fig. 4.1.[569]

First, "classic markets" (many players interacting on a spot market basis) as well as "bureaucracies" (hierarchical organizations with antagonistic labour-management relationships) are organizational arrangements plagued by transaction costs and therefore driven by a competitive, zero-sum game approach to relationships. Second, "clans" (as defined by Ouchi, 1980) are cooperative organizational

[567]Cf. Snow et al. (1992, pp. 6–11) or Hinterhuber and Levin (1994).

[568]Cf. Thorelli (1986), Powell (1990, pp. 314–322) or Snow et al. (1992, pp. 11–14).

[569]Cf. Jarillo and Ricart (1987) or Jarillo (1988).

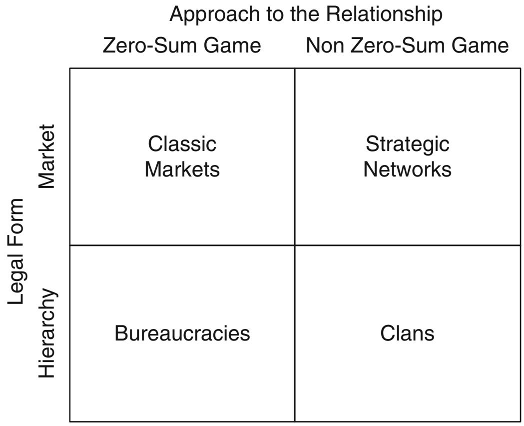

Fig. 4.1 Four modes of organizing economic activity (Source: adapted from Jarillo and Ricart, 1987)

arrangements which can be best characterized as long-term relationships based on relational contracts within the formal environment of an organization. Finally, in "strategic networks," a focal firm has special cooperative relationships with other members forming a network of closely interrelated, but still independent organizations. Like "clans," their relationships are long-termed and based on relational contracts upon relatively unstructured tasks. But at the same time, they can be regarded as some kind of an investment, because "there is always a certain "asset specificity" to the know-how of, say, dealing with a given supplier instead of a new one" (Jarillo, 1988).

The logic behind such a strange hybrid is as follows: A company can be regarded as a collection of value-adding activities where some can be outsourced while others are conducted in-house. It is then quite rational that activities in which one has some comparative advantage will be kept internally while others are contracted out to the most efficient supplier unless transaction costs are not too high. In order to keep them low, these inter-organizational relationships are established in a more collaborative way in order to end in a self-reinforcing system, where "[...] every characteristic of the network builds on the others: adoption, specialization, trust, long-term outlook, internal consistency *vis-à-vis* the outside world, etc., which provide efficiency and flexibility. This delivers a good competitive position, justifying the existence of the network and reinforcing its characteristics" (Jarillo 1993, p. 143). At the end, this kind of network structure reduces behavioural uncertainty and enables reaching higher efficiency at the same time.

It was then Sydow (1992, 1993) who restated these initial, rather loosely formulated considerations and explored further the circumstances under which a strategic network arrangement lowers transaction costs. For him, strategic networks are the result of either a "quasi-internalization" or a "quasi-externalisation" which means an in- or outsourcing of value-adding activities in connection with a network-like coordination approach. However, Sydow (1992, p. 296, 1993, p. 234) concludes that Williamsonian TCE – mainly relying on (transaction)cost considerations – can be at best a partial approach to explain the evolution of strategic networks.

Therefore, Sydow et al. (1998, 1995) introduced a theory of structured inter-organisational networks based on the theory of structuration by Giddens (1984) which considers actions and structures as related in structuration processes. Following Sydow et al. (1998), two theorems are central to this theory: (1) the duality of structure and (2) the recursiveness of life. The basic idea of the duality of structures is that "[t]he constitution of agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality" (Giddens 1984, p. 25). Therefore, actions as well as structures of networks should always be investigated in respect to three dimensions: (1) signification, referring to the cognitive aspect of social practice in social systems, (2) legitimation referring to the normative aspect inherent in any social practice and (3) domination, as allocative and authoritative resources referred to intervene in ongoing network practices.[570] The second theorem finally points to the fact that the history of interaction matters, because outcomes of structured action are necessarily the input for further actions. Backed by this theory of structuration, they explored the recursive interplay between industry's structures and interfirm networks therein in several cases like financial services networks (Sydow et al., 1998, 1995) or strategic networks in franchising (Sydow, 1998).

4.2.2 Applications and Critical Comments

Looking at the field of transport and logistics a multitude of strategic alliances emerged within the last decades.[571] Especially in the airline and the container shipping industry, strategic alliances – among other neither market nor hierarchy forms of organization – are of high importance to actual market structures, as already described in Sect. 2.2.2.2 and 2.2.3.1. Furthermore, quite a few interesting contributions focusing on strategic network issues not initiated by carriers can be identified:

- While discussing corporate governance structures of German freight forwarder transport networks on a European scale, Stahl (1995a,b) observed a distinct organizational form in which "[...] legally autonomous transport firms coordinate their activities [...] in a cooperative fashion transcending organisational [sic!] boundaries, in order to jointly obtain strategic competitive advantages *vis-à-vis* competing suppliers of international logistical services from outside the network" (Stahl, 1995b). Furthermore, he showed that type of cooperation agreements, coordinating mechanisms employed and degree of centralized decision making are precisely tailored to specific cooperation characteristics as well as to their monitoring and safeguarding requirements.

[570] Cf. Sydow et al. (1998) or Sydow (1998).

[571] See e.g. Faller (1999), Jung (1999) and Kaspar (1999).

- In Becker (1999), a focus is set on the institutional arrangements in strategic alliances of air freight forwarding companies teaming up in air cargo consolidation in order to reach critical shipment volumes to obtain lower freight rates. Backed by an empirical study among German freight forwarders acting as IATA cargo agents, he offered managerial implications for planning and implementation of such strategic alliances, which can be regarded at the same time as strategic networking on a horizontal level.
- Furthermore, Lunnan and Reve (1995, pp. 357–368) considered the corporate governance structure of Laboremus, a small Norwegian company in industrial shipping, to be a strategic network. Rather than vertically integrating all activities in one single firm, it performs activities like network management and strategy, accounting and finance as well as ship procurement as its core competencies in-house with ship management, marketing and operations actually done by closely related but independent companies around.

While the first two contributions solely draw their theoretical background from Williamsonian TCT, the last one is based on a so-called "contract theory of strategic management" first formulated by Reve (1990) where he attempted to bring Porter (1980) competitive positioning model together with PAT and TCT considerations of organizational governance.[572] Common to both underlying theoretical concepts is that they provide some rational why such strategic networks are workable in the field of transport and logistics, but fail to explore further how such networks are structured.

This criticism is in line with Weyer (2000) discussing Sydow et al. (1998, 1995) theory of structured inter-organizational networks and concluding that networks are considered to be planned constructs of strategically acting actors, who coordinate their actions to obtain specific benefits. As the focus is set on a specific phenomenon – trustful cooperation – only field studies or historic-reconstructive, qualitative methods are available so that the inherent network structure is just verbally described. Another topic is assessed by Hirsch-Kreinsen (2002, p. 109) who claims strategic networks to represent only one extreme pole of the spectrum, as they are inter-organizational arrangements hierarchically coordinated by one or more dominant firms.

Summing up in a more precise way, the strategic network approach has two main deficits: (1) It is only centred around a focal firm, their organizational governance and the contractual relationships to others being adjacent and (2) as this firm is considered to be somehow dominant, the inherent presumption is that of a

[572]More specifically, Reve (1990) considered a firm to be a nexus of internal and external contracts offering organizational and inter-organizational incentives in order to bind core and complementary skills to it. The strategic core of a firm can then be defined as a bundle of skills which are of high asset specificity and therefore governed with in the boundary of the firm. Further, complementary skills are of medium asset specificity and can therefore be acquired by vertical, horizontal or diversification alliances forming a strategic network whereas other assets of low specificity are obtained in the market.

hierarchically ordered network structure where the firm is like a queen bee served by their subordinates. Looking at the freight forwarding business in multimodal transport chains as outlined in Sect. 2.2, it is quite evident that the strategic network approach is not too useful in this context.

4.3 Dynamic Networks: Temporary Virtual Companies for Specific Tasks

Another innovative management approach in connection with inter-organizational network structures was provided by Miles and Snow (1984, 1986). Building on their earlier findings, that all kind of organizations need a fit between business strategy, organizational structure and process mechanisms to be successful (Miles et al., 1978), they proposed a new organizational concept called "dynamic networks" as an alternative response to this changing business environment as already described in the last section.

4.3.1 Theoretical Background

For them, the main characteristics of such dynamic networks come along with (1) a strict vertical disaggregation of business operations, (2) external and internal brokerage, (3) employment of market substitutes for administrative purposes and (4) supportive full-disclosure information systems, so that:[573]

- Business operations are performed within a group of more or less independent organizations, instead of being vertically aggregated inside the hierarchy of a single company.
- At least one single broker is responsible to assemble all resources needed by employing these network members specialized in production of components and services to end in a joint product or service for external sale.[574]
- Instead of hierarchical organization structures of plan and control, market mechanisms are employed to administer these resources inside this network of business operations.

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[573] Cf. Miles and Snow (1984, pp. 26–27, 1986, pp. 64–65) or Rennings (1992, pp. 40–41). Further Siebert (1991, pp. 294–298) with a quite similar approach to characterize corporate networks along functional specialization, market mechanism efficiency, trust, cooperative conduct and information integration.

[574] Later on, Snow et al. (1992, pp. 14–19) discussed fundamental different functional roles of such an broker in establishing (the "architect"), operating (the "lead operator") and maintaining (the "caretaker") such dynamic networks.

- A full-disclosure information system is established as a substitute for lengthy transaction procedures between all network members in order to ease e.g. ordering or financial flows.

As such dynamic networks rely on a radical disintegration of business operations in favour of a network of resources, they are considered to be highly adaptive as they allow to quickly reshape their organizational structure whenever necessary in order to meet a complex and ever changing competitive environment. As Ochsenbauer (1989, p. 275) or Rennings (1992) noted, this network concept is closely related to Piore and Sabel's (1985, pp. 286–307) more global notion of "flexible specialization" as a "shift of the technological paradigm" away from mass production based on vertical integration and a rigid allocation of resources to produce low-cost standardized products towards a more customized, adaptive way of production.[575] More specifically, they postulated the renaissance of the former artisan method of production as a path to prosperity in saturated markets with demand instability and increasing uncertainties in the business environment.

Having usually one face to their customers, such dynamic networks can be regarded at the same time as "virtual corporations," a term first coined by Davidov and Malone (1993, [1992]) in their rather visionary management reader. In the following, this term became an often cited metaphor for either (1) small company business backed by a much larger network of easily accessible external resources or (2) temporary business networks of otherwise independently operating companies joining their resources for a specific purpose.[576]

4.3.2 Applications and Critical Comments

While referring to the works of Piore and Sabel (1985), Miles and Snow (1986) and Ochsenbauer (1989), Rennings (1992) proposed the idea that freight forwarders can be regarded as a brokerage element in dynamic networks built on the principle of flexible specialization, but failed to go into more details. Furthermore, in a study focusing on the impact of information processing technology on transaction costs in multimodal transport chains for deep-sea container shipping, Kylaheiko et al. (2000) considered all participants involved in physical goods, documentary and/or financial flows in such transport chains to form a single virtual organization, or better say, a virtual corporation *vis-à-vis* the seller, headed by the freight forwarder as the central broker.

Following these authors, a freight forwarder might be considered to be a single broker in a dynamic network assembling together different specific resources to

[575] See also Sydow (1993, pp. 185–188) with a critical review.

[576] Cf. Voss (1996), Christie and Levary (1998) or Corsten and Gössinger (2000, pp. 24–51) with further references.

bundle a final product in form of a tailored door-to-door service. If then a shipper wants him to expedite a shipment, he should act like a single virtual corporation assembling all resources needed for fulfilment.

But this illustration of the freight forwarding business seems to be somehow misleading, because most freight forwarders cannot be regarded to be such a simple broker only organizing tailored door-to-door shipments by employing temporary network relationships upon request. As already shown in Sect. 2.1.4, freight forwarders are usually engaged in much more fields of activity than such single transport brokerage at the same time like transport operations on own account, cargo consolidation and groupage service on a permanent basis or they offer long-term contractual agreements, including warehousing and value added services in logistics.

4.4 Entrepreneurial Networks: Specialized Intermediaries Economizing on Information Costs and Hierarchical Network Structures

In a series of contributions on international business issues, Casson (1990, 1993, 1997a) developed an information-based view of the economy as a system of structured information flows heavily influenced by entrepreneurial activity. For him, entrepreneurs specialized in information processing are the driving force to allocate resources properly on an international (as well as a national) scale. Free market economies backed by a legal framework of property rights as well as a moral framework of trust encourage them to intermediate effectively between factor input owners and prospective consumers based on their knowledged decision making. Doing this, they facilitate exchange of goods (and services) by enabling people to get in touch with each other, to communicate needs and wants, to explain what they want to offer, to negotiate prices and to monitor performance. To clarify his solely verbal reasoning on economic behaviour, he introduced a system of schematic diagrams as a flexible tool for comparative-static analysis, which can be also employed to survey network structures.[577] Although this approach to network structure is rather isolated and not well reflected in mainstream economic literature, it seems to be another viable starting point for a network perspective of international freight forwarding under the label "entrepreneurial networks".[578]

[577]See e.g. Casson (1993; 1997a, pp. 6-9 and 124–139, 1997c, pp. 157–162) or Casson and Cox (1997, pp. 183–189) for a general introduction.

[578]Initially, he talked about "business networks", "inter-firm networks" or "intermediated networks", see Casson (1997a, pp. 117–145) or Casson and Cox (1997). Later on, Casson (1997b,c) sticked on the term "entrepreneurial networks", which should indicate that "[i]n the aggregate, entrepreneurs may work better as a cooperative network than as a collection of competitive individualists" (Casson 1997b, p. 811).

4.4.1 Theoretical Background

Drawing on and developing further seminal work on the economy as an information system by Hayek (1937), Richardson (1960) and Marschak (1974) as well as on the nature of entrepreneurship by Knight (1921) and Schumpeter (1931), Casson (1996, 1997a,c, 1999) questioned the main lines of thought in NIE as shown in Sect. 3.1.3 to a great extent. More specifically, he felt quite uncomfortable about their overstatement of bounded rationality, information asymmetries, opportunism and asset specificity problems as well as the overall disaggregated modelling approach in TCT and PAT emphasizing too much on "the adversial use of information rather than the use of information for creative purposes" (Casson 1997a, p. v). He wanted to provide instead an integrated approach along a concept of information cost economizing behaviour with a "theory of the firm centred on the entrepreneur as the founder and the prime-mover within it" (Casson 1997a, p. 114).[579] Furthermore, he wanted to highlight the value of intermediation as a real value-adding activity, which is heavily negated by NIE, too.[580]

According to him, the information-based economy can at best be described as an information system, where handling of information flows relating to goods and services direct material flows (see e.g. Casson 1997a, pp. 3–9). Therefore, "the structure of institutions existing at any time can be interpreted as a rational response to the social needs to economize on information costs. As information costs change, so too [sic] does the institutional structure of the economy" (Casson 1997a, p. 3). Furthermore, he defined information costs as the costs of collecting, communicating, and memorizing of information as well as the costs of calculation and forming judgements required to make reasonable decisions.[581] They do not occur only in connection with actual economic transactions or agency relationships, but evolve during the whole process of decision-making in a firm like forecasting market demand, monitoring of competitors or appraising investments.[582] So he considered his information cost approach as a more general concept than TCT or PAT coping with transaction costs and/or agency costs.[583]

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[579] Following Casson (1996, p. 60, 1997a, p. 81), "[...] a firm may be defined as a specialized decision-making unit, whose function is to improve coordination by structuring infromation flow, and which is normally endowed with privileges [...]." Further, he considered (1) limited liability, (2) indefinite life and (3) favourable taxation rules as the main privileges of a firm, see Casson (1996, pp. 59–60, 1997a, pp. 80–81).

[580] According to Casson (1997a, pp. 5–6), 1999, pp. 79–80), NIE as well as the international business literature mainly emphasizes that the intermediary's role is just to organize production as the core function of a firm with raising mainly three issues: (1) The provision of technology, (2) the coordination of intermediate product flows and (3) the direction and supervision of labour involved in the underlying production process.

[581] Cf. Casson (1997c, p. 151).

[582] Cf. Casson (1997a; 1997c, pp. 151–152, 1999, p. 80).

[583] Actually, Casson (1997a, 1999, pp. 85–86) mainly stressed on the difference between information costs and transaction costs, but the same arguments hold in connection with agency costs, too.

Another important factor in his framework is the information-intensive activity conducted by intermediaries, who usually buy goods in order to resell them later, perhaps after some transformation.[584] Mark Casson called this intermediary activity "market-making" and distinguished between retailers intermediating in both physical good and information flows while market-makers in his sense intermediate only in information flows.[585] Furthermore, he added another aspect of intermediation, namely the ownership of goods, which may change many times in a free market economy. For him, taking title on goods is a means to extract rents from information accumulated in advance, because ownership on goods gives power to realize benefits from information-improved decision-making.[586] Following Casson (1997a, pp. 35–75, 1997c, pp. 155–157), these intermediaries specialized in (1) search, (2) specification, (3) negotiation, (4) completion and (5) enforcement tasks are the driving force of a sequential and localized coordination process to allocate resources efficiently. Doing this on a regular basis, they perceive not only considerable economies of scale in the actual process of intermediation but also lower transaction costs and create a chain of trust needed for successful business transactions.[587] Moreover, this intermediating activity essentially captures the spirit of entrepreneurship as formulated by Schumpeter (1931) considering innovations not only to address technological issues, but also to encompass creating new products, developing new markets and tapping new sources of supply.[588]

Expanding this theoretical framework of an information-based economy to a network perspective, Casson (1997a, pp. 117–145, 1997b, 2000c) as well as Casson and Cox (1997) considered again that physical goods flows are being coordinated by information flows. Furthermore, they considered social bonds to lower information

[584]See Casson (1997a, pp. 15–16, 1999, pp. 80–84). However, despite it is explicitly mentioned, this is again valid for the intermediation in services, too, as already shown in Sect. 3.3.

[585]Notably, he used the terms "intermediation" and "market-making" with a slightly different meaning in contradiction to the strict definitions in Sect. 3.2. But all in all, he came to the same conclusions.

[586]According to Casson (1997a, p. 16), another reason of goods ownership in this context is that by taking title on goods, "the possessor of information insures potential users of the information against the consequences of its being false." This in turn forces the possessors of the information to ensure their quality for beneficial decision-making.

[587]Cf. Casson (1997a, pp. 87–89, 1997c, pp. 155–157).

[588]See Casson (1997b, pp. 815–816, 1999, p. 81, 2000c, p. 265) referring to Schumpeter (1934) and Casson (2000b, pp. 228–235) for a more detailed discussion about contributions by Joseph Alois Schumpeter and the Austrian School to the theory of entrepreneurship in the context of international business. Notably, there seems to be a deviation between Schumpeter (1931) and Schumpeter (1934) in connection with "new markets" and "new sources" in question, because Mark Casson implied them to be found only abroad, whereas Schumpeter (1931) believed them just being other markets or sources. Further, Langen and Welters (1999) researched innovation issues in the freight transport industry and came to the conclusion, that radical innovations in transport technology (they called it "hardware") seem to be of diminishing importance. But innovation in the organization of business practice (denoted as "orgware") are needed to cope with the dynamic environment.

costs, which leads to an increased sharing of information between entrepreneurs forming entrepreneurial networks. There are two crucial components which allow to establish and maintain such network structures:

- First, there is a need for trust-worthy relationships between cooperating entrepreneurs. In this context, Casson (1997a, pp. 118–123) proposed a strict rational approach to trust: "It defines trust as a warranted belief that someone else will honour their obligations, not merely because of material incentives, but out of moral commitment, too" (Casson 1997a, p. 118). To him, trust is either generated through material incentives mechanisms backed by a legal system of property rights or it relies on emotional incentives mechanisms arising from social bonds and moral commitments.[589] As the obstacles of such moral trust mechanisms are high, they tend to work best in tightly connected social groupings with a common moral commitment like a family, church, school, university, military service, clubs, professional associations and/or political parties.[590]
- Following Casson (1997a, pp. 123–129), a second component of entrepreneurial networks is the dispersion in actual ownership of goods as well as resources employed. And as for him ownership is usually based upon competence due to better decision-making, a wide distribution of ownership implies a wide distribution of competence underpinning it. In addition to this, a relative uniformity of network members not only in terms of competence but also in terms of optimism and risk aversion support such network structures, because it reinforces trust-worthy relationships, too.[591]

Bringing these two components together, entrepreneurial networks can then be characterized as networks with high-trust relationships based on emotional incentives but subject to a diffused distribution of ownership and competence.[592] This allows again to make a topology with markets and firms being the other forms of organization along the dimensions of (1) intensity of trust and (2) distribution of ownership (including competence).[593] Moreover, the issue of intermediation can

[589]In both instance, adequate investments have to be undergone to perceive warranted trust: either establishing a quite impersonal system of monitoring and sanction enforcement or building up and maintaining social ties with other network partners based on a system of common moral beliefs, see Casson (1997a, pp. 119–120, 1997b, pp. 814–815, 2000c, pp. 258–259) or Casson and Cox (1997, pp. 177–180).

[590]Cf. Casson and Cox (1997, pp. 180–182) or Casson (2000c, pp. 262–264).

[591]Another aspect of this sort of uniformity among the participants of an entrepreneurial network is a standardized language and culture, which actually reduces communication costs, see Casson (1997c, p. 814, 2000c, p. 258) referring to Casson (1997a, pp. 26–27).

[592]Cf. Casson (1997a, pp. 123–124, 1997b, p. 815, 2000c, p. 259).

[593]Following Casson (1997a, pp. 123–124), "[t]he difference between the markets and the networks lies in the degree of trust involved, while the difference between the market and the firm lies principally in the distribution of competence instead." Further, he distinguished between high-trust firms (or clans) relying on internal networking as well as emotional incentives mechanisms and low-trust firms (or hierarchies) with material incentive mechanisms.

be easily introduced in this theoretical framework by considering intermediaries as multi-affiliated entrepreneurs in privileged positions between network members adjacent to them.[594] More specifically, they intermediate in information flows instead of integrating in ownership forward and/ or backward for the purpose of an improved physical goods flow coordination. To fulfil these promises, an intermediary first needs some superior competence *vis-à-vis* the others which allows him again a better decision-making. Furthermore, he should possess a wide-ranged personal network of high-trust relationships to often spatially dispersed individuals belonging to different social groupings as already described above, which gives him a business opportunity to mediate between them upon request.

Casson (1997b, 2000c) went a step further, considering that a special feature of entrepreneurial networks is that if there are several subnetworks of tightly connected social groupings with overlapping memberships existing, members of a higher-level subnetwork specialize in belonging to several lower-level subnetworks which leads to a hierarchical network structure. Then an intermediary being a member of a higher-level and a lower-level subnetwork at the same time can be considered as an information hub being able to mediate between different lower-level subnetworks by employing their high-trust relationships to other higher-level subnetwork members who are again members belonging to other lower-level subnetworks otherwise non-reachable.[595] Furthermore, it can be asserted that "the lower the level of the group, the greater is the focus on supporting routine operations and the stronger is the consequent incentive to channel information through a hub" (Casson 1997b, p. 821). A higher-level subnetwork of entrepreneurs, however, tend to be more democratic and collegial, reflecting the dispersion of expertise among their spatially dispersed members.

4.4.2 Applications

Only quite a few direct applications of Mark Casson's entrepreneurial network theory can be found in literature, with a focus set on research around historical international business practices and long-term developments in international trade:

- In Casson (1997a), three cases are discussed: (1) a comparison of two industrial districts – namely the Italian textile industry of the 1970s in the province of

[594] See Casson (1997a, pp. 129–130) or Casson and Cox (1997, pp. 186–189) for this and the following.

[595] Moreover, such higher-level subnetworks can play an important role in synthesizing information, too, because "it is often cheaper to get information and advice from other people [...]. "Who you know" is often more important than "what you know" because the *people* that you know can plug the gaps in *what* you know. This, of course, depends on knowing the *right* people. Sometimes the right people are those who know a lot of facts, but more often they are people simply know a lot of other people who in turn know useful facts. These people can act as brokers, linking the decision-maker who demands the information to the person who ultimately knows the facts" (Casson 2000c, p. 257).

Prato and the iron industry at Merthyr Tydfil in South Wales between 1750 and 1850 with a focus set on the important role of intermediating entrepreneurs there, (2) free-standing firms during the age of imperialism as a distinctive form of an international business enterprise and (3) a case study showing how chartered trading companies became the dominant market making firms on colonial trade routes from the seventeenth to the nineteenth century.

- Casson and Cox (1997, pp. 189–194) examined rather general strategical and operational issues connected with British international business networks in the nineteenth century.
- Casson (1998) conducted an economic analysis of multinational trading companies, where he discussed topics like the difference between market making[596] and brokerage in an international dimension and vertical integration of such companies in production, shipping, banking and/or finance.
- Casson (2000b, pp. 235–249) showed the evolution of the international business system from subsistence to global economy of today in a sequence of schematic diagrams with a focus set on the British economy.
- Popp (2000) observed clothing supply chains of a contemporary fashion market retailer and showed that intermediaries add value there by handling information.

By adapting this schematic diagram approach to entrepreneurial networks to the context of this work, a stylized model of hierarchical network structures in multimodal transport chains can be established. Players in this model are (in addition to transport middlemen TM_x, transport service providers TP_x, and logistics service providers LP_x as defined in Sect. 3.3) primary sector firms P_x, industrial sector firms I_x, distributors D_x, retailers R_x and customers C_x, situated in two countries called h (home) and f (foreign) and indicated by the subscript x. Normally, primary sector firms are suppliers of raw materials and/or intermediate goods to industrial sector firms, who process them to final products ready for distribution in both countries through domestic outbound logistic chains including some distributors, retailers and customers at the end. The resulting entrepreneurial network is shown in Fig. 4.2, where the thick lines stand for transport service providers employed in physical movement of goods between nodes, and the boxes standing for different participants handling and/or transforming goods along their way from P_x to C_x at home ($x = h$) or abroad ($x = f$). For example, if a domestic distribution of final products takes place, the goods are moved downstream from the firms of the industrial sector I_h to their distributors D_h by some domestic transport service providers TP_h as performing carriers.[597]

[596] In this contribution, Casson (1998, pp. 24–29) used the word "reseller" instead of "market maker" in order to stress on the fact that these sort of intermediaries take title on goods in order to resell them later.

[597] Notably, these performing carriers are either third-parties specialized in physical goods movement or belong to primary sector firms, industrial sector firms, distributors, retailers or customers who move their physical goods on own account.

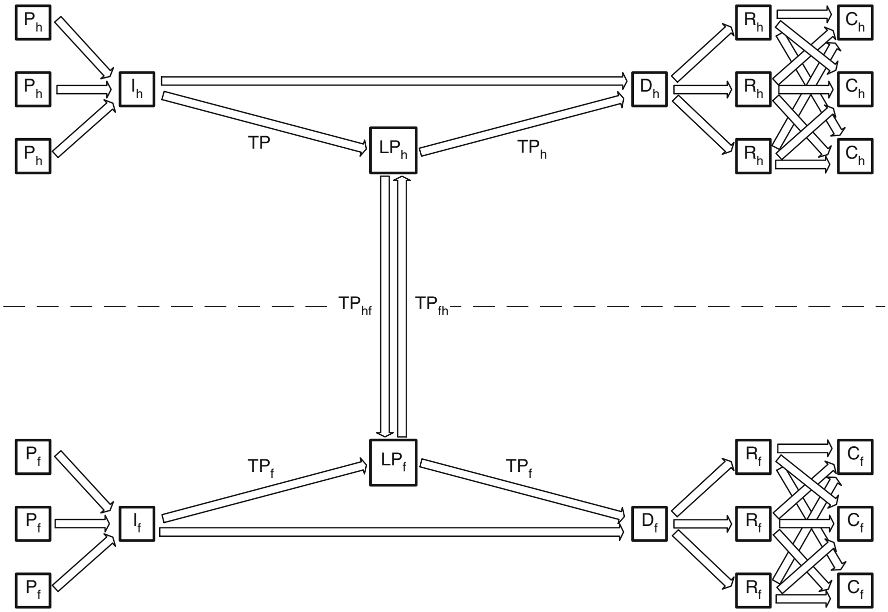

Fig. 4.2 Physical goods movements in multimodal transport chains

Due to the mostly multimodal character of cross-border good flows and the already mentioned additional problems in international transports operations, international distribution of final products is more complex. First, the logistics service providers LP_h and LP_f represent points of transhipment and/or consolidation between different modes of cross-border shipment (e.g. ocean shipping between home and abroad by TP_{hf}) and inland transportation (e.g. trucking by TP_h at home and TP_f abroad). Looking at the information flows in Fig. 4.3, a second deviation from domestic distribution patterns is quite evident: Transport middlemen are managing the cross-border transportation of physical goods by employing transport and logistics service providers for physical goods movement.[598] They can be considered as intermediaries specializing on information flows (indicated by thin single arrowed lines) between shippers, transport and logistics service providers in different countries due to some superior competence in cross-border logistical processes (e.g. documentary paperwork and customs procedures) and a higher-level entrepreneurial network with high-trust relationships to colleagues abroad (shown as thin double arrowed lines). This enables them to manage cross-border transportation of physical goods from door to door along a multimodal transport chain, which seems to be the main reason why transport middlemen, customs house

[598]Notably, all information flows at both ends of each transport operation performed by one of the many transport service provider as shown in Fig. 2.4 are omitted in Fig. 4.3. in order not to overload the diagram.

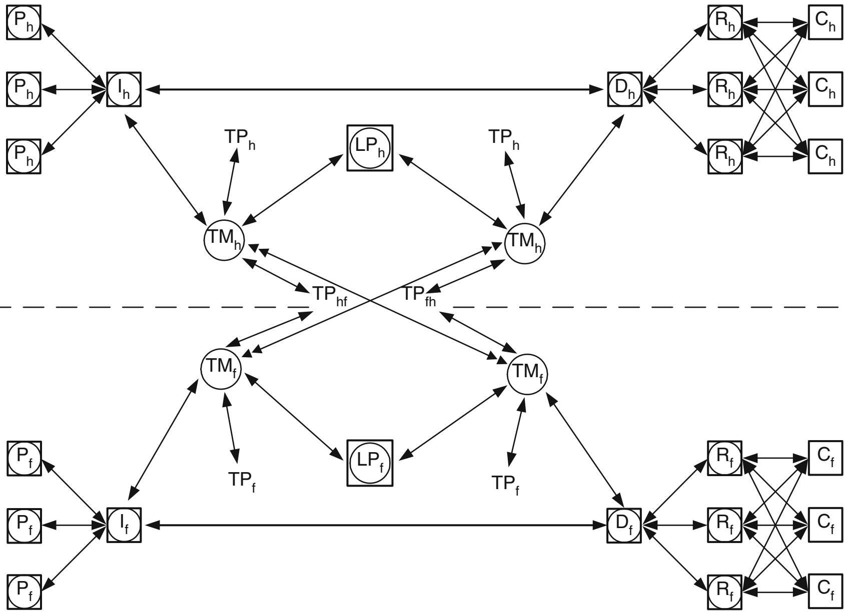

Fig. 4.3 Information flows in multimodal transport chains

brokers or NVOs as specialists and international freight forwarders as generalists are often regarded as being "the Architects of Transport" in international transport and logistic chains.

4.4.3 Critical Comments

Unfortunately, this stylized model framework cannot be quantified straight-forward, but travel trips of shipping company representatives as described by Miller (2003) and the traditional correspondence system of international freight forwarders as described by Fischer et al. (1930, pp. 310–311), Schlichting (1931, pp. 78–81), Mayer (1933, pp. 64–65), Kirchner (1950, pp. 78–86) or Fuhrmann (2000) as well as horizontal alliances of small and medium sized freight forwarders in traditional air cargo logistic chains (see Neiberger, 2007 and Sect. 2.2.4.3) strongly support such a view.

In addition to this, actual international freight forwarders' disintermediation threats can be clarified shortly. First, transport service providers on the cross-border main haul may feel able to vertically integrate forward and/or backwards in landbased operations (including at least provision of documentary paperwork, customs clearance and airline or carrier haulage on pre- and onward-carriage legs). Then they are able to offer door-to-door services directly to industrial sector firms as well as distributors, bypass other transport intermediaries and make them obsolete. At the same time, exporting industrial firms as well as importing distributors may seek to engage themselves more actively in their cross-border goods movement and attempt to organize them in-house. Then they again bypass the transport intermediaries and build up direct relationships with logistics and transport service providers at home and abroad in order to keep the physical goods moved along the logistic chain under their control. This is a viable approach for shippers with a considerable expertise in cross-border goods movements and constantly large shipment volumes like automobile manufacturers feeding assembly lines all around the world on a regular basis. In both instances, building up and maintaining relationships beyond the status quo as shown above may result in an increase of control of information flows which direct physical goods movements.

4.5 Industrial Networks: Interdependent Business Relationships Within a Network of Interrelated Actors, Activities and Resources

Starting again in the 1980s, a network view of industrial marketing and purchasing (IMP) gained considerable popularity, especially among Scandinavian researchers or other members of the IMP research group being founded in the mid 1970s to conduct a series of cross-country empirical studies on industrial markets. According to Easton (1992, p. 3), this industrial network approach

> "[...] shares with other approaches a belief that the existence of relationships, many of them stable and durable, among firms engaged in economic exchange provides a compelling reason for using inter-organizational relationships as a research perspective. It differs from other approaches mainly in terms of its scope. It is concerned to understand the totality of relationships among firms engaged in production, distribution and the use of goods and services in what might best be described as an industrial system."

4.5.1 Theoretical Background

Following Johanson and Mattsson (1988), Easton (1992) or Mattsson (1995), the antecedents of this network approach lie in (1) US-American marketing channels research as already briefly discussed in Sect. 2.2.1, (2) internationalization process theories of industrial firms as developed e.g. by the Uppsala School and (3) a series of empirical studies on interaction and relationships in industrial markets conducted in the late 1970s.[599] Probably the most direct predecessor is the last mentioned

[599] See e.g. Hertz (1993, pp. 33–63) for a thoroughly discussion.

"interaction approach" initiated by the first IMP research project, where a group of European researchers joined together in the IMP research group developing a dynamic model of buyer–supplier relationships in industrial markets (the interaction model) and illustrating its applicability through comparative studies of buyer–supplier relationships within and across a number of European countries (namely France, Germany, Italy, Sweden, and the United Kingdom).[600] The main conclusion of these initial pan-European studies was that buying and selling of goods and services in industrial markets could not be understood as a series of isolated and serially independent market transactions. Instead, these transactions should only be examined as episodes in often long-lasting, complex, relatively balanced and quite informal business relationships between them.[601]

Shortly after these initial empirical studies focusing on buyer–seller relationships, researchers of the second IMP research project began to explore the implications of such strong and stable inter-organizational relationships for the network structure of industrial markets in general.[602] Whereas markets were traditionally regarded as being either totally frictionless (NCE) or burdened with some transaction and agency costs (NIE), empirical evidence from the first IMP project demanded a new treatment of industrial market settings. Constantly referring to the notion by Cook and Emerson (1978) that networks can be defined as sets of connected exchange relationships, industrial markets were considered as networks of heavily interdependent business relationships.[603] According to this "markets-as-networks" approach, market coordination takes place through ongoing mutually oriented interaction between reciprocally committed counterparts closely interrelated with third parties or other business relationships.[604]

More specifically, each business relationship between two actors in an industrial network can be described along two dimensions, namely their (1) layers of substance and (2) levels of function. The first dimension characterizes present business

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[600] See e.g. Johanson and Mattsson (1988, pp. 288–290) or Ford and Håkansson (2006) for a brief overview, the findings of this IMP research project are well documented in Håkansson (1982) or Turnbull and Valla (1986).

[601] Cf. Håkansson and Snehota (1995, pp. 7–8).

[602] See Hägg and Johanson (1982) or Hammarkvist et al. (1982) for early treatments, followed by Axelsson and Easton (1992) or Håkansson and Snehota (1995) presenting the findings of this second IMP project.

[603] Cf. Johanson and Mattson (1992, p. 209) or Axelsson (1992, p. 239) or Håkansson and Johanson (1993, p. 32). Notably, in this work Emerson and Cook (1978) is associated with network exchange theory (NET) as an extension of social exchange theory (SET) to a network level, see Sect. 4.6.1.3.

[604] Cf. Håkansson and Snehota (1995, pp. 25–26). According to Håkansson and Snehota (1995, pp. 9–18), four interaction process characteristics (adaption, cooperation and conflict, social interaction and routinization) and at least five contexts of relationship interdependencies (available technologies, accumulated knowledge, social relations, administrative and systems as well as legal ties) were prevalent. Further, see Easton and Araujo (1994) for a similar description along the social and temporal context of market exchanges.

relationships as an entity of activity links, resource ties and actor bonds representing three layers of substance (Håkansson and Snehota (1995, pp. 26–27)[605]:

- "*Activity links* regard technical, administrative, commercial and other activities of a company that can be connected in different ways to those of another company as a relationship develops.
- *Resource ties* connect various resource elements (technological, material, knowledge resources and other intangibles) of two companies. Resource ties result from how the relationship has developed and represents in itself a resource for a company.
- *Actor bonds* connect actors and influence how the two actors perceive each other and form their identities in relation to each other. Bonds become established in interaction and reflect the interaction process."

As a consequence, an industrial network consists not only of actors and their mutual business relationships, but also of changing activities employing resources and bonds reflecting an endless chain of interaction. The second dimension goes a step further and describes more far reaching impacts of such business relationships: As an industrial network is considered to be heavily interdependent by nature, they probably affect and are affected by third parties or other business relationships. Therefore, Håkansson and Snehota (1995, pp. 27–28) distinguished at least three different, but closely interwoven functions of business relationships:

- "*Function for the dyad*: This originates in the conjunction of the two companies; their activities, resources and actors. Activity links, resource ties and actor bonds in a relationship integrate various elements and thereby some unique outcomes and effects are produced.
- *Function for the individual company*: A relationship has effects on each of the companies, on what it can do internally and in other relationships. These depend on how what is produced in the dyad can be connected to other internal elements of the company and its other relationships.
- *Function for third parties*: Being a building element in the larger network structure, what is produced in a relationship can affect and is affected by other relationships that involve other parties. The effects on third parties and from third parties and their relationships on the relationship in any of the three layers of substance depend on how tight the connectedness of relationships is in the overall network."

Furthermore, these three levels of business relationship functions allow three different levels of analysis: (1) companies, single actors or other forms of organizations engaged in one or more business relationships, (2) the dyads resulting from

[605]See Håkansson and Snehota (1995, pp. 24–49) for this and the following. Other, much shorter overviews of this "markets-as-networks" approach can be found e.g. in Johanson and Mattsson (1987, pp. 34–41, 1988, pp. 448–453), Easton (1992, pp. 8–16), Håkansson and Johanson (1992, 1993) or Mattsson (1995, pp. 206–209).

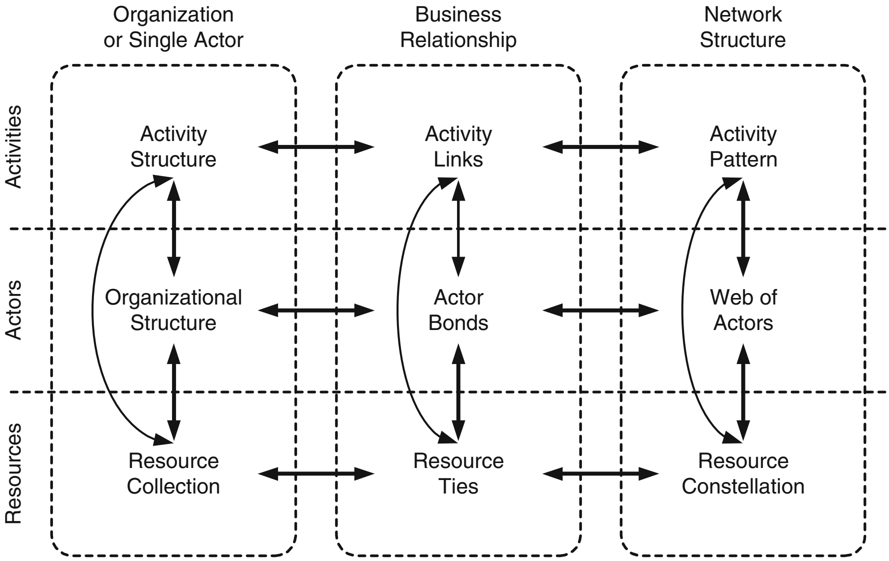

Fig. 4.4 Analytical scheme for industrial networks
(Source: adapted from Håkansson and Snehota 1995, pp. 43–45)

establishing such business relationships and (3) their impacts on third parties (and vice versa) forming a network structure.[606] Putting then both dimensions together, a conceptual framework for industrial network research emerges in form of a broad analytical scheme as shown in Fig. 4.4. There are three different levels of analysis (organization or single actor, business relationship and network structure) with each level having three layers of substance (actors, activities and resources). As indicated by bidirectional arrows, all these elements are considered to be connected by mutual interdependencies.

Following Håkansson and Snehota (1995, pp. 44–46), this broad analytical scheme can be used either "as a conceptual framework to analyse the effects of change in a relationship and/or identify the factors that effect the possibilities of development of a relationship" or "as a heuristic device in coping with relationships in business." But looking at Fig. 4.4, it is quite evident that other perspectives than "networks as relationships" (Easton 1992, p. 8) can be developed out of this conceptual framework. Especially Easton (1992, pp. 16–25) proposed "networks as structures," "networks as position" and "networks as process" to be three

[606]Notably, Håkansson and Snehota (1995) defined "company", "relationship" and "network" to be the levels of analysis. But for sake of internal consistency of this work, these levels of analysis were renamed in "organizations or single actors", "business relationships" and "network structure" without alternating their theoretical content.

alternative points of view arising from this industrial network approach apart from the relationship perspective as the most important one:

- *Networks as structures*: As the elements of an industrial market system are interdependent rather than independent, they sum up to a network structure, which can be described along measures like structuredness (or general level of interdependency among actors and their relationships), homogeneity (the similarity of actors and their relative importance) and exclusiveness (the extent to which the actors in focus hold relationships to other networks outside).[607]
- *Networks as position*: Focusing on an organization or a single actor as elements inside an industrial network structure, their position can be defined as a result of past and present activities both by them and by others.[608] In this context, several concepts of position were proposed e.g. by Johanson and Mattsson (1988).[609]
- *Networks as process*: First, as long as industrial networks are considered to be stable but not static, an ever ongoing evolutionary process of interaction shapes them over time, which is worth to be observed more closely. Second, coordination processes taking place in industrial networks can be conceived as being effected by three classes of mechanisms, namely market, hierarchies and networks with the last considered to be a specific heterarchical governance structure influenced by a balance between cooperative and competitive elements.[610]

4.5.2 Applications

Although this network approach was initially dedicated to industrial markets mainly dominated by manufacturing companies, there are indeed some contributions with a focus on transport and/or logistics topics, which will be discussed briefly in the following.

Hertz (1993, 1996a,b) first employed the industrial network approach to develop a dynamic network model of internationalization in the transport industry based on a series of event studies tracking the internationalization processes of three large Swedish freight forwarding companies and their resulting transport network

[607] See Johanson and Mattsson (1988, pp. 294–294) or Easton (1992, pp. 16–19) referring to an earlier work by Mattsson (1986).

[608] Cf. Johansson and Mattsson (1988, pp. 292–295, 1992, pp. 211–214) or Easton (1992, pp. 19–21).

[609] More specifically, Johansson and Mattsson (1988, p. 293) distinguished two types of positions: "A micro-position is characterised by: (1) the role the firm has for the other firm; (2) its importance to the other firm; and (3) the strength of the relationship with the other firm. A macro-position is characterised by: (1) the identity of the other firm with which the firm has direct relationships and indirect relations in the network; (2) the role of the firm in the network; (3) the importance of the firm in the network; and (4) the strength of the relationships with other firms."

[610] Cf. Easton (1992, pp. 21–25), Axelsson (1992, pp. 239–242), Håkansson and Johanson (1993, pp. 44–49) or Håkansson and Snehota (1995, pp. 19–21).

transformation over a period of almost fifty years. Her study showed typical patterns of internationalization in the freight forwarding industry and complications occurring in connection with the adoption of their transport systems after cross-border expansion of operations.

Furthermore, in this already in Sect. 3.1.3.1 mentioned treatment of freight forwarder transport networks, Stahl (1995a, pp. 122–134) discussed the industrial network approach as an additional theoretical background for his purely transaction cost-driven treatment of organizational governance. For him, the main reasons not to follow fully this industrial network perspective was, that he wanted to generate and prove hypotheses by an empirical survey but not conducting a longitudinal study of strategic alliance formation.

It was then Ludvigsen (2000), who underwent a longitudinal case study about a Nordic freight forwarder network called the E-1 Alliance from the early beginnings as an Inter-Nordic logistic alliance to an expansion of their operations on the European continent in order to derive a verified model of alliance evolution based on industrial network methodology.

Recently, Skjøtt-Larsen (1999a,b), Mattsson (2003), Halldórsson et al. (2004, 2005, 2007) as well as Gadde and Hulthén (2009) discussed the applicability of the industrial network approach for third-party logistics outsourcing and/or supply chain management treatments. The main conclusions of them were, that it is useful especially when the focus of investigation is set on the social context and dynamic aspects of long-term relationships.

4.5.3 Concluding Comments

The industrial networks approach first contrasts sharply with other more economic views of business relationships in network structures as shown up to now, especially those that regard such inter-organizational relationships as formal cooperative agreements for a competitive advantage like in the strategic or dynamic network approach. Indeed, it shares some concerns with Williamsonian TCE (e.g. most of the basic assumptions and what accounts for the existence of different governance structures), but rejects its comparative-static framework methodology, as well as the assumption of ever present actor opportunism.[611] Furthermore, the concrete contractual form of business relationships is regarded to be of less importance, because they are not considered to be a series of rather isolated transactions being either market-related or hierarchically structured but emerge through an ongoing interaction process of establishing, maintaining and terminating them as a governance mode of its own with boundaries between individual organizations tending to be rather unclear. Moreover, different levels of analysis (including

[611] See especially Johanson and Mattsson (1987, pp. 43–46), Easton and Araujo (1994), Håkansson and Snehota (1995, pp. 379–381) or Skjøtt-Larsen (1999a, 1999b, 2000) for this and the following.

different perspectives for actors, dyadic relationships, networks and the ongoing development process) are possible, whereas in TCE solely a pure relationship perspective is offered. Taking all the intellectual roots and ancedents of the industrial networks approach as shown above into consideration, Easton and Araujo (1994, p. 82), drew the conclusion that

> "[i]ts positioning is half-way between economics and sociology. [...] It is concerned with how different types of actors transform, consume, create and use economic resources in industrial systems and is prepared to formulate complex models of micro-behaviour taking into account insights generated by sociological theory."

4.6 Social Networks: Network Structure, Positions and Relationships

After exploring diverse economic arguments of network structure, this last section is about *social networks* of economic action. The idea, that social phenomena can be interpreted as networks of relations has been recurrent since Georg Simmel's *formal sociology* and his studies of relations between actors in triads and dyads in Simmel (1908).[612] In the following, researchers originating from various disciplines in the social sciences, including psychology, sociology, polity, anthropology and (to some extent) economics were attracted to conduct research on social networks and their contributions summed up to an exorbitant bulk of literature about this truly multi-disciplinary approach to network structures.[613] But it took until a break-through article by Granovetter (1985), promoting a new approach to economic sociology to overcome an inherent oversocialized view of economic action common to most works of sociologists, anthropologists, political scientists and historians in this field.[614] After heavy criticism of both over- and undersocialized conceptions of man in sociology and economics neglecting ongoing structures of social relations, he suggested an embeddedness concept of economic action.[615] This paper was a starting point for intensive research efforts under the label of *New Economic Sociology* (NES) centred around the issue of embeddedness of actors in social network structures and social capital as the value of connections therein.[616] In the following, this theoretical core of NES is briefly discussed, before two alternative

[612]Cf. Schenk (1984, pp. 12–17) or Freeman (2004, pp. 10–30) for a more elaborate discussion.

[613]See Sect. 5.1 for more details.

[614]Cf. Wrong (1961), Coleman (1988), Swedberg (1991), Smelser and Swedberg (1994).

[615]More specifically, Granovetter (1985, p. 485) considered that "both have in common a conception of action and decision carried out by atomized actors; in the undersocialized account, atomization results from narrow utilitarian pursuit of self-interest; in the oversocialized one, from the fact that behavioral patterns have been internalized and ongoing social relations thus have only peripherial effects on behavior."

[616]Cf. Swedberg (1991, 1997) or Borgatti and Foster (2003).

analytical approaches to social network structures are shown and some applications from the field of transport and logistics are presented.

4.6.1 Theoretical Background

As already indicated above, NES offers (1) a new sociological way to think about economic action taking place within a network of social relations (the issue of embeddedness) and (2) the sum of these social relations itself is valuable (the issue of social capital). Both offer a theoretical background to catch the inherent structure of social networks.

4.6.1.1 Embeddedness and Social Capital

Granovetter's (1985, p. 487) initial arguments about embeddedness were that "[a]ctors do not behave or decide as atoms outside a social context, nor do they adhere slavishly to a script written for them by the particular intersection of social categories that they happen to occupy. Their attempts at purposive action are instead embedded in concrete, ongoing systems of social relations." In Granovetter (1992, p. 33) he put this issue of embeddedness further as he referred it "to the fact that economic action and outcomes, like all social action and outcomes, are affected by actors' dyadic (pairwise) relations *and* by the structure of the overall network of relations. As a shorthand, I will refer to these as the relational and the structural aspects of embeddedness."

Furthermore, Zukin and DiMaggio (1990, pp. 15–20) argued that apart from Mark Granovetter's "relational" and "structural embeddedness" there is a cognitive, cultural and political dimension to be considered, too. For them, *cognitive embeddedness* refers to "the ways in which the structured regularities of mental processes limit the exercise of economic reasoning," a limited ability of actors well-known in the field in NIE under notion of bounded rationality. *Cultural embeddedness* is then considered to show "the role of shared collective understandings in shaping economic strategies and goals."[617] Finally, by *political embeddedness* they meant "the manner in which economic institutions and decisions are shaped by a struggle

[617]Zukin and DiMaggio (1990, p. 17) went into more detail when explaining how economic behavior is culturally embedded: "Culture sets limits to economic rationality: it proscribes or limits market exchange in sacred objects and relations [...] or between ritually classified groups. Moreover, [...] culture may shape terms of trade. [...] Culture, in the form of beliefs and ideologies, taken for granted assumptions, or formal rule systems, also prescribes strategies of self-interested action [...] and defines the actors who may legitimately engage in them. [...] Culture provides scripts for applying different strategies to different classes of exchange. Finally, norms and constitutive understandings regulate market exchange". Further see Dequech (2003) for a closer look at cognitive and cultural embeddedness considering them to be intertwined.

for power that involves economic actors and nonmarket institutions," such as the legal framework of the state. Common to these three aspects of embeddedness introduced by them is that they capture the social environment and not the network structure so that they are not too useful at the moment.[618]

The other stream of literature in the field of NES copes with the value of connections itself in a social network structure, called "social capital". Although this term was mentioned several times before,[619] the first systematic contemporary analysis can be dated back to Bourdieu (1980, 1983, 1985), where he distinguished three forms, namely economic, cultural and social capital.[620] For him, social capital is "[...] the aggregate of actual or potential resources which come along with the possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (Bourdieu 1985, p. 248) as cited by Portes 1998, p. 3). Alternatively, it can be regarded as resources which determine membership to a certain group (Bourdieu Bourdieu, 1983, pp. 192–193).

In another well cited formulation, Coleman (1988, p. S98) distinguished social capital from physical and human capital and defined it rather vague by its function: "It is not a single entity but a variety of different entities, with two elements in common: they all consist of some aspect of social structures, and they facilitate certain actions of actors - whether persons or corporate actors – within the structure. Like other forms of capital, social capital is productive, making possible the achievement of certain ends that in its absence would not be possible. [...] Unlike other forms of capital, social capital inheres in the structure of relations between actors and among actors." Therefore, social capital can be considered as a useful resource for individuals, like thrustworthiness in the social environment, existence of information channels or effective norms in communities.

Whereas Bourdieu (1980, 1983, 1985) regarded social capital as a resource resulting from relationships forming a social structure and Coleman (1988) defined it as a function of social structure and a resource for actions, Burt (1992, 1997, 1998, 2000) focused on the network structure effect of social capital in offering opportunities.[621] He considered financial and human capital to be distinct in from social capital two ways: (1) they are the property of individuals as they are owned in whole or in parts by them and (2) they get invested to create opportunities. Therefore, he sees social capital as "[...] friends, colleagues, and more general contacts through whom you receive opportunities to use your financial and human capital" (Burt, 1992, p. 9). Later on, he asserted that "[s]ocial capital is the contextual complement to human capital. The social capital metaphor is that the people who do better are somehow better connected. Certain people or certain

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[618]Cf. Uzzi (1996, 1997).

[619]See e.g. Woolcock (1998, p. 155) or Anderson and Jack (2002, pp. 194–195).

[620]The initial treatment by Bourdieu (1980) was in French, the second (Bourdieu, 1983) in German and the third (Bourdieu, 1985) in English, which was concealed in the pages of a text on the sociology of education, as Portes (1998, p. 3) noted.

[621]Cf. Walker et al. (1997, p. 109–112) or Burt (2000, pp. 348–349).

groups are connected to certain others, trusting certain others, obligated to support certain others, depend on exchange with certain others. Holding a certain position in the structure of these exchanges can be an asset in its own right" (Burt, 2000, p. 347).

Although these three approaches to social capital are different at first sight, they have much in common: All emphasize its highly intangible character (in comparison to other forms of capital) and its value as a collective or group-level phenomenon identifying an informal social context that constrains and influences the behaviour of individuals.[622]

4.6.1.2 Social Network Structures

After discussing the basic notions of embeddedness of actors and their social capital, the focus switched on the structure of social networks surrounding them. Already before Granovetter (1985), initial works emerged during the 1970s and 1980s, as a group of sociologists around Harrison White (including him) got heavily interested in topics of economic sociology from a network point of view.[623] In the following, two distinct streams of argumentation appeared concerning the importance of ties between actors: one about the strength of weak ties by Granovetter (1973, 1982) and Burt (1982, 1997, 1998) and the other by Coleman (1988, 1990) and Krackhardt (1992) emphasizing the strength of strong ties.

Granovetter (1973, 1982) explained the importance of weak ties in bridging subgroups (weak tie argument). For him, the strength of a tie can be defined as "a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie" (Granovetter 1973, p. 1361). His argument is shortly as follows: Acquaintances with weak ties are less likely being socially involved with one another than close friends with strong ties.[624] As the degree of overlap of two individual's friendship networks varies directly with the strength of their ties to one another, a weak tie between them is valuable, because its a bridge between both friendship networks.

Burt (1992, 1997, 1998) refined this weak tie argument of Granovetter (1973, 1982) and showed the benefits of bridging ties from the average strength of these ties leading to a structural view of social capital. There, social capital is regarded as a function of the information and control advantages of an actor who stands in

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[622]See e.g. Lin (1999), Paldam (2000), Adler and Kwon (2002), Li (2007) or Lee (2009) for this and other facets of social capital not addressed in this work.

[623]Examples are Granovetter (1973) analyzing the role that information networks play when people get jobs, Baker (1984) analyzing buyers and sellers in a national securities market or Mintz and Schwartz (1985) as well as Palmer (1983) conducting studies on interlocking directorates.

[624]Or more precisely described in the words of Granovetter (1982, p. 105):"[T]he set of people made up of any individual and his or her aquaintances will constitute a low-density network (one in which many of the possible relational lines are absent), whereas the set consisting of the same individual and his or her *close* friends will be densely knit (many of the same possible lines present)."

between otherwise unconnected actors, which gives him the opportunity to exploit this "structural hole".[625] Furthermore, Burt (2000, p. 353) noted, that it is "an opportunity to broker the flow of *information* between people, and *control* the form of projects that bring together people from the opposite side of the hole."[626]

Coleman (1988, 1990) extensive personal bonds (strong tie argument), as it is derived from a theory of rational action leads to a relational view of social capital, where it is a function of the inseity and extensiveness of personal bonds among actors. In this perspective, strong ties among actors, intense relationships characterized by mutual trust, a sense of obligation, common norms and expectations create social capital on which the respective actor can draw.[627] Finally, employing Granovetter (1973) definition for tie strength, Krackhardt (1992) explored the affective character of strong ties playing an important role especially in cases of severe change and uncertainty.

To end this discussion which form of tie (strong or weak) might be more important for the formation of social capital, some authors like Täube (2002, pp. 72–74, 2004) offered a rather Solomonian way out. To him, there are simply two distinct sorts of social capital: (1) strong ties generate *support capital* and (2) weak ties as well as structural holes offer *leverage capital*.[628] This distinction is in line with Adler and Kwon (2002) identifying three different views of social capital: (1) *bonding, internal capital* focusing on collective actors' internal characteristics (Coleman, 1988, 1990), (2) *bridging, external capital* of external linkages of focal actor as well as (3) a neutral view of social capital in respect of this external/internal dimension. Moreover, they recommend further research to address both external and internal dimension simultaneously.[629]

All these findings about embeddedness and formation of social capital so far were derived from personal to intra-organizational settings. But they can be easily extended to an inter-organizational context if entrepreneurial activity is observed in a market environment:

- Podolny (1994, 2001) explored ways of organizations to overcome market uncertainty. Podolny (1994) found support for the strong tie argument in investment banking because with increasing market uncertainty, they engage in exchange

[625] Cf. Burt (1997, 1998) or Ebers (2001).

[626] Therefore, the benefits of such a brokerage role are – apart from simply exploiting its power of control – having access to information beyond one can process alone, getting information early and obtaining referrals to get own interests in a positive light at right time and place, see Burt (1998).

[627] Cf. Coleman (1990) or Ebers (2001).

[628] Following Täube (2004, p. 34), "[*s*]*upport capital* is typically generated in informal groups with dense relations that are the result of a high frequency of interaction between socially similar persons. [...] *Leverage capital* comes into existence when an increasing differentiation of a group (as a result of its size) leads to growing distances with less frequent interactions between some of the group members. With widening gaps between smaller groups of high internal density, structural holes [...] come into existence allowing actors that bridge such gaps to exploit weaker relations for their own sake."

[629] Cf. Adler and Kwon (2002, p. 35).

relations with those they have transacted in the past and with those of similar status. In Podolny (2001) an analytical distinction between two types of market uncertainty was drawn: ego-centric, which refers to a focal actor's uncertainty regarding market opportunities and the set of resource allocation decisions that will best enable him to realize these opportunities, and alter-centric, which denotes the uncertainty confronted by his (her) exchange partners regarding the quality of him (her). Observing venture capital markets, he found out that the value of structural holes increases with ego-centric uncertainty, but not with alter-centric uncertainty. In contrast, the value of status increases with alter-centric uncertainty, but declines with ego-centric uncertainty.

- Uzzi (1996, 1997) observed how embeddedness and network structure affects economic action in New York's apparel industry. His findings suggest that embeddedness is a logic of exchange, that promotes economies of time, integrative agreements, allocative efficiency, and complex adaption. These positive effects rise up to a threshold, however, after which embeddedness can reduce economic performance by making entrepreneurs vulnerable to exogenous shocks or insulting them from information that exists beyond their network. Therefore, both sorts of social capital are important.
- Walker et al. (1997) tested empirically whether social capital (as outlined by Bourdieu (1980, 1983, 1985) or Coleman, 1988, 1990) or Burt (1992) structural holes are more important in the formation of relational networks in high growth technology-intensive industries, taking intercompany collaboration of biotechnology firms as an example. Their analysis showed clearly that network formation is significantly influenced by the development and maintenance of social capital and not by opportunities for entrepreneurs exploiting structural holes which in turn may be applicable more to networks of market transactions.
- Fafchamps and Minten (1999) documented the role that personal relationships play in economic exchange while observing agricultural traders in Madagascar. While regularity of supply and demand and the sharing of risk appeared to be of particular importance, larger and more prosperous traders were those with qualitatively better relationships and family ties played little role in business beyond of assistance at start-up.
- Rangan (2000a,b) showed that social networks are most significant in those spheres of activity, where search (or identifying potential exchange partners) and deliberation (assessing their quality and intension to deal honestly) are important but problematic. If potential exchange partners are spatially dispersed and when the object of the exchange does not trade at high margins or in high volumes then social networks will tend to matter in the search process as entrepreneurs embedded in a broad social network are better positioned to discover them. Furthermore, in situations where uncertainty coupled with large downside risk which cannot be cost-effectively levied by insurance, deterrence, prediction or internalization, social networks will tend to matter, too. Examining speed and elasticity with which US-American imports respond to the US-dollar's real exchange rate and comparing US-American multinationals with industry

average, he found support for both of his social network explanations about search and deliberation.

- Anderson and Jack (2002) and Jack and Anderson (2002) discussed the effects of embeddedness on the entrepreneurial process or, better said, whether the nature of social capital is a glue to form network structures or a lubricant that facilitates the operation of networks. Backed by a considerable number of ethnographs, they found social capital not to be a thing but a process that creates a condition of social capital with both aspects as dimensions of this process. Moreover, they discovered that there exist successful etiquettes of social capital formation, shared values or paradigms that allow a common understanding of appropriate ways of interacting which can be regarded as a third, cognitive dimension of social capital.[630]
- Liao and Welsch (2003) investigated entrepreneurial growth aspiration of US-American business start-ups. Their results suggested that technology-based entrepreneurs benefit more from relational embeddedness coming along with freer and greater exchange of non-redundant information which supports Coleman (1988, 1990) strong tie arguments. In contrary, non-technology-based entrepreneurs benefit more from structural embeddedness or the extensiveness of their social networks consistent with Burt (1992, 1997, 1998) structural holes and Granovetter (1985) weak tie arguments. Therefore, support or bonding capital as well as leverage or bridging capital provide certain benefits, which depend on entrepreneurs' suitable growth strategies.

Common to all of these studies (and many more not explicitly stated above) is, that they showed clearly, in which way the issues of embeddedness and social capital are not only programmatic statements but contribute to a better understanding of entrepreneurship in different market environment settings.

4.6.1.3 Analytical Concepts

As already indicated above, in this wide field of research on social capital and embeddedness issues in social networks at least two methodologically distinct streams of analytical approaches can be identified, namely (1) social network analysis (SNA) and (2) network exchange theory (NET).[631]

First, since Moreno (1934, 1953) initial efforts in the structural analysis of groups, an ever increasing body of mathematical calculus was employed to describe sets of actors and their relationships between them forming a social network structure in very different contexts. Whereas early rather descriptive treatments of social networks like the famous Hawthorne Studies (see Roethlisberger and Dickson, 1939 and Homans, 1950) or diverse field studies in social anthropology

[630] See Anderson and Jack (2002) referring to Nahapiet and Ghoshal (1998).

[631] Cf. Cook (1982), Cook and Whitmeyer (1992) or Hirsch-Kreinsen (2002, p. 107).

from African communities to next door neighbourhood relations in European cities (see Barnes, 1954; Bott, 1957; Gluckman, 1955 or Mitchell, 1969) rested simply on graph theoretic expressions and aggregated measures of social network structure by counting actors and relationships, the information processing revolution enabled researchers to apply more sophisticated mathematical methods based on matrix algebra to analyse social network structures empirically.[632] According to Wellman (1988, p. 47),

> "[s]tructural analysis has become self-conscious and organized. Intellectually, it has moved from a minimalist position, where 'network analysis' was seen as a useful supplementary method, to a maximalist, paradigmatic position, where its central concept – that all social phenomena are best studied through methods designed to uncover basic social structure – is seen as an important new approach to social inquiry. In addition to its critiques of other sociological approaches, structural analysis has now developed a coherent set of characteristics and principles backed by a sizeable body of empirical work."

Recently, Freeman (2004, p. 3) regarded modern social network analysis to be "an organized paradigm for research" with a strong commitment in four features, which together define the field: It is (1) motivated by a structural intuition based on ties linking actors, (2) grounded in systematic empirical data, (3) drawing heavily on graphic imagery and (4) relying on the use of mathematical and/or computational models.

Second, authors like Richard M. Emerson, Karen S. Cook, Toshio Yamagishi, James S. Coleman, Peter V. Marsden, David Willer or Barry Markovsky extended social exchange theory (SET) based on merely micro-sociological works from Thibaut and Kelley (1959), Homans (1961), Emerson (1962) or Blau (1964) to a network level.[633] Following Cook and Whitmeyer (1992, p. 110), these authors

> "[...] advance[d] a basic image of social structure as a configuration of social relations among actors (both individual and corporate), where these relations involve the exchange of valued items (which can be material, informational symbolic, etc.). Exchange theory increasingly has involved explicit consideration of social structure, as both product and constraint, typically in the form of networks of social relations."

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[632] See Sect. 5.1 or merely methodological contributions like Mitchell (1974), Kähler (1975), Shulman (1976), Burt (1980a, 1982), Lincoln (1982), Knoke and Kuklinski (1982), Schenk (1984), Weiman (1989), Marsden (1990), Scott (1991), Wasserman and Faust (1994), Diaz-Bone (1997) or Jansen (2003).

[633] See overviews by Cook (1982), Cook and Whitmeyer (1992), Willer (1992), Sydow (1993, pp. 193–199), Yamaguchi (1996, pp. 308–322) or Jansen (2003, pp. 163–181) for further details. Following them, there are at least three schools of thought to distinguish: (1) the power-dependence theory stream originated in the works of Emerson (1962, 1972a,b) with a series of insightful laboratory experiments like Stolte and Emerson (1977), Cook and Emerson (1978), Cook et al. (1983), Yamagishi et al. (1988), Cook and Yamagishi (1992), (2) the exchange theory of purposive action as first formulated by Coleman (1972, 1973) and further extended by Marsden (1981, 1982, 1983) in order to observe brokerage behavior in networks with restricted access, and (3) a merely graph-analytic approach with contributions like Markovsky et al. (1993, 1988), Patton and Willer (1990), Lovaglia et al. (1995) or Willer (1999, 2003).

As already indicated in Sect. 4.5.3, the NET approach to social network structure has much in common with the industrial network approach with the notable exception that not only actors and their relationships between them are of importance, but also activities by them as well as resources employed.[634] Both SNA and NET conceptualize social network structures as a configuration of social relationships and actor positions, but their treatments are very different[635]:

- Being deeply rooted in the SET tradition of modelling social exchange, NET is much more theory-driven than the mostly empirical-driven SNA just attempting to analyse observed structures of social networks.
- Whereas NET considers per definition only mutual relationships of social exchange, SNA principally allows to analyse all kind of mutual as well as asymmetric communication, information, negotiation, financial or goods flows as relationships in a given network structure.
- While NET considers all relevant exchange relationships in a social network to be of interest (including potentially available exchange alternatives), SNA takes only actually realized connections into consideration.
- NET draws a distinction between positive (cooperative, conditional non-exclusive or substitutable), negative (competitive, conditional exclusive or complementary) and mixed connected social network structures, whereas in SNA, there are no such special conditions laid on the configuration of relationships between actors.[636]

To sum up, it can be concluded that SNA and NET are complement approaches to assess social networks structures: While the first just analyses observable network structures of actors and their relationships as a whole, the latter focuses more on relationships of social exchange between the actors therein. Or in other words: whereas NET focuses on relational embeddedness, SNA deals more with structural embeddedness issues of social networks.

4.6.2 Applications

Until recently, only quite a few works making use of social network theory in the field of transport and logistics could be identified like Cisic et al. (2000a,b) exploring flows of documentary paperwork in maritime transport chains or Carter et al. (2007a) surveying the relationships of participants in a cross-functional

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[634]Cf. Easton (1992, pp. 5–6), Axelsson (1992, pp. 239–240), Håkansson and Johanson (1993, pp. 35–36), Araujo and Easton (1996, pp. 99–102) and Batt (2008, pp. 488–489).

[635]Cf. Cook (1982), Cook et al. (1983, pp. 275–279), Cook and Whitmeyer (1992) or Weyer (2000, pp. 14–18).

[636]Notably, this has a decisive impact on the identification of the most powerful or prominent actor in a social network structure, see e.g. Cook et al. (1983), Bonacich (1987), Yamagishi et al. (1988), Yamaguchi (1996) or Mizruchi and Potts (1998).

environmental and safety initiative of a high-technology firm. Furthermore, contributions employing citation analysis (Carter et al., 2007b; Phillips and Phillips, 1998) or author collaboration studies (Autry and Griffis, 2005) as classical applications of SNA can be mentioned, where a network structure of journals, authors or their affiliation as actors and their relationships, denoted as citations or coauthoring are surveyed in a social network context. However, considering that supply chains are in fact supply networks (Lamming et al., 2000 or Harland et al., 2001), authors like Omta et al. (2001), Lazzarini et al. (2001), Choi et al. (2001) promoted social network analysis in their rather programmatic statements to overcome an overall present myopic view in supply chain management research focusing mostly on single relationships and dyads. This resulted in a steadily increasing stream of contributions importing concepts from SNA to the supply chain management domain, as noted e.g. by Carter et al. (2007a) or Borgatti and Li (2009).

4.6.3 Concluding Comments

To conclude this section, (1) a well grounded sociological theory about personal interaction, weak and strong ties, structural holes, social capital and embeddedness issues offers opportunities to explore network structures from a sociological point of view and (2) social network analysis as well as network exchange theory allows to explore and/or quantify relationships of actors in social network structures.

During the last two decades, NES got popular across multiple research disciplines so that authors like Paldam (2000), Adler and Kwon (2002) or Batt (2008) even suggested that social capital should get a "broad umbrella concept" for all social sciences. Accordingly, Richter and Furubotn (2003, pp. 209–210), Richter (2005) or Williamson (2000) stated that NES is more a complement than a rival to NIE.[637] In addition to this, several authors like Easton and Araujo (1994), Welch and Wilkinson (2004) or Batt (2008) saw a third wave of IMP research extending the research agenda of industrial networks towards more sociological notions. At least several examples showing how authors adopted the issues of embeddedness and social capital in order to overcome an undersocialized view of economic theory can be mentioned:

- Elg and Johansson (1993) as well as Jones et al. (1997) mandated to integrate TCE and structural embeddedness issues in order to get a better understanding how industrial or network governance emerges and sustains.
- Easton and Araujo (1994) and Halinen and Törnroos (1998) elaborated the concept of embeddedness in industrial network research. While Easton and

[637]Especially Williamson (2000) drew an extensive four level hierarchical structure of NIE with a social embeddedness level at the top (represented by NES), followed by an institutional environment level (represented by PRT), governance level (represented by governance approach of TCT) and the lowest level coping with resource allocation and employment (represented by PAT as well as some contributions from NCE).

Araujo (1994) focused on the structural and temporal context of exchange relationships, Halinen and Törnroos (1998) defined six types of embeddedness characteristic to business networks, namely temporal, spatial, social, market, technological and political embeddedness with the latter further developed by Hadjikhani and Håkansson (1996), Hadjikhani and Ghauri (1998) or Welch and Wilkinson (2004).

- Autry and Griffis (2008) as well as Min et al. (2008) discussed the role of social capital in supply chains. Whereas Autry and Griffis (2008) introduced structural and relational embeddedness concepts to supply chain management in order to establish a theoretical framework of supply chain capital and its impact on supply chain knowledge as well as performance, Min et al. (2008) tried to explain the supply chain phenomenon through the concepts of social identity salience (the extent to which a firm senses that it belongs to a supply chain) and social capital (the sum of formal and informal ties of supply chain members).
- While introducing a concept of triads as the smallest unit to study the embeddedness of relationships in a network structure, Laage-Hellman (1989), Blankenburg (1992), Pedersen (1996), Havila (1996) as well as Havila et al. (2004) sought to overcome the inherent "dyadic reductionism" in the industrial network approach.[638] Albeit not directly referring to these contributions, recent works from Choi and Kim (2008), Li and Choi (2009) and Choi and Wu (2009) go into this direction, too. Recognizing that dyadic buyer–supplier relationships sometimes are influenced by relationships with other buyers or suppliers (Wu and Choi, 2005), they explored triads of buyer–supplier–supplier as well as buyer–supplier–buyer relationships applying the concepts of embeddedness, social capital and structural holes as well as balance theory to the field of supply networks.[639]
- Finally in the case of international trade intermediaries, Ellis (2003) proposed that transaction cost reduction as well as alleviation of adverse selection and moral hazard problems cannot fully explain their market making activity. But information gaps between markets which create opportunities for them to negotiate cross-border exchange can explain their existence which are in line with the core principles of Burt (1992) structural hole theory.

4.7 Comparisons and Evaluation

After presenting six distinct modelling approaches to network structure, it is now time to compare and evaluate them, which can be done along several dimensions as shown in Table 4.1.

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[638]Reviewing this stream of literature, Holmen and Pedersen (2000) even proposed the concept of "serial tetrads" in order to avoid "triadic reductionism".

[639]Balance theory itself, as developed by Heider (1946, 1958), is part of the sociometric stream of social network analysis, see Sect. 5.1.1.

Table 4.1 Models of network structure

	Network modeling in OR/MS	Strategic networks	Dynamic networks	Entrepreneurial networks	Industrial networks	Social networks
Original domain	Planning and operations management	Strategic management	Strategic management	International business	Industrial marketing	Economic sociology
Theory objec-tive	Solve problems of network design and/or network flow	Offering managerial solutions	Offering managerial solutions	Explaning entreprenuerial activity	Broad anlytical scheme for industrial networks	Analysis of social network structures
Drivers	Optimizing available resources under certain restrictions	In-and Outsourcing of value-added activites	Teaming up resources whenever needed	Economizing on information costs and employment of personal networks	A system of activity links, resource ties and actor bonds	Embeddedness and social capital of actors
Actors	Focus laid on objects of network flow, not on actors	Focal company and their related partners	Group of more or less independent organizations and central broker(s)	Entrepreneurs as market-makers intermediating in information flows	Independent but closely interconnected actors	Individuals representing their companies
Linkages	Transport and storage processes	Long-term contractual arrangements	Short-term market-like business relationships	Information flows, goods flows and trustworthy reltionships	Long-lasting heavily interdependent business relationships	Personal interaction or information flows
Arguments	Strictly economic reasoning (max-min)	Strictly economic reasoning	Strictly economic reasoning	Economic as well as social aspects considered	Economic as well as social aspects considered	Mainly social aspects considered
Network gover-nance	Considered as being ex ante given, not of special interest	Hierarchically ordered network structure around a central actor	Market-like network organization or virtual corporation	Hierarchically structured in several levels of sub-networks	Markets as networks of highly intedependent business relationships	Undetermined
Analytical instru-ments	Mathematical programming and graph theory	Solemnly verbal reasoning	Solemnly verbal reasoning	Verbal reasoning supported by schematic diagrams	Verbal reasoning and schematic diagrams	Mathematical expressions and graph theory

The foremost objective of the OR/MS approach to network modelling is just to solve problems of network design and/or flow, where available resources as objects of network flow are optimized under certain constraints and restrictions. This is in sharp contrast to other approaches to network structure which capture functional as well as institutional issues to offer explanations for network formation and ongoing processes therein.

Both deeply rooted in the strategic management literature, the strategic and the dynamic network approaches have much in common: Both stick on solely verbal reasoning of strictly economic arguments to promote managerial solutions to an ever changing business environment. But the drivers of network formation are different: Whereas in case of the strategic network approach, a central actor wants to gain competitive advantage by in- or outsourcing of value-added activities on a long-term commitment basis, in the dynamic network approach at least one central broker teams up resources from a group of more or less independent organizations whenever needed which gives him a high amount of flexibility.

In the entrepreneurial network approach, entrepreneurial activity in an information-based economy is explained where network formation occurs by actors as market makers economizing on information costs and employing their personal network of group memberships in different sub-networks allowing them to establish trustworthy relationships with distant colleagues. Its verbal reasoning supported by schematic diagrams can be regarded as a further development of findings from MMT and ITF as described in Sect. 3.2 in the wider context of network structures.

Although the industrial and social network approach both share common social values with the closest ties between the industrial network approach and the network exchange theory, their approaches to network structure are very different. The industrial network approach with its system of activity links, resource ties and actor bonds offers a broad analytical scheme for networks of independent but closely interconnected actors through long-lasting, heavily interdependent business relationships whereas in social network theory, a sociological view of economic action sets the focus on actors embedded in a network structure of personal interaction or information flows which sums up to social capital on a personal as well as company level if these actors are regarded as representatives of their companies. As already shown, NET and SNA are two complementary analytical concepts: Whereas NET focuses on networks of social relationships or relational embeddedness, SNA deals more with social network structure or structural embeddedness.

Furthermore, undersocialized as well as rather oversocialized network approaches can be identified with the OR/MS approach of network modelling being clearly the most undersocialized and the social network approach as the most socialized one. Being somewhere in between, the entrepreneurial as well as the industrial network approach partly build on sociological notions, whereas the strategic and the dynamic network approach deny social contacts between network members in favour of strictly economic arguments.

Common to all network approaches as described in the last sections is that in all one or more actors in a network structure under observation are considered to play specific roles, which can easily be described in terms of being an intermediary, middlemen, broker and/or agent as already thoroughly discussed in Sect. 3.3. Their differences lie in the model assumptions made with the strategic network approach ruling out agent positions with its focus on focal companies, the dynamic network approach supposing brokerage action and the others being virtually open to all possibilities.

From an overall institutional point of view these six network approaches form a continuum of network governance from strictly hierarchically ordered to market-like network structures. Towards the hierarchical end of this continuum, both the entrepreneurial as well as the strategic network approach can be located, whereas the dynamic and the industrial network approach propose merely markets-as-network structures with the OR/MS approach and the social network approach being in first instance undetermined and therefore open to all forms of network governance.

Last but not least, the applicability of all of these six approaches to network structures has to be assessed, as their comparison unveils considerable differences in their theoretical core. This in turn has a decisive impact on their usefulness in the given context, because different approaches to network structure support different structural properties and network governance. Therefore, an one-fits-all approach to network structure is not recommended as outlined in the following:

- First, the OR/MS approach to network modelling demands well defined problems of network design and/or flow, where objects of network flow are subject to subsequent transport, handling and storage processes which can be optimized under certain restrictions. As already discussed in Sect. 4.1.3, this approach to network structure is not useful, regarding the purpose of this work.
- The strategic network approach offers concrete managerial solutions to specific network structure constellations around a focal actor. Such forms of network governance are prevalent in real-world supply chains of big scale automotive or high-tech industry where an original equipment manufacturer (OEM) has to orchestrate other members of his supply chain as discussed e.g. by Dyer (1996), Lambert et al. (1998) or Pfohl and Buse (2000). In addition to this, this network approach can be employed to conduct studies of merger and acquisition behaviour or strategic alliance building e.g. in the maritime or airline industry because there, dominant carriers like Maersk, Wallenius Wilhelmsen or Lufthansa can be easily identified as focal actors in a strategic network. As the object of interest are freight forwarders being one of many players in multimodal transport chains, the strategic network approach does not seem to be appropriate in this context.
- Dynamic networks, as outlined before, are clusters of small or medium sized companies forming market-like network organizations or virtual corporations for specific tasks. This specific network governance is very common in supply chains of the toy or apparel industry with low-tech value-adding activities and short production cycles as well as of quickly evolving industries like biotechnology and microelectronics (Miles and Snow, 1994 or Pfohl and Buse, 2000) where companies like the Li & Fung Group (Magretta, 1998 or Flextronics Int. (Ferry,

2004) serve as a central broker. Furthermore, Bitran et al. (2007) recently presented their “maestro model” of third-party co-ordination in supply chain governance, which can be regarded as a further development of these dynamic network considerations. In concordance with this, some authors like Rennings (1992) or Kylaheiko et al. (2000) considered that a freight forwarder can be regarded as serving such a central broker role, too. However, striking reasons against such a view are given in Sect. 4.3.2, which prevent the dynamic approach to be applicable in this work.

- The entrepreneurial network approach itself focuses on intermediary aspects in an information-based economic environment, which is often a topic in cross-border transport chains e.g. organized by freight forwarding companies or intermediaries of the international trade sector with far reaching business contacts supporting transport, logistics as well as supply chain management. In Sect. 4.4.2, a short example was already outlined, where the freight forwarder serves as a transport middleman in multimodal transport chains due to cross-border logistical processes and a higher-level entrepreneurial network with high-trust relationships to colleagues abroad. But the overall descriptive nature of the entrepreneurial approach prevents to draw further conclusions beyond steady-state observations.
- The industrial network approach seems to be of special interest, if interdependencies between resources and/or actors are high and there is a market environment present. These conditions can be found in the land-based groupage service sector, third-party logistics provision or other not too much concentrated industry clusters with the first well reflected e.g. in Hertz (1993) or Ludvigsen (2000) and the second e.g. in Skjøtt-Larsen (2000) or Halldórsson et al. (2007). Referring to freight forwarding in multimodal transport chains, it might be questionable whether interdependencies of valuable resources are ever present. But principally, this approach to network structure seems to be applicable if the focus is laid on social context and long-term business relationships.
- However, the social network approach is highly relevant in all kind of transport, logistics or supply chain management studies, if there is a need (1) to model a full set of actors and their linkages in a network, (2) to develop purely social aspects and/or information flows in network structures beyond strictly economic considerations and (3) to explore and/or quantify them directly. No further presumptions are laid on network governance.

Finally, analytical instruments offered by these network approaches as shown in Table 4.1 can serve as a guide for the appropriate research methodology. The social network approach allows operationalizing network structure directly but comes along with a lot of mathematical calculus. It is common to the strategic, dynamic, entrepreneurial and industrial network approach that they all show an inherent descriptive nature to assess institutions and their relationships which demands a case study methodology where network structures are initially described and then compared in order to discover common patterns and to end in more or less general conclusions.

To conclude this section, the social network approach with SNA as a measurement concept seems to show the highest usability in the context of this work, as it (1) allows to model a full set of possible actor roles as well as network governance without bias, (2) develops purely social aspects and/or information flows in network structures beyond strictly economic considerations and (3) allows to explore and/or quantify them directly.

Chapter 5
A Closer Look on Contemporary Social Network Analysis

In the following, roots, levels of analysis and relevant measurement issues of SNA are discussed. The main purpose of these sections is to show (1) which are the main streams of development towards contemporary SNA, (2) which are possible levels of analysis and (3) which are relevant analytical instruments to capture social network structures as well as social capital issues.

5.1 Roots of Contemporary Social Network Analysis

As already indicated above, Georg Simmel's *formal sociology* and his studies of relations between actors in triads and dyads in Simmel (1908) are somehow the beginning of social network analysis. These initial efforts were further developed by two groups of social scientists, namely social psychologists from Austria and Germany deeply rooted in *Gestalt theory* of Köhler (1921) postulating that a total view on the "Gestalt" gives every element a meaning and US-American as well as British social anthropologists heavily influenced by the *structural-functional anthropology* of Radcliffe-Brown (1940, 1957).[1] Following Schenk (1984, pp. 1–29, 138–162), Mitchell (1979), Scott (1991, 7–38), Hummon and Carley (1993), Galaskiewicz and Wasserman (1993, pp. 6–12), Wasserman and Faust (1994, pp. 10–18), Jansen (2003, pp. 37–49) and Freeman (2004), contemporary social network analysis can be tracked along three main lines of more or less convergent developments: (1) sociometric analysis and graph theory, (2) US-American community and industrial sociology and (3) the Manchester School of social anthropology. In addition to this, methodological breakthroughs in the mid 1970s like blockmodelling analysis

[1] According to Schenk (1984, pp. 2–3) or Freeman (2004, pp. 100–103), Alfred Reginald Radcliffe-Brown was the first introducing the term "social structure" as a metaphor for networks of actually existing relations.

H.-J. Schramm, *Freight Forwarder's Intermediary Role in Multimodal Transport Chains*, Contributions to Management Science, DOI 10.1007/978-3-7908-2775-0_5,

and models of social typology led to contemporary social network analysis as shown in Fig. 5.1.

5.1.1 Sociometric Analysis and Graph Theory

The roots of this first stream of development can be dated back to the 1920s and 1930s, when a group of Austrian and German researchers working on the topics in cognitive and social psychology heavily influenced by the *Gestalt theory* of Köhler (1921) emigrated to the United States. These emigrated researchers, namely Jakob Moreno, Kurt Lewin and Fritz Heider, stressed the role played by the structure of interpersonal relations in the construction of cognitive schemes, and their studies dealt with information flows and the information of shared ideas.

Being the founder of *sociometry*[2], Moreno (1934, 1953) pioneered sociometric analysis techniques by constructing sociograms as pictorial representations in order to map social linkage patterns. These sociograms are two-dimensional diagrams consisting of a set of points representing actors and a set of lines which stand for linkages connecting actors to each other. When a pair of actors is linked to each other, a line is drawn between them. Recognition, that sociograms could be employed in studies of social structures led to a rapid development of more analytical techniques.

Lewin (1936) early work in what he called "topological psychology" outlined his view that group behaviour has to be regarded as being determined by a "field" of social forces, a social space in which the group and its surrounding environment is located. Furthermore, he argued that the environment of social groups matters to the extent it is perceived by their members. According to Lewin (1951), structural properties of this social space can be analyzed by employing mathematical techniques of topology and set theory. The aim of his *field theory* is to determine the interdependence between group and environment in a system of relations. But this theoretical framework was not developed further in the field of sociometric analysis, although the late work of Lewin (1951) published after he died suddenly and unexpectedly in 1947 provided a basis of mathematical modelling of group relations.[3]

Another contribution to social psychology was the work on *group dynamics* by Heider (1946, 1958). His initial work was on cognitive psychology of attitudes and

[2]Following Moreno (1953, pp. 15–16), "[s]ociometry is the mathematical study of psychological properties of populations, the experimental technique of and the results obtained by application of quantitative methods." Further, to him "[s]ociometry aspires to be a science within his own right" (Moreno (1953, p. 48)). The term itself can be regarded as a combination of "socius" (Lat.), meaning social or companion and "metrum" (Gr.) or "metron" (Lat.) standing for measurement.

[3]Main reason to this may be, that "field theory is in place indeterminate and resists formalization" (Martin (2003, pp. 42–43)) and therefore no progress into this direction occurred. Martin (2003) itself provides a good review of further development and discussion of contemporary field theory.

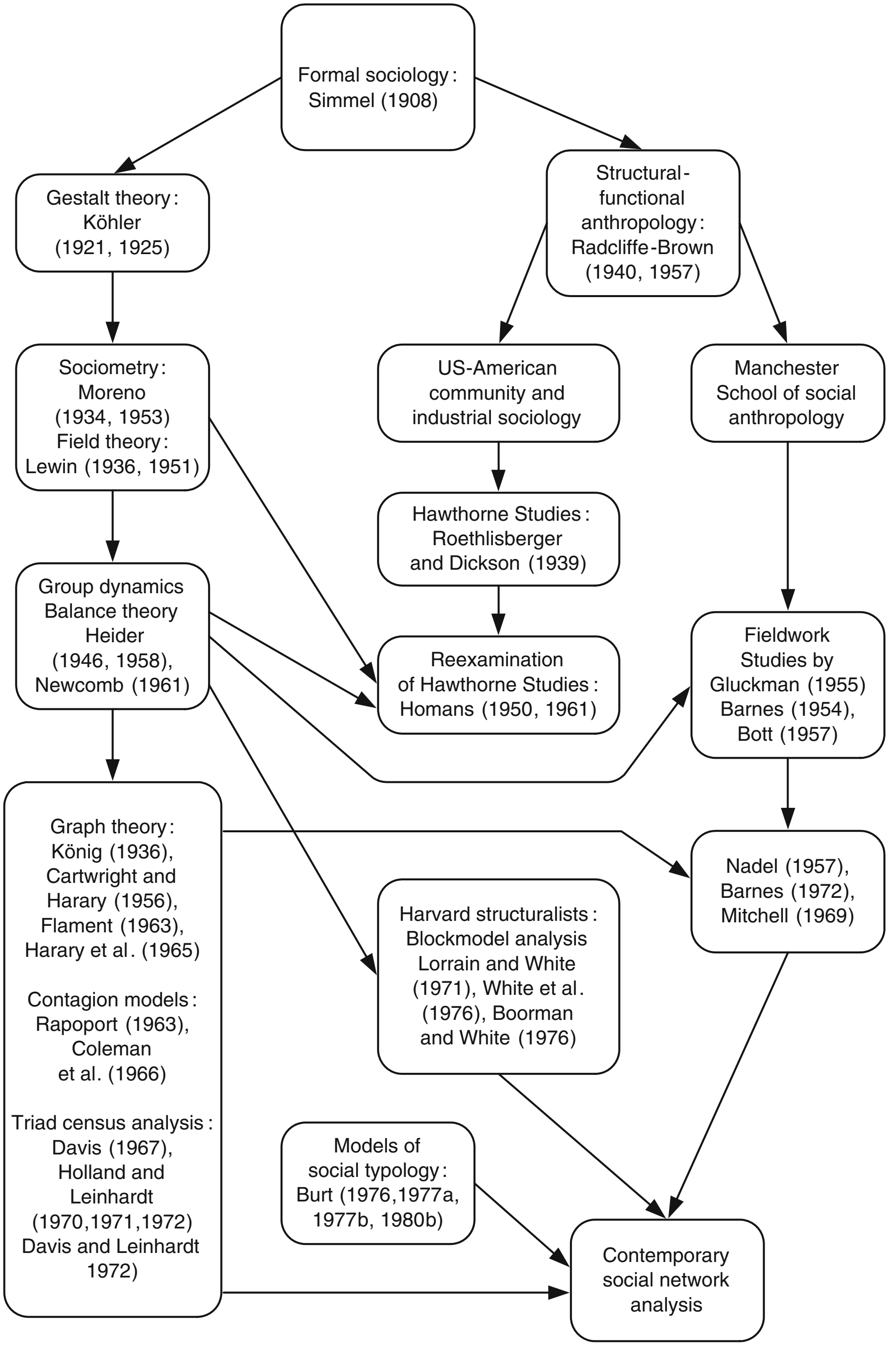

Fig. 5.1 Roots of social network analysis

perceptions and he was especially interested in the *cognitive balance* of a person's attitudes towards others. This concept of *balance theory* was further developed by Newcomb (1961) extending it to an objective approach of *structural balance* in a group. With his work, a shift occurred from a concept of cognitive balance of individuals to that of interpersonal balance in groups so that it was from now on possible to build models of systematic interdependence between the attitudes held by different persons within a group.

Furthermore in the 1950s and 1960s, Dorwin Cartwright, Frank Harary and Claude Flament were among the first to quantify these structural balance propositions in group dynamics mathematically by employing mathematical instruments from *graph theory*. In addition to this, the attempt to apply mathematics in order to model the structure of groups was of course no new idea (see e.g. Zeleny, 1940a,b, 1941, Bavelas, 1948, 1950, Seeley, 1949 or Katz, 1953), but contributions by Cartwright and Harary (1956), Flament (1963) and Harary et al. (1965) provided a path-breaking methodological framework for powerful models to show cohesion, social pressure, cooperation, power and/or leadership in social groups.

In the following, researchers like Rapoport (1963) and Coleman et al. (1966) developed *contagion models* in order to study diffusion of diseases, information and inventions in networks with heavy usage of statistical methods because these traditional methods of sociometric analysis were not found quite suitable in the analysis of large populations.

Another stream of research in the tradition of balance theory is *triad census analysis*. In this context, authors like James A. Davis, Paul W. Holland and Samuel Leinhardt made basic contributions writing a series of papers in the 1970s, which are worth to mention. Davis (1967) e.g. discussed which types of triads including three actors and all observed relations between them should and should not arise in empirical research. Based on this work, Holland and Leinhardt (1970, 1971, 1972) and Davis and Leinhardt (1972) refined in a series of papers their concept of triad census analysis by introducing a wide variety of randomly directed graphs distributions in order to test their hypotheses about various structural tendencies.

5.1.2 US-American Community and Industrial Sociology

A second stream of development originates in the community and industrial sociology tradition of US-American researchers around the anthropologist William Lloyd Warner and the psychologist George Elton Mayo at Harvard University who conducted a series of important anthropological studies during the 1920s and 1930s to collect ethnographic data in several communities as well as industrial companies. The aim of this first Harvard structuralist group was to uncover social structures of interacting individuals and groups of actors.

One of the most famous outcomes of this extensive research programme were the *Hawthorne studies* (reported e.g. by Roethlisberger and Dickson, 1939), which mark a starting point for the *Human Relations Movement* in industrial sociology.[4] Among other topics not related to this context, it was central to this study to investigate the relationship between informal group structure and work performance.

Combining Moreno (1934) sociometric analysis techniques with matrix formulation, Homans (1950, 1961) re-examined the data of Roethlisberger and Dickson (1939) later on, but finally he failed to get further insights mainly due to the sheer complexity of this task and a lack of computational capacity at that time.

5.1.3 Manchester School of Social Anthropology

The third stream of development as indicated above is closely related to the Manchester School of social anthropology with classical field studies e.g. by British social anthropologists like Max Gluckman, John Barnes, Elizabeth Bott and Clyde Mitchell.[5] This group of researchers was even more influenced by the structural-functional anthropology of Radcliffe-Brown (1940, 1957) than their US-American colleague at Harvard University. For them, conflict and power were integral elements of any social structure and therefore, in contrast to a traditional emphasis on social integration and cohesion, they developed network analysis concepts to study conflict and power relations in social groups.

Max Gluckman was the central figure at the Manchester School who combined his interest in complex African societies with the development of a structural approach recognizing the important part played by conflict and power in both the maintenance and the transformation of social structures (see e.g. Gluckman, 1955). Furthermore, Barnes (1954) reported a field study of social behaviour in a Norwegian fishing village conducted by him. This field study seems to be one of the first contributions to social network analysis, where the term "social network" was explicitly defined. Another well cited early field study about kinship relations and social environment of families in London was conducted by Bott (1957) who is often regarded to be the first who developed measurement concepts for personal, ego-centered networks. All these three classical field studies from African communities to next door neighbourhood relations in European cities offered examples of a viable approach to the discovery of informal relations between members of social groups. In addition to this, measurement concepts like density, connectedness, reachability, as well as parameters related to the intensity and strength of ties were first developed by them.

[4]See Rogers and Agarwala-Rogers (1976, pp. 36–48) or Freeman (2004, pp. 43–64) for a historical overview.

[5]Notably, Max Gluckman was the only resident in Manchester with the other three being regular visitors working at London School of Economics, see Freeman (2004, pp. 103–105). Moreover, anthropologists from other countries did also field studies of this style, see Mitchell (1974, 1979) or Wolfe (1978) for a more broad review.

Meanwhile, Siegfried Nadel, an Austrian psychologist, got in contact with them and attempted to join their findings together with the other two streams of development to form a theoretical basis for a structural sociology backed by formal network analysis. To him, social structure was an overall system network or pattern of relations, which can be analyzed without observing single actions of individuals involved therein. Moreover, he asserted that social structures are structures of role occupants together with their corresponding role-sets which should be the object of further analysis employing matrix algebra. Unfortunately, his sudden death in 1956 prevented him from developing further his ideas he had signposted in Nadel (1957).

In the following, Mitchell (1969) and Barnes (1972) tried to realize this research agenda of Nadel (1957) by developing a full bag of graph theory related measurement instruments, but their exclusive concern on informational relations mainly restricted to personal, ego-centered networks and its merely descriptive approach have contributed to a decline of this stream of development during the 1970s.

5.1.4 Methodological Breakthroughs

By this time, a first breakthrough in analytical development of social network analysis was made by a second Harvard structuralists group around Harrison C. White. They combined graph theoretical methods with algebraic models of group theory and founded *blockmodel analysis* as a way to formulate explicit models of social structure driven by matrix algebra. Doing this, they developed an algorithm which allows to draw conclusions about position and role structures in social networks having relational data on the individual level and this even in large networks of social structure. Examples of early works in blockmodelling are Lorrain and White (1971), White et al. (1976) or Boorman and White (1976).

Lorrain and White (1971) did foundational work by expressing the theoretical concept of social role as a formal mathematical procedure called structural equivalence. For them, individuals who have identical relationships to and from all others in a network are structural equivalent. White et al. (1976) and Boorman and White (1976) extended this to a self-consistent search procedure in order to partition networks into sets of actors called blocks being structural equivalent with respect to other such sets across several types of relationships.

The second breakthrough in analytical development was in a steady stream of contributions by Ronald S. Burt summing up to the coherent framework of *social typology* in order to describe a system of actors forming a network. In Burt (1976, 1977a), he determined network positions of actors in terms of social distance and employed cluster analysis and structural equation modelling to work out structural equivalent positions. In the following, he specified e.g. three general conceptualizations of actor's power within a network in Burt (1977b) and defined a concept of structural autonomy in Burt (1980b) only to name two other early contributions of his extensive research agenda.

Now, social network analysis can be regarded as an established stream of research dominated by US-American researchers.[6] Widespread application of social network analysis in form of empirical studies as well as theoretical treatments are occurring in the fields of anthropology, sociology, politics, geography, communication and organization studies as cited e.g. in Hummon and Carley (1993), Jansen (2003, pp. 48–49) or Freeman (2004).

5.2 Levels of Analysis in Contemporary Social Network Analysis

According to network data, Knoke and Kuklinski (1982, p. 16) distinguished between an attributional and a relational level of analysis.[7] Attributes are considered to be intrinsic characteristics of actors like people, objects, or events. These persons, objects or events may at the same time be involved in some relationships, but these relationships are not an intrinsic characteristic of either party involved in isolation, nor an emergent property of the connection or linkage between units of observation. Where attributes of actors may persist over a long time, relations are context specific and alter or disappear upon an actor's removal from a network structure.

In addition to this, Jansen (2003, pp. 60–67) identified five levels according to the unit of analysis: (1) dyads, (2) triads, (3) actors and their personal networks, (4) subgroups and (5) complete networks.

For her, a *dyad* is the smallest unit of analysis in a network structure and the dyad itself can be regarded as a network consisting of two points of actors and their relation to each other. The next higher level of analysis is a network structure with three points or actors called *triad* and their relations to each other. *Actors and their personal networks* are a distinct type of networks called *ego-centric networks,* which are according to Shulman (1976, p. 310)

> "[...] the set of persons connected to a particular individual (ego) who represents the focal point or anchorage of the network. The total [personal] network is not focused in an individual's connections but on all existing connections [sic] among all persons in some defined set or domain."

The fourth level is a *subgroup* of actors in a social network structure formed by several dyads, triads or even higher combinations of actors with special relations to each other. Finally the focus of analysis can be the *complete network* (sometimes called *socio-centric network*), including all actors and all relations in a network structure.

Burt (1980a, p. 80) provided a more structured view of measurement issues in network structures as shown in Table 5.1. According to him, social network

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[6]Cf. Hummon and Carley (1993). Notably, only a few contributions about methodological issues in social network analysis are being published in German, e.g. Kähler (1975), Schenk (1984), Pappi (1987) and Jansen (2003).

[7]See Jansen (2003, pp. 53–58) with a similar definition.

Table 5.1 Concepts of social network structure and level of analysis (Source: Burt (1980a, p. 80) with some extensions)

	Actor aggregation in a unit of analysis		
Analytical approaches	Actor (micro perspective)	Multiple actors as a network subgroup (meso perspective)	Multiple actors and/or subgroups as a structured system (macro perspective)
Relational approach	Personal network as extensive, dense and/or multiplex	Primary group as a network clique: a set of actors connected by cohesive relations	System structure as dense and/or transitive
Positional approach	Occupant of a network position as central and/or prestigious	Status or role-sets as a network position: a set of structurally equivalent actors	System structure as a stratification of status/role-sets

structures can be analyzed at three levels of aggregation. At the highest level (*macro perspective*), all actors in a social network structure and their relations to each other are treated as a single unit of analysis. At the lowest level, each actor in a social network structure and his relations to other actors can be subject to investigation (*micro perspective*). Between these extremes, actors in a social network structure can be aggregated to a network subgroup or clique, so that these subgroups or cliques within are compared as units of analysis (*meso perspective*).

In addition to this, Burt (1980a, p. 80) distinguished between two fundamentally different analytical approaches within these three levels of aggregation, namely the relational and the positional approach. In the *relational approach*, the focus is set on relationship patterns between pairs of actors and these are treated in isolation to others in the whole network structure. In the *positional approach*, an actor is regarded as one of many actors in a network structure and patterns of all relevant relationships are used to define his network position. Both the relational and the positional approaches describe relationships in network structures, but they do it from very different intellectual traditions. On one hand, the relational approach develops a social-psychological concept of differentiation. There, network structure is primarily described in terms of typical relationships in which individual actors are involved. On the other hand, the positional approach stands for more sociological and anthropological concepts of differentiation. Network structure is then regarded as consisting of interlocked, differentially prestigious status or role-set in which actors are stratified.

5.3 Analytical Instruments of Contemporary Social Network Analysis

In the following, some important analytical instruments of SNA with a focus on the above mentioned micro and macro perspective being relevant in the context of this

Table 5.2 Analytical instruments for social network structure per level of analysis

	Actor aggregation in a unit of analysis		
Analytical approaches	Actor (micro perspective)	Multiple actors as a network subgroup (meso perspective)	Multiple actors and/or subgroups as a structured system (macro perspective)
Relational approach	Degree, multiplexity, heterogeneity brokerage and/or constraint	Clique analysis, triad zensus, brokerage	Size, density, cohesion, multiplexitiy, heterogeneity, brokerage
Positional approach	Centrality and prestige	Structural equivalence, blockmodelling and cluster analysis	Centralization and hierarchization

work are discussed (see Table 5.2 for a general overview).[8] First, basic measures on the individual, relational and network level are described before more complex measurement concepts of the positional approach (centrality, centralization, prestige and hierarchization) and the relational approach (network constraint and brokerage capacity) are presented.

5.3.1 *Actor's Degree, Density, Multiplexity, Heterogeneity and Connectedness*

As already noted above, basic elements of all kinds of networks are a set of *points* or *actors* and a set of *relations* (or synonymously *edges*, *links*, or *ties*). In order to analyse social networks structures, these two basic elements have to be measured in some way.

The first and most natural measure to characterize a point or an actor in a social network structure is, apart from attributional or sociodemographic data, the amount of links or relations he or she has.[9] Or in other words, it is simply the number of points or actors to which a given point or actor is adjacent to. This measure is usually called the *actor's degree* and can be expressed mathematically in the following way:

$$d(p_i) = \sum_{j=1|j\neq i}^{N} a_{ij} \;\forall\, i \tag{5.1}$$

[8]Of course, there are more than the following measurement concepts existing as tools for social network analysis like triad analysis, structural equivalence, blockmodelling but these measurement concepts are (1) not suitable in the research context and (2) therefore beyond the scope of this piece of work. For further reference of these measurement concepts see e.g. Burt (1980a, pp. 96–130), Burt (1982, pp. 37–87), Knoke and Kuklinski (1982, pp. 56–86), Schenk (1984, pp. 83–108), Scott (1991, pp. 103–148), Wasserman and Faust (1994, pp. 227–721), Jansen (2003, pp. 163–220) or Knoke and Yang (2008, pp. 72–117).

[9]Cf. Burt (1983, p. 177), Scott (1991, pp. 71–72) or Jansen (2003, pp. 103–104).

In addition to this, for directed networks an *actor's outdegree* $d_0(p_i)$ and an *actor's indegree* $d_1(pi)$ can be calculated accordingly by

$$d_0(p_i) = \sum_{j=1|j \neq i}^{N} a_{ij} \ \forall\, i \tag{5.2}$$

and

$$d_1(p_i) = \sum_{j=1|j \neq i}^{N} a_{ji} \ \forall\, i \tag{5.3}$$

where $d_1(pi)$ ($d_0(p_i)$) counts directed relations to (from) the point or actor p_i from (to) other points or actors adjacent in a social network structure. Unfortunately, $d(p_i)$, $d_1(p_i)$ and $d_0(p_i)$ are biased in N, but all three measures can be standardized by division with $(N-1)$ if $a_{ii} = 0$ for all $i = 1, \ldots, N$ holds.[10] The last expression means, that reflexive relations (a relation from an actor to himself or herself) are not allowed by definition.

Furthermore, an *actor's density* is the number of actual existing relations divided by the number of possible relations or in case of a directed graph

$$AD(p_i) = \frac{\sum_{i=1}^{N} \sum_{j=1|j \neq i}^{N} a_{ij}}{N(N-1)} \ \forall\, i \tag{5.4}$$

with $N(N-1)$ the maximum number or relations for a single point or actor in a network with N points or actors.[11] For some authors like Weimann (1989, p. 190) $AD(p_i)$ stands for the degree of integration in a personal network.

Multiplexity is a special feature of social network structures, if there exist more than one distinct kind of relations between a pair of points or actors.[12] The network structure can then be regarded as a M-dimensional construct so that each $z_{ij}(m) = z(p_i, p_j, m)$ is defined as the strength of the mth link between p_i and p_j. Based on this definition, a measure of *multiplexity of actor's contacts* can be calculated by

$$AM(p_i(m)) = \frac{\sum_{j=1|j \neq i}^{N} z_{ij}(m)}{(N-1)} \ \forall\, i \tag{5.5}$$

with $z_{ij} = 0$ if p_i has only one kind of relation to p_j and 1 else.

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[10] Cf. Jansen (2003, p. 104).

[11] This relationship was first formulated by Kephart (1950). The same formulae can also be used for undirected graphs if all mutual relations are counted twice.

[12] Cf. Barnes (1979, pp. 411–412), Burt (1980a, p. 90), Burt (1982, p. 32) or Diaz-Bone (1997, p. 59).

Another special feature in social networks structures is actor's *heterogeneity*, where actors with different attributes form subgroups as a part of the whole network structure. A measurement of heterogeneity has to capture that an actor may have contacts especially to other actors in different subgroups. In order to operationalize this, actors with the same attribute(s) can be grouped together to form o distinct subgroups $o = 1, \ldots, O$. Then a N-dimensional construct with elements $z_{ij}(o) = z(p_i, p_j, o)$ with $i \neq j$ and $i, j = 1, \ldots, N$ and $z_{ij}(o) = 1$ if p_i and p_j belongs to the same distinct subgroup o and 0 else can map adequately memberships in different subgroups existing in a social network structure.[13] Burt (1983, p. 178) proposed in the case of ego-centric networks to count the number of different subgroups of alters directly connected to ego's subgroup to get a measure of *heterogeneity of actor's contacts*[14]

$$AH(p_i(o)) = \sum_{j=1|j \neq i}^{N} z_{ij}(o) \; \forall \, i. \tag{5.6}$$

Last but not least there is a concept of *connectedness*, where effects of changes in the elements of a network are employed as a basis to describe the importance of a point or an actor in a given network structure.[15] If the removal of a point or an actor including the relations associated with him or her results in a disconnected graph, this point or actor represents a *cut point* in a social network structure. The importance of these cut points or actors originates from their unique structural position and their ability to bring members of different subgroups together that are otherwise unrelated to each other. But this is considered to be closely related to the above already discussed measurement concepts of degree and density, so that no special measures of connectedness are proposed in social network analysis literature. The higher the average degree and density of actors in a social network structure, the more connected is a graph and therefore the less likely is the result of a disconnected graph, when a point or actor is removed.

5.3.2 Tie Strength, Durability, Directedness, Multiplexity and Connectedness

After discussing basic measurement concepts applicable to points or actors in a social network structure, now the focus is set on ways to characterize the relations between them. At the same time, they can be used to describe dyads accordingly,

[13] Cf. Wasserman and Faust (1994, pp. 145–117), Diaz-Bone (1997, p. 46).

[14] Some authors called this measure *homogeneity* or *individual diversity*, see e.g. Weimann (1989, p. 190).

[15] Cf. Knoke and Kuklinski (1982, p. 41), or Jansen (2003, pp. 97–98).

because they are defined as a set of relations between a pair of points or actors.[16] As already defined in Sect. 4, every link between two points or actors has at least two basic attributes: tie strength and direction. Furthermore, duration of a relation can be assessed and a set of relations can be described along other dimensions like reciprocity and/or multiplexity.[17]

First, there are numerous ways to measure *tie strength*. In a lot of studies of social network structure, ties are just regarded to exist or not to exist, and then tie strength is a dichotomous parameter with $z_{ij} \in \{0; 1\}$ for all $i \neq j$. In other cases, ties might have a different strength or magnitude (so-called valued relations) and/or they are quite opposite relations, indicated by a positive or negative sign. Quite often, tie strength is considered as a multidimensional construct, employing a set of measures like amount of time spend, frequency of contact, emotional intensity, intimacy and/or contractual basis only to mention a few possible dimensions.[18] Employing these indicators, most studies of network analysis deal implicitly with strong ties, which is to some extent in contradiction to Granovetter (1973) "strength of weak ties," where weak ties are considered to be important due to their bridge-function connecting members of different subgroups.

Another measure closely related to tie strength is the *durability* of a relation. Principally, there are two approaches to measure durability: (1) Each actor can be asked how long each particular relation exists if there is any or (2) he or she can be asked after some time again if a particular relation still exists in order to get longitudinal data about relations. But both approaches of measurement are quite problematic (1) with taking only a snapshot at a certain point of time and (2) only being applicable, if there is a perpetual access given to an actor's group in a network survey.[19]

Following graph theoretical definitions already presented in Sect. 4, three different types of linkages in terms of *directedness* between two points or actors can occur, namely asymmetric, mutual, and null ties. These three possible states lead to different types of graphs called directed or undirected graphs visualizing distinct forms of social network structures. Looking closer at measures of directedness on the link level, relations in undirected graphs are always considered to be either mutual or null and represent kinship, contractual relations, exchange of property right or resources, whereas relations in directed graphs can be subject to all different types of linkage and are often employed to show relations of asymmetric power distribution and/or differences in actor's status or prestige.

In order to get a more differentiated view of directedness, one can allow *multiplexity* of relations so that not only one single relation can exist between a

[16] Cf. Lincoln (1982).

[17] Cf. Lincoln (1982, pp. 4–6), Schenk (1984, pp. 65–74), Weimann (1989, pp. 190–192).

[18] See Mitchell (1969, pp. 20–27), Kähler (1975), Marsden and Campbell (1984, pp. 483–484) or Weimann (1989, p. 191) with further reference.

[19] Cf. Shulman (1976).

pair of points or actors. Strictly speaking, multiplexity occurs on a link level if a relationship between two points or actors (1) is supported by more than one undirected or directed relation with the same direction, (2) consists at least of more than one mutual relation or (3) there are several paths connecting them, including some intermediary points or actors in between. In addition to this, relations can be judged in terms of *reciprocity* as a more refined concept of directedness applicable to directed graphs, whereas in undirected graphs it has no meaning.[20] Reciprocity occurs if a relation in one direction is allowed to be reflected by another relation of the opposite direction. This reflection of relations, of course, can be instantaneous or occur with some time lag.

The concept of *connectedness*, as already mentioned before, builds on changes in the elements of a network and can be used again as a basis to describe the importance of a link in a given social network structure.[21] If a graph becomes disconnected by removing a line as a single relation between two points or actors, this line represents a *bridge* between them if they are members of different subgroups otherwise unconnected to each other. In the case of directed graphs, connectedness can be further defined as a relation's attribute indicating how two points or actors are linked together by path consisting of directed lines. Then two points or actors are:

- Null-connected, if there are no directed lines joining them in either direction.
- One-connected if they are joined by relations disregarding their direction.
- Two-connected, if they are joined by a path in one direction but not in another.
- Three-connected, if they are joined by paths in both directions.

To conclude this variety of measurement issues on a link level, some comparisons have to be made in order to show that they are closely related to each other. Shulman (1976) asserts that networks in which most actors are directly linked to each other, offer a greater chance of developing shared views. Then durability of relations cause a higher density by providing greater opportunity for actors to meet each other, and members of high density networks are more likely to establish a shared view through mutual interaction with reciprocated relations. After re-analyzing three classical social network studies, Marsden and Campbell (1984) come to the conclusion that there must be a distinction made between indicators and predictors of tie strength. For them, indicators are actual components of tie strength, whereas predictors are aspects of actual relationships closely related to them.[22] Furthermore, they found in their data that emotional intensity of a relationship seems to be the best indicator for tie strength, because other measures like duration, frequency of contact or time spend were too much correlated with other measures. Some authors like Weimann (1989, p. 191) or Scott (1991, p. 68) see multiplexity as an alternative measure of intensity or strength of relations.

[20] Cf. Lincoln (1982, p. 5).

[21] Cf. Knoke and Kuklinski (1982, p. 41) or Jansen (2003, pp. 97–98).

[22] Cf. Marsden and Campbell (1984, pp. 485–488).

5.3.3 Network Size, Density, Cohesion, Multiplexity and Connectedness

A basic indicator of a complete network structure is *network size* measured either in terms of points or actors or in terms of relations between them. So network size can be either measured simply by counting all points or actors being connected to each other in a social network structure or it can be calculated by summing up the number of all links between all pairs of points (p_i, p_j) regardless of their strength or direction so that

$$NS = \sum_{i=1}^{N} \sum_{j=1|j \neq i}^{N} z_{ij} \text{ with } z_{ij} \in \{0; 1\} \tag{5.7}$$

and $z_{ij} = 1$ if there is a link between p_i and p_j and 0 otherwise. In the case of ego-centric networks, another measure of network size is proposed by Burt (1983): to him, it is just the number of alters named by ego because "[t]he number of actors directly connected to an individual is an index of the extent to which the individual is involved in many different relationships" (Burt (1983, p. 177)) so that

$$NS_{ego} = \sum_{j=1|j \neq i}^{N} a_{ij} = d(p_i) \; \forall \, i. \tag{5.8}$$

Second, *network density* is a good measure at the complete network level indicating a general level of linkage among the points forming a social network structure. It seems to be one of the most widely used concept of measurement in social networks.[23] A maximum network density is reached in a complete graph where all points or actors are adjacent to each other. In case of a directed graph, with N points the maximum number of edges is then $N(N-1)$ and for an undirected graph $N(N-1)/2$, respectively.[24] Therefore, a measure for network density e.g. in a directed binary graph is

$$ND = \frac{\sum_{i=1}^{N} \sum_{j=1|j \neq i}^{N} z_{ij}}{N^2 - N} \tag{5.9}$$

and *ND* valued in a range between 0 and 1.[25] Again, in ego-centric networks, ego as the focal actor and his or her direct links should not be necessarily taken into

[23] Cf. Niemeijer (1973), Mitchell (1974, p. 288), Shulman (1976), Barnes (1979, pp. 406-408), Scott (1991, pp. 72–84), Wasserman and Faust (1994, p. 181) or Jansen (2003, p. 108).

[24] See Kephart (1950) for a formal derivation of these figures.

[25] *ND* is, virtually by definition, a relative measure of network density. An absolute measure of network density, of course, was developed by Scott (1991, p. 98), but discussing this measure in

account, because these relations exist almost by definition.[26] An alternative measure for network density in a directed ego-centric network is therefore excluding ego and calculating the *alters' network density* or

$$ND_{alter} = \frac{\sum_{i=2}^{N} \sum_{j=2|j \neq i}^{N} z_{ij}}{N^2 - 3N + 2} \tag{5.10}$$

and $i/j \neq 1$ if ego is indexed by $i = 1$.[27] A quite fundamental problem common to both network density measures is that they are biased in N due to the fact that with an increasing number of points the maximum number of possible relations between them increases exponentially.[28] But considering that each actor in a network structure can only handle a small portion of all possible relations, a *standardized measure of network density* based on a mean actor's degree can be calculated by

$$ND' = \frac{N \frac{1}{N} \sum_{i=1}^{N} d(p_i)}{N^2 - N} \tag{5.11}$$

in the case of an undirected binary graph.[29]

Another measure is *network cohesion*, which expresses the number of mutual links in a directed network structure:

$$NC = \frac{2 \sum_{i=1}^{N} \sum_{j=1|j \neq i}^{N} (z_{ij} + z_{ji})}{N^2 - N} \tag{5.12}$$

with $i < j$ and $(z_{ij} + z_{ji}) = 1$ if relations in both directions are existing and 0 otherwise.[30] Values of NC range between 0 an 1 with larger values for networks with a greater proportion of reciprocated relations. Usually in empirical studies of network structure, there seems to be not much difference between network density and cohesion.[31]

Looking at the overlap of several kinds of relations on the network-level, a network is considered to be multiplex to the extent that there are multiple types

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depth is beyond the scope of this work. In case of an undirected graph, the same formulae can be employed with mutual relations counted twice.

[26]Cf. Burt (1980a), Scott (1991, p. 75), Jansen (2003, p. 108) or McCarty and Wutich (2005).

[27]See e.g. Jansen (2003, p. 109). Again, this formulae can be applied to an undirected graph with mutual relations counted twice.

[28]This is a well known attribute common to all network structures, usually called the "network effect."

[29]Cf. Scott (1991, pp. 77-78).

[30]Cf. Knoke and Kuklinski (1982, p. 50), Witt (1996, p. 35) or Jansen (2003, p. 111).

[31]Cf. Knoke and Kuklinski (1982, p. 50) or Witt (1996, p. 35).

of relations between points or actors.[32] This *network multiplexity* can be expressed by the amount of multiplex relations divided by the amount of possible relations or

$$NM = \frac{\sum_{i=1}^{N} \sum_{j=1|j \neq i}^{N} z_{ij}}{N^2 - N} \tag{5.13}$$

with $z_{ij} = 0$ if p_i has only one kind of relationship to p_j and 1 else.[33] Furthermore, under the notion that a network with multiple types of relations is more dense or cohesive, *NM* can be at the same time regarded as an alternative measure of density or internal cohesion.

The concept of *connectedness* on the actors level can be expanded on the network level, too.[34] There, a graph as a visual representation of a given social network structure is:[35]

- Strongly connected if every pair of points or actors is three-connected.
- Unilaterally connected, if every pair of points or actors is two-connected.
- Weakly connected, if all pairs of points or actors are one-connected.
- Disconnected, if at least one point or actor is null-connected towards the others.

Having a measure of heterogeneity of actor's contacts, a cautious reader might miss now some measure of *heterogeneity* on the network level. Indeed, in the literature of SNA, there exists no specific measure of heterogeneity on the network level. But the measurement concept of prominence, especially the measures of hierarchization which will be discussed in the following section, capture the fact of heterogeneity.

5.3.4 Prominence: Centrality, Centralization, Prestige and Hierarchization

According to Wasserman and Faust (1994, p. 169), "one of the primary uses of graph theory in SNA is the identification of the 'most important' actors in a social network." In order to describe the location or position of an actor or highlight differences between more or less important actors in a social network structure, two distinct concepts of *importance*, or synonymously, *prominence*, can be employed: centrality and prestige.[36] In both concepts, actors being in a relative central location

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[32] Cf. Burt (1980a).

[33] Cf. Knoke and Kuklinski (1982, p. 51) or Jansen (2003, p. 111).

[34] Cf. Knoke and Kuklinski (1982, p. 41) or Jansen (2003, pp. 97–98).

[35] According to Barnes (1969, p. 239), these definitions are originally made by Harary et al. (1965), but several other classifications of connectedness on the network level are existing, too.

[36] See Knoke and Burt (1983, pp. 198–200), Wasserman and Faust (1994, pp. 169–178) or Koschützki et al. (2005) for a more thoroughly discussion of these two concepts.

or represent a focal point within a social network structure are considered usually to be the most important or the most prominent.[37]

Measurement concepts of *centrality* stick to the fact, that an important actor in a social network structure has a lot of ties to other actors and therefore he is simply more involved in comparison to more "dispersed" located actors with less ties and therefore less involvement. They are originally designed for nondirected binary graphs, so that in this section the overall focus is laid on them with additions to refinements for directed and/or valued graphs, if necessary.

The idea of centrality in social network structure was first introduced by Bavelas (1948), studying communication in small groups and hypothesizing a relationship between structural centrality and influence in group processes. In the following, many other authors developed three distinct centrality concepts based on *degree* (e.g. Shaw, 1954, Rogers, 1974 and Nieminen, 1974), *betweenness* (e.g. Shaw, 1954 and Freeman, 1977) and *closeness* (e.g. Bavelas, 1950; Beauchamp, 1965; Sabidussi, 1966 and Rogers, 1974). Freeman (1979) summarized these early developments and offered a whole family of measures for each of these three concepts, one absolute and one relative measure of the centrality positions in a network called *point* or *actor centrality* and one reflecting the degree of overall centralization of an entire network called *graph centrality*. In addition to this, Bonacich (1972a,b) developed a *rank- or status-based measure of centrality* and generalized it to a whole family of local and global measures in Bonacich (1987). All four common forms of centrality measures will be discussed in the next section.

In order to quantify *prestige*, usually digraphs are employed to distinguish choices sent to from choices received by actors. The most prestigious actors are then those who receive the highest amount of choices from others. Knoke and Burt (1983, p. 199) commented this by:

> "The fact of being involved in a relation is less important than the distinction between being the source versus the object of the relation. Control over valued resources, and the authority and deference produced by inequalities in control, is a substantive area requiring this emphasis on the asymmetry of relations, with the source of a relation being qualitatively distinct from the object of the relation in the sense of the distinction between subordination and superordination."

Therefore, actors with high prestige can be seen as leaders who are object to extensive relations from followers, while the latter are only object to few relations. Both, leaders and followers, are involved in relations, but these relations are different in terms of amount and direction which is highlighted by the following measurement concepts of prestige. According to Knoke and Burt (1983, p. 175), first studies

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[37] Scott (1991, pp. 95–96) questions this implicit assumption that a network structure has always an easily identifyable focal point being quite in the centre, and refers to Christofides (1975) concept of *eccentricity*, which builds on a distance matrix containing shortest path distances (or geodesics) between each pair of point. Then the eccentricity of a point is defined as the length of the longest geodesic in the distance matrix and the point with the lowest eccentricity is the absolute centre of a given graph. In some graphs, two or more points have equally low eccentricity. Then an imaginary point lying on a path between them is considered to be the absolute centre.

of prestige date back e.g. to Moreno (1934, pp. 98–103), Zeleny (1940a,b, 1941), Proctor and Loomis (1951) and Katz (1953), which used the term of status instead of prestige in their works. Three measurement concepts, namely prestige based on *indegree* of an actor, his or her *proximity* to other actors and *status* or *rank* of other actors and their extension to measures of hierarchization in a given social network structure will be discussed later on.

5.3.4.1 Measures of Centrality

Thinking of network structure looking like a star or a wheel, a central point seems to have the most central position possible. In order to measure this obviously unique position in such a network, we can assert that this central point (1) has the maximum possible *degree* of all points, (2) falls on the geodesics *between* the largest possible numbers of other points and (3) is maximally *close* to them because it is located at the minimum distance to all other points.[38]

A first family of measures of point centrality can be regarded as some functions of the degree of a point. Shaw (1954) first introduced the idea of using degree as a measure of point centrality and, together with other authors like e.g. Rogers (1974) and Nieminen (1974), he regarded centrality as being the same as degree without further discussion.[39] Following Nieminen (1974), a *degree-based absolute measure of point centrality* can be calculated simply by adding up the number of adjacencies $a_{ik} = a(p_i, p_k)$ with $i \neq k$ for a point p_k or more formally:

$$C_D(p_k) = \sum_{i=1|i\neq k}^{N} a_{ik} \;\forall\; k \tag{5.14}$$

where $a_{ik} = 1$ if and only if p_i and p_k are adjacent otherwise $a_{ik} = 0$.[40] $C_D(p_k)$ is therefore large, if p_k is adjacent to a larger number of other points and small if p_k has only a few direct contacts. At the minimum, the point p_k is totally unconnected and so min $C_D(p_k) = 0$. Conversely, at the maximum all other points are adjacent to p_k and so max $C_B(p_k) = N - 1$. Unfortunately, $C_D(p_k)$ as being an absolute measure of centrality strongly depends on the total size of the network for which it is calculated and so a comparison between network structures of different size cannot be made seriously. In order to get a *degree-based relative measure of*

[38] Cf. Freeman (1979), Schenk (1984, pp. 51–56), Witt (1992) or Wasserman and Faust (1994, pp. 178–192).

[39] See Freeman (1979), Wasserman and Faust (1994, p. 178) or Witt (1996, pp. 19–28) for a more rigorous discussion.

[40] It is worth mentioning, that the magnitude of $C_D(p_k)$ is virtually identical to the actors degree $d(p_i)$, because both are defined as a sum of adjancies, see Burt (1983, p. 190) for further discussion. In the case of digraphs, Wasserman and Faust (1994, p. 199) proposed to count the outdegrees of an actor.

point centrality, the effect of network size must be removed. According to Freeman (1979), it can be simply done by dividing $C_D(p_k)$ by $N-1$, so that

$$C'_D(p_k) = \frac{1}{N-1} \sum_{i=1|i \neq k}^{N} a_{ik} \ \forall\, k \tag{5.15}$$

is the proportion of other points that are adjacent to p_k and $C'_D(p_k)$ varies between 0 and 1.

A second family of measurement concepts can be constructed on the structural attribute of betweenness of a point p_k considering all the geodesics $g_{ij} = g(p_i, p_j)$ with $i \neq j$ that contain p_k as a point between them. Both Bavelas (1948) and Shaw (1954) suggested that when a person is strategically located on the communication paths linking pairs of others, that person can be considered to have a central position because this person can influence the others by withholding or distorting information in transmission.[41] On this theoretical base Freeman (1977) developed a betweenness-based measure defining $G_{ij} = g(p_i, p_j)$ with $i \neq j$ as the number of all geodesics linking p_i and p_j,and $G_{ij}(p_k)$ with $k \neq i \neq j$ as the number of geodesics linking p_i and p_j that contain p_k. Then, a *betweenness-based absolute measure of point centrality* for a point p_k can be constructed by summing up the proportion of geodesics linking p_i and p_j that contain p_k:

$$C_B(p_k) = \sum_{i=1|i \neq j \neq k}^{N} \ \sum_{j=1|j \neq i \neq k}^{N} \frac{G_{ij}(p_k)}{G_{ij}} \ \forall\, k. \tag{5.16}$$

This provides a measure of the overall centrality of a point p_k in a given network structure.[42] Furthermore, Freeman (1977) showed that for any undirected graph containing N points $\max C_B(p_k) = ((N-1)(N-2))/2$ for all k. Again, this absolute measure of point centrality depends on the total size of the network for which it is calculated and so it should be normalized to get a *betweenness-based relative measure of point centrality* by calculating

$$C'_B(p_k) = \frac{2}{N^2 - 3N + 2} \sum_{i=1|i \neq j \neq k}^{N} \ \sum_{j=1|j \neq i \neq k}^{N} \frac{G_{ij}(p_k)}{G_{ij}} \ \forall\, k \text{ and } i < i \tag{5.17}$$

so that the magnitude of $C'_B(p_k)$ falls again in the range between zero and one.[43]

[41] See Freeman (1979), Burt (1980a, pp. 91-93), Burt (1982, p. 33–35), Wasserman and Faust (1994, pp. 188–190) or Koschützki et al. (2005, pp. 28–32) with a similar discussion.

[42] See Anthonisse (1971) or Jansen (2003, pp. 148–149) for the digraph case.

[43] Following Wasserman and Faust (1994, p. 200), $C'_B(p_k)$ must be multiplied by 2 for digraphs because $\max C'_B(p_k) = (N-1)(N-2)$.

The third family of measures is based on closeness or the degree to which a point is close to other points in a network. But looking at communication or efficiency issues, there are some other meaningful interpretations of closeness possible, as shown in e.g. Freeman (1979) or Wasserman and Faust (1994, pp. 183–184). Bavelas (1948) suggested that a message originating in the most central position in a network would spread out in minimum time. Beauchamp (1965) considered closeness as being a basic principle to build up organizations of optimum efficiency in communication. Sabidussi (1966) defined the most central point in a network as that with the minimum costs or time for communication with all other points. For Freeman (1979), a point is central to the extent he can avoid the control potential of other points in the network. Closeness-based measures of centrality have been developed e.g. by Bavelas (1950), Beauchamp (1965), Sabidussi (1966) and Rogers (1974), but for Freeman (1979), the measurement of decentrality by Sabidussi (1966) seems to be the simplest and most natural of these measures. Following him, a *closeness-based absolute measure of point centrality* can be constructed by summing up all distances $d_{ik} = d(p_i, p_k)$ with $i \neq k$ on the geodesics linking a point p_k to all other points in the network:[44]

$$C_C(p_k)^{-1} = \sum_{i=1|i\neq k}^{N} d_{ik} \ \forall\ k. \tag{5.18}$$

Being an inverse measure of point centrality for p_k , the magnitude of $C_C(p_k)^{-1}$ is bigger (smaller) with increasing (decreasing) distance between p_k and other points and it is furthermore only meaningful for a connected network, since an unconnected point is equal to an infinite distance $d_{ik} = \infty$ to all the other points. Again, this absolute measure of point centrality is dependent upon the number of points from which it is calculated. But Beauchamp (1965) solved this problem of standardizing $C_C(p_k)^{-1}$ by dividing it through $N - 1$ as being the minimum sum of distances for p_k being adjacent to all other points in a network. A *closeness-based relative measure of point centrality* can therefore be defined as

$$C'_C(p_k) = \left[\frac{1}{N-1}\sum_{i=1|i\neq k}^{N} d_{ik}\right]^{-1} = N-1\left[\sum_{i=1|i\neq k}^{N} d_{ik}\right]^{-1} \ \forall\ k \tag{5.19}$$

with $\min C'_C(p_k) = 0$ and $\max C'_C(p_k) = 1$. $C'_C(p_k)$ can then be viewed as the inverse average distance between p_k and all the other actors and equals 1 when p_k is adjacent or maximally close to all other actors, like in a star.[45]

Central to the idea of a *rank-based measure of centrality* (sometimes also called *eigenvector centrality)* is that the centrality of an actor should be proportional to the

[44]Following Koschützki et al. (2005) this resembles to much earlier formulations by Wiener (1947) or Shimbel (1953). Further, Wasserman and Faust (1994, pp. 200–201) for the digraph case.

[45]Cf. Wasserman and Faust (1994, p. 185).

strength of the actor's ties to other network members and their centrality. Originally, Bonacich (1972a,b) motivated this centrality measure as an indicator of popularity, related to the measures of rank or status prestige discussed further later on.

Following Bonacich (1972a,b) or Mizruchi et al. (1986), a rank-based centrality measure for the kth actor denoted by $C_R(p_k)$, can be expressed as a linear combination of the same centrality measures of other actors in a network, multiplied by the tie strength between them:

$$C_R(p_k) = z_{1k}\, C_R(p_1) + z_{2k}\, C_R(p_2) + z_{3k}\, C_R(p_3) + \cdots + z_{Nk}\, C_R(p_N)\ \forall\, k\,. \tag{5.20}$$

This leads to a system of N interdependent linear equations with N unknown rank-based measures of centrality, which can be expressed alternatively in matrix notation by

$$C = Z'C \tag{5.21}$$

with a vector $C = (C_R(p_1),\ C_R(p_2),\ C_R(p_3), \ldots, C_R(p_N))'$ of rank-based centrality measures for each actor and a Z' as a matrix with elements $z_{ij} = z(p_i, p_j)$ for all $i \neq j$ and $i, j = 1, \ldots, N$ representing the relations between all actors. Unfortunately, this system of interdependent linear equations has no trivial nonzero solution. However, Bonacich (1972b) showed in the case of Z being a symmetric matrix of relationships that a solution can be ensured just by multiplying $C_R(p_k)$ with a constant λ equal to the largest positive eigenvalue of Z. Doing this, a similar linear combination of rank-based centralization measures of the form

$$\lambda C_R(p_k) = z_{1k}\, C_R(p_1) + z_{2k}\, C_R(p_2) + z_{3k}\, C_R(p_3) + \cdots + z_{Nk}\, C_R(p_N)\ \forall\, k \tag{5.22}$$

occurs, and the resulting system of interdependent linear equations can be expressed in matrix notation by

$$\lambda C = Z'C. \tag{5.23}$$

This is similar to the problem of finding eigenvalues and corresponding eigenvectors in an eigensystem with λ being an eigenvalue and C an eigenvector. Bonacich (1972b) showed for any symmetric matrix Z that there is always an eigenvalue $\lambda \geqq 0$ such that all elements of its eigenvector C are greater than or equal to zero. Knowing this, the rank-based measures of centrality from $C_R(p_1)$ up to $C_R(p_N)$ in a given social network structure can be obtained quite easily by (1) extracting the eigenvalues of Z (2) defining λ as the largest eigenvalue of Z and (3) extracting the corresponding eigenvector C from Z, whose elements are essentially the rank-based measures of centrality from $C_R(p_1)$ up to $C_R(p_N)$.[46]

[46]Of course, there are a huge amount of other methods to solve this problem of obtaining eigenvalues and eigenvectors in a eigensystem in the field of network analysis proposed by other authors like Katz (1953), Hubbel (1965), Taylor (1969), Bonacich (1972b) and briefly discussed

Although some authors like Mizruchi et al. (1986), Bolland (1988), Bonacich et al. (1998) or Poulin et al. (2000) proposed various methods to standardize these rank-based measures of centrality, a one-for-all solution of standardization for rank-based measures of centrality does not exist up to now, as shown by Ruhnau (2000). The very problem is that either (1) $C_R(p^*) = \max(C_R(p_1),\ C_R(p_2),\ C_R(p_3), \ldots,\ C_R(p_N))'$ has to be assigned equal to 1 for each network structure separately, because the maximum possible value of $C_R(p^*)$ is virtually unknown for most N until now or (2) by employing other standardization methods, a maximum value of $C_R(p^*)$ is not equal to 1 by definition.

5.3.4.2 Measures of Centralization

In addition to all these above mentioned measures of point centrality, corresponding measures reflecting the degree of centralization of an entire network can be calculated. According to Freeman (1979), they all have certain features in common: (1) They should index the degree to which the centrality of the most central point or actor exceeds the centrality of all other points or actors, and (2) they should each be expressed as a ratio of that excess to its maximum possible value for a graph containing the observed number of points or actors. If we define $C_X(p_k)$ as one of the three point centrality measures based on degree, closeness and betweenness already defined above and $C_X(p^*)$ as the maximum value of $C_X(p_k)$ for all $k = 1, \ldots, N$ in the network then

$$C_X = \frac{\sum_{k=1}^{N} [C_X(p^*) - C_X(p_k)]}{\max \sum_{k=1}^{N} [C_X(p^*) - C_X(p_k)]} \tag{5.24}$$

is an acceptable measure of centralization of an entire network. It determines the degree to which $C_X(p^*)$ exceeds the centrality of all other points or actors and, since C_X is a ratio of a sum of differences to its maximum value, it will vary between 0 and 1. C_X equals 0, when all points or actors in a given social network structure have exactly the same centrality index and it equals 1, if one point or actor is in the centre of a star or wheel and therefore dominating the other points or actors.[47]

Using the above mentioned expression, a *degree-based measure of graph centrality* is defined as

$$C_D = \frac{\sum_{k=1}^{N} [C_D(p^*) - C_D(p_k)]}{N^2 - 3N + 2} \tag{5.25}$$

in Wasserman and Faust (1994, pp. 206–209) or more recent contributions by Richards and Seary (2000), Poulin et al. (2000), Bonacich and Lloyd (2001) or Koschützki et al. (2005, pp. 46–51).

[47] Cf. Wasserman and Faust (1994, p. 177).

because $(N-1)(N-2)$ is the largest sum of differences in terms of degree. It can be regarded as a general formula for determining the centrality of a network in terms of degree. Furthermore, Freeman (1977) defined a *betweenness-based measure of graph centrality* as the average difference between the relative centrality of the most central point $C'_B(p^*)$ and that of all other points. Freeman (1979) shows, that

$$C_B = \frac{\sum_{k=1}^{N}\left[C'_B(p^*) - C'_B(p_k)\right]}{N-1} = \frac{\sum_{k=1}^{N}\left[C_B(p^*) - C_B(p_k)\right]}{N^3 - 4N^2 + 5N - 2} \tag{5.26}$$

and that this measure takes its maximum value for network in form of a star or a wheel. Thus, C_B provides a general measure of graph centrality based on betweenness. Finally, a *closeness-based measure of graph centrality* can be defined as

$$C_C = \frac{\sum_{k=1}^{N}\left[C'_C(p^*) - C'_C(p_k)\right]}{(N^2 - 3N + 2)/(2N-3)} \tag{5.27}$$

due to the fact that the maximum possible difference in terms of closeness is $(N-2)(N-1)/(2N-3)$.[48] In all of these three measures, a network in form of a star or a wheel yields the maximum sum of differences by considering the alternatives. Conversely, the lowest value of graph centrality is assigned to a complete graph or a social network structure where all points or actors are connected to each other.

In the case of *rank-based measures of centralization*, this proposed method of calculating a graph centrality cannot be seriously employed for most networks, because the maximum of $C_R(p^*)$ is virtually unknown there. But Wasserman and Faust (1994) proposed another family of measures expressing centralization of a graph or social network structure by simply calculating overall means and variances, which at the same time can be considered as a measure for heterogeneity of points or actors in a graph.

Following them, degree-based point centrality can be summarized on the overall graph level by

$$\overline{C}_D = \frac{1}{N}\sum_{k=1}^{N} C_D(p_k) \text{ and } S_D^2 = \frac{1}{N}\sum_{k=1}^{N}[C_D(p_k) - \overline{C}_D]^2 \tag{5.28}$$

where $\overline{C}_D$ can be regarded as an *average of actor degrees* and S_D^2 expresses the *variance of actor degrees*. Unfortunately, the maximum values of $\overline{C}_D$ and S_D^2 depend on N and the entire set of degrees.[49] In order to obtain a standardized measure of $\overline{C}_D$, it can be simply divided by $(N-1)$ to get a measure called *average*

[48]Cf. Freeman (1979) or Wasserman and Faust (1994, p. 186).

[49]See Snijders (1981) or Wasserman and Faust (1994, p. 181) for this and the following discussion.

standardized degree

$$\overline{C}'_D = \frac{1}{N(N-1)} \sum_{k=1}^{N} C_D(p_k) = \frac{1}{N} \sum_{k=1}^{N} C'_D(p_k) \tag{5.29}$$

which is simply an average of degree-based measures of point centrality. To standardize S_D^2, a complicated procedure calculating a maximum possible variance given the set of degrees actually observed to obtain a dimensionless index is proposed by Snijders (1981).

In analogy to the degree-based measures, closeness-based measure of point centrality can be summarized on the overall graph level simply by calculating

$$\overline{C}'_C = \frac{1}{N} \sum_{k=1}^{N} C'_C(p_k) \text{ and } S_C^2 = \frac{1}{N} \sum_{k=1}^{N} [C'_C(p_k) - \overline{C}_C]^2 \text{ with } \overline{C}_C = \frac{1}{N} \sum_{k=1}^{N} C_c(p_k), \tag{5.30}$$

where $\overline{C}'_C$ can be called *average standardized closeness* and S_C^2 *variance of actor closeness*, respectively.[50] S_C^2 especially can be regarded as an index of heterogeneity, because with an increasing (decreasing) S_C^2, a network becomes less (more) homogeneous with respect to distance and thus more (less) centralized. The same calculus can be conducted for betweenness-based and rank-based measures of point centrality, obtaining

$$\overline{C}'_B = \frac{1}{N} \sum_{k=1}^{N} C'_B(p_k) \text{ and } S_C^2 = \frac{1}{N} \sum_{k=1}^{N} [C'_B(p_k) - \overline{C}_B]^2 \text{ with } \overline{C}_B = \frac{1}{N} \sum_{k=1}^{N} C_B(p_k) \tag{5.31}$$

and

$$\overline{C}_R = \frac{1}{N} \sum_{k=1}^{N} C_R(p_k) \text{ and } S_R^2 = \frac{1}{N} \sum_{k=1}^{N} [C_R(p_k) - \overline{C}_R]^2 \tag{5.32}$$

as betweenness-based and rank-based measures of centralization.

5.3.4.3 Measures of Prestige and Hierarchization

As discussed already before, prestige can be measured by looking at asymmetric relations between actors in social network structures with actors being prestigious

[50] Cf. Wasserman and Faust (1994, p. 187). Further, Wasserman and Faust (1994, pp. 200–201) for the digraph case.

to the extent they receive choices from others. Therefore, the simplest measure of prestige on actor-level is the *actor's degree prestige,* which is just the indegree of an actor.[51] The idea is that actors who are prestigious tend to receive many nominations or choices, so that

$$P_D(p_k) = d_1(p_k) = \sum_{i=1|i\neq k}^{N} z_{ik} \ \ \forall\, k. \tag{5.33}$$

Again, the value of $P_D(p_k)$ depends on N, so that it should divided by $N-1$ to get

$$P'_D(p_k) = \frac{d_I(p_k)}{N-1} \ \forall\, k \tag{5.34}$$

as a *standardized degree prestige* measure for the kth actor.[52] Then, a maximum of actor's prestige based on degree occurs for $P'_D(p_k) = 1$, when p_k is chosen by all other actors and a minimum of $P'_D(p_k) = 0$ if p_k does not get choices from other actors.

Using the indegree as an indicator of prestige, only those actors who are adjacent are taken into consideration. But other actors outside this first-order zone of ego can make some contribution to the prestige of an actor, too. Therefore, the concept of degree prestige should be generalized by defining an influence domain of p_k as the set of actors who are either directly or indirectly connected to him (or her).[53] Such actors are reachable to him (or her), or alternatively, are those, from which he (or she) is reachable. A simple measure for the magnitude to this influence domain of p_k is just the number of actors in this influence domain, denoted by I_k. Furthermore, it has to be taken into account that these actors in the influence domain of p_k are more or less distant located to him (or her) so that at least an average distance of the other actors to p_k has to be included. Then, an *actors's proximity prestige* can be calculated as a proportion of actors who can reach p_k to the average distance these actors are from p_k or expressed mathematically

$$P_P(p_k) = \frac{I_k/(N-1)}{\sum_{i=1|i\neq k}^{N} d_{ik}/I_k} \ \forall\, k. \tag{5.35}$$

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[51]Cf. Knoke and Burt (1983, pp. 200–202), Wasserman and Faust (1994, p. 202) or Jansen (2003, pp. 142–145). According to Knoke and Burt (1983, p. 201), Moreno (1934, pp. 98–103) was the first author who introduced such a degree-based measure of prestige.

[52]This sometimes called a *relative indegree*, according to Wasserman and Faust (1994, p. 203).

[53]Cf. Burt (1980a, pp. 93–95), Burt (1982, pp. 33–35), Knoke and Burt (1983, pp. 203–204), Wasserman and Faust (1994, pp. 203–204) or Jansen (2003, pp. 145-147). According to Wasserman and Faust (1994, p. 203), Lin (1976, pp. 340–349) was the first author who defined such an influence domain in order to construct a measure for proximity prestige.

Again, the maximum of $P_P(p_k) = 1$ where all actors are adjacent to him, so that $I_k = N - 1$ and $d_{ik} = 1$. The minimum of $P_P(p_k) = 0$ is reached, if p_k is unreachable, so that $I_k = 0$.

In addition to prestige based on indegree or proximity of actors to p_k, a measurement concept based on the prominence of actors can be defined, which is called *status or rank prestige* of p_k.[54] There, p_k is considered to have a high status or prestige, if the influence domain of p_k is full of actors, who have a high status or prestige, too. Unfortunately, to calculate this measure again some sophisticated mathematics are needed, because an actor's status or rank depends on the status or rank of the others connected to him or her and the ranks or status of those again depends on the status or rank of the others connected to them, and so *ad finitum*. Seeley (1949) first proposed a solution to this infinite chain of dependencies and this solution was subject to further discussion e.g. by Katz (1953), Hubbel (1965), Taylor (1969), Bonacich (1972a,b, 1987) or Mizruchi et al. (1986) to name only a few authors.[55]

The simplest way to express this problem of infinite chain of interdependencies is e.g. to define a rank prestige measure for the kth actor, denoted by $P_R(p_k)$, as a linear combination of rank prestige measures of the other actors in a network:

$$P_R(p_k) = z_{1k}\ P_R(p_1) + z_{2k}\ P_R(p_2) + z_{3k}\ P_R(p_3) + \cdots + z_{Nk}\ P_R(p_N)\ \forall\, k\,. \tag{5.36}$$

This leads to a system of N interdependent linear equations with N unknown variables, which can be expressed in matrix notation by

$$P = Z'P \tag{5.37}$$

with a vector $P = (P_R(p_1),\ P_R(p_2),\ P_R(p_3), \ldots, P_R(p_N))'$ of rank prestige measures for each actor and Z' as a matrix with elements $z_{ij} = z(p_i, p_j)'$ for $i \neq j$ and $i, j = 1, \ldots, N$ representing the relations between all actors. By rearrangement

$$(\Phi - Z')P = 0 \tag{5.38}$$

is obtained, which is identical to a characteristic equation usually used to extract eigenvalues and eigenvectors in an eigensystem, where P is an eigenvector of Z' corresponding to an eigenvalue of 1 and Φ standing for an identity matrix. One of various methods to tackle this problem of eigendecomposition is recommended by Katz (1953). Following him, this problem of eigendecomposition can easily be solved by (1) standardizing Z to have columns of unity, (2) extracting the

[54] Cf. Knoke and Burt (1983, pp. 206–207), Wasserman and Faust (1994, pp. 207–209) or Jansen (2003, pp. 149–153).

[55] See Wasserman and Faust (1994, pp. 207–210) or Koschützki et al. (2005, pp. 46–51) for a brief review of this literature.

eigenvalues of Z' getting at least one largest eigenvalue with a value of 1 and (3) extracting the corresponding eigenvector P from Z', whose elements are essentially the rank prestige measures from $P_R(p_1)$ up to $P_R(p_N)$.[56]

Last, but not least, some might think that a *betweenness-based measure of prestige* can also be defined, but this kind of measurement concept is virtually non-reflected in literature up to now.[57] There is a strong reason for this: All measurement concepts of prestige discussed above are based on choices received from other actors, but a betweenness-based measure has to build on the notion that an actor is between other actors and therefore he receives choices in order to give choices to other actors. Therefore, betweenness-based measures of centrality $C_B(p_k)$ and $C'_B(p_k)$ applied to directed graphs might be more useful.

In analogy with the measures of centralization, *measures of hierarchization* on the network-level can be calculated employing actor's prestige measures presented above. If we define $P_Y(p_k)$ standing for one of the three actors prestige measures defined above and $P_Y(p^*)$ as the maximum value of $P_Y(p_k)$ for any point in the network then

$$P_Y = \frac{\sum_{k=1}^{N} [P_Y(p^*) - P_Y(p_k)]}{\max \sum_{k=1}^{N} [P_Y(p^*) - P_Y(p_k)]} \tag{5.39}$$

is a measure of *network hierarchization*.[58] Accordingly, mean and variance of prestige can be calculated in order to get

$$\overline{P}_Y = \frac{1}{N} \sum_{k=1}^{N} P_Y(p_k) \tag{5.40}$$

and

$$S^2_{P_Y} = \frac{1}{N} \sum_{k=1}^{N} [P_Y(p_k) - \overline{P}_Y]^2 \tag{5.41}$$

as measures of prestige or hierarchization on the network-level.[59] $\overline{P}_Y$ will then be between 0 for an empty directed graph and 1 for a complete directed graph. $S^2_{P_Y}$ will be positive and measures how much heterogeneity is present with respect to indegree, proximity, rank or status.

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[56] See e.g. Burt (1980a, pp. 93–95), Burt (1982, pp. 33–35), Scott (1991, p. 55), Wasserman and Faust (1994, pp. 206-209), Richards and Seary (2000) and Poulin et al. (2000) for a detailed discussion of this and other more refined eigendecomposition methods.

[57] Cf. Knoke and Burt (1983, pp. 204–206) or Jansen (2003, pp. 149–149).

[58] Cf. Jansen (2003, p. 144).

[59] Cf. Wasserman and Faust (1994, p. 204) or Jansen (2003, pp. 142–143).

5.3.4.4 Refinements and Comparisons

Up to this point, four general motivations for centrality were exploited: (1) Actors are central if they are active in the network (*degree-based centrality*), (2) actors are central if they can contact others through efficient (short) paths (*closeness-based centrality*), (3) actors are central if they have the potential to mediate and/or control flows of resources or information between other actors (*betweenness-based centrality*) or (4) actors are central if they have ties to other actors that are themselves central (*rank-based centrality*).[60] But as these measures of centrality are not suitable for every instance, following refinements were proposed in the literature:

- Bonacich (1987) refined his rank-based measure of centrality introducing a beta factor which allowed him to define *power-based measures of centrality* with varying degree to which status is transmitted from one actor to another. Moreover, this beta factor permits the assessment of power in negatively connected networks.[61]
- Thinking of communication not always occurring on the shortest possible path along the geodesics like in the case of closeness-based centrality, Stephenson and Zelen (1989) constructed *information-based measures of centrality* by taking all possible paths (including the geodesics) and their information content into consideration. It focuses on the information contained in all paths originating from a specific actor, the information of an actor is then considered averaging the information in these paths, which, in turn, is inversely related to the variance in the transmission of a signal from one actor to another.
- Freeman et al. (1991) introduced *flow-based measures of centrality* based on a model of network flows.[62] Comparing it with the original betweenness-based measure of centrality, they found that they do not yield to the same results except the special case where the set of paths linking each pair of points or actors p_i and p_j is equal to the set of geodesic linking those points or actors.
- Friedkin (1991) derived three complementary measures called (1) *total effects centrality* (TEC), (2) *immediate effects centrality* (IEC) and (3) *mediative effects centrality* (MEC) out of a network effect model, which are by definition rather congruent with the rank-based, closeness-based and betweenness-based measures of point centrality already defined above.
- Furthermore, measures of centrality based on random-walks were defined e.g. by Noh and Rieger (2004) or Newman (2005) with the first closely related to closeness-based and the second to betweenness-based centrality so that it can be called *random-walk closeness* and *random-walk betweenness,* respectively. Following Noh and Rieger (2004), *random-walk closeness* is a measure of

[60] See e.g. Bolland (1988).

[61] Cf. Bonacich and Lloyd (2004) or Bonacich (2007).

[62] These centrality measures are often called *flow betweenness*, see e.g. Newman (2005) or Borgatti and Everett (2006).

relative speed with which randomly walking messages reach a player from elsewhere in the network, whereas Newman (2005) *random-walk betweenness* is appropriate to networks in which information wanders about essentially random until it finds its target and it includes contributions from many paths that are not optimal in any sense, although shorter paths still tend to count more than longer ones since it is unlikely that a random walk becomes very long without finding the target.

- While describing procedures for finding key players in a social network structure, Borgatti (2006) constructed two new measures: (1) *degree of fragmentation* defined as the average reciprocal distance among actors after removal of a given actor and (2) *degree of reach* as the weighted proportion of all actors reached by a clique, where actors are weighted by their minimum distance from the clique and only actors at distance 1 are given full weight. The first catches the amount of reduction on cohesiveness of a network structure that would occur if a key player would not be present, whereas the second describes the extent to which key players are connected to and embedded in the network around them.
- Last but not least, Ballester et al. (2006) introduced an *intercentrality measure* which takes into account both an actor's centrality and his contribution to the centrality of the others. In contrary to rank-based centrality, it does not derive from individual considerations, but from collective concerns in order to identify key players whose removal would result in the maximal decrease in overall activity.

Apart from these refinements, some authors like Freeman (1979), Bolland (1988), Nakao (1990), Wasserman and Faust (1994, pp. 198–202), Marsden (2002), Everett and Borgatti (2005) or Borgatti et al. (2006) conducted studies concerning reliability and/or applicability of centrality measures for different sorts of network structure:

- Freeman (1979) himself underwent an extensive study to show the usability of his measures of centrality. According to him, betweenness-based centrality seems to be most suitable to indicate importance of an actor in social network structure. Other important findings were that betweenness-based measures of centrality are subject to the highest and degree-based measures of centrality to the lowest variation in values.
- Bolland (1988) surveyed Freeman's measures of centrality based on degree, closeness and betweenness as well as the rank-based centrality measure by Bonacich (1972a,b), which the author named "continuous flow model" combining degree-based and closeness-based centrality. He conducted a series of analysis in order to test all four centrality measures for robustness and sensitivity under conditions of random and systematic variations in a community influence network. All four measures of centrality performed well, although all three Freeman's measures of centrality are quite sensitive to random and systematic errors. Furthermore, degree-based, closeness-based and continuous-flow-based measures of centrality were subject to high intercorrelations, suggesting quite a similarity in the measurement concept. Summing up his findings, Bolland

recommended to use betweenness-based and rank-based measures of centrality, because they are complements to each other with one based on the ability to facilitate network flow while the other is based on the ability to hinder flow.

- Nakao (1990) compared the three Freeman's measures of graph centrality C_B, C_C and C_D. For him, there is an extremely high linear association between C_C and C_D with all three closely interrelated but subject to different order of magnitude: in chain-like or decentralized networks divided into sub-clusters which are connected to each other by a line or via a focal player with a small amount of relations close to $N - 1$ the order tend to be $C_B > C_C > C_D$ whereas in one-cluster network settings coming along with many relations it changes to $C_C > C_D > C_B$.
- Wasserman and Faust (1994, pp. 198–202) showed that the centrality measures based on degree, betweenness, closeness, information and network flow as well as the alternative centrality measures by Friedkin (1991) can be applied to digraphs. But only degree-based and closeness-based measures of centrality are considered to be suitable for directed relations and therefore are recommended by them, in addition to all measures of prestige discussed in the last section.
- Marsden (2002) examined ego-centric versions of Freeman's centrality measures, focusing on edges inside the first-order zone around an ego point p_k and compared it to sociometric centrality measures calculated out of complete (socio-centric) network data. He came to the conclusion that in the case of degree-based measures of centrality both versions yield identical information, because (by definition) an ego-centric network in the first-order zone around the ego point p_k includes all other points p_i (his alter) adjacent to him. Furthermore, a betweenness-based measure of centrality in an ego-centric network will correspond imperfectly to socio-centric version, being smaller in magnitude. A simple reason to this is that for ego-centric network data, the maximum geodesic distance between two points p_i and p_j is 2, since by definition all pairs of points within the first-order zone of p_k are connected either directly or indirectly via p_k (as well as other possible connections between p_i and p_j within the ego's first-order zone). So the betweenness measure of centrality will not cover indirect linkages with a geodesic distance of length 3 and more in ego-centric networks. But comparing betweenness-based measures calculated both in the ego-centric and socio-centric versions for 17 classical network structure studies of varying network size, they find a quite high correlation between them, being usually above 0.9. In some special kinds of network structure, both measures of betweenness are identical. For example, in a complete (fully connected) graph, all points have a betweenness of 0, since there are no geodesics longer than 1 in such a network. Likewise, in a network of maximum centralization in form of a star, both centrality measures are again identical, because all peripheral points (having a betweenness of 0) are directly connected to the central ego point p_k. At last, closeness-based measures of centrality are found to be uninformative in the case of ego-centric networks since all geodesic distances from the ego point p_k to other points in the first-order zone are virtually 1 by definition.

- Everett and Borgatti (2005) again recommended betweenness-based centrality as being useful in ego-centric networks and showed a high correlation association to the socio-metric counterpart by simulating networks of different size. Furthermore, they found degree-based centrality to be virtually the same as the degree of an actor, whereas closeness-based and rank-based measures of centrality are simply not applicable because all relations outside of the first-order zone around an ego point p_k are left out.
- Finally, Borgatti et al. (2006) analyzed the robustness of measures of centrality in the face of random error in the network data. One of their key findings was that the four centrality measures based on degree, betweenness, closeness and rank are surprisingly similar with respect to deletions or additions of edges and nodes of randomly generated network data of different size. Generally, dense networks were the most robust to all error types with the notable exception of edge deletion where sparse networks were more accurately measured.

To sum up this review of measurement approaches to importance or prominence, classifications by Knoke and Burt (1983) and Borgatti and Everett (2006) are shown in order to clarify their similarities and differences.

- It were Knoke and Burt (1983) who presented a first coherent methodological framework including most of these measures of centrality, centralization, prestige and hierarchization well defined before. According to them, measures of centrality show prominence reflected by an actor's aggregate involvement in relations, his access to and control of information in a social network structure of symmetric relations, whereas prestige measures reflect the extent to which an actor is the object of relations and show a grade of difference accorded to him by others in the same networks with asymmetric relations. Furthermore, Knoke and Burt (1983) distinguished at least eight different measurement concepts as shown in Table 5.3.[63]
- Borgatti and Everett (2006) followed a graph-theoretic approach and reviewed centrality measures according to the way they are calculated in the case of undirected graphs. There, they distinguished four basic dimensions of which two are of special interest in this context: the properties of walks measured (or walk property) and the type of nodal involvement (or walk position).[64] The walk property dimension distinguishes between volume measures that evaluate the number of walks a node is involved in and length measures that evaluate the length of those walks. The walk position dimension distinguishes between radial measures that evaluate walks emanating from a node and medial measures that

[63]Originally, Knoke and Burt (1983) named their measurement concepts VAR1 to VAR5, with VAR1 equivalent to degree-based measures, VAR3 to closeness- or proximity-based measures, VAR4 to betweenness-based measures and VAR5 to rank- or status-based measures. VAR2 are measures based on connectivity or reachability, a measurement concept quite similar to degree, which was excluded from investigation.

[64]The other two are the types of walks considered (such as only geodesics, only true paths, limited length walks, and so on) and the choice of summary statistic (e.g. sum or average).

Table 5.3 Measurement concepts for prominence (Source: adapted from Knoke and Burt (1983, p. 200))

	Centrality and Centralization: Prominence in a Network of Symmetric Relations	**Prestige and Hierarchization:** Prominence in a Network of Asymmetric Relations
Volume of relations:		
Many ties: Degree or Indegree	Many actors directly and/or indirectly connected with ego	Many actors directly and/or indirectly connected to ego
Many close ties: Closeness or Proximity	Strong relations with other actors	Strong relations from other actors
Quality of relations:		
Kinds of ties: Betweeness	Involvement in all connections between actors	Involvement in all asymmetric connections between actors
Kinds of actors: Rank or Status	Strong relations with central actors	Strong relations from prestigous actors

Table 5.4 Cross-classification of centrality measures (Source: adapted from Borgatti and Everett, 2006)

	Radial (Focus on Group Membership)	**Medial** (Focus on Brokerage)
Volume (number of walks envolved)	Degree by Freeman (1979), TEC by Friedkin (1991)	Betweenness by Freeman (1979), MEC by Friedkin (1991), Freeman et al. (1991), Anthonisse (1971), Newman (2005)
	Bonacich (1972a, 1972b, 1987), Katz (1953), Hubbel (1965)	
Length		
(length of walks envolved)	Closeness by Freeman (1979), Stephenson and Zelen (1989), IEC by Friedkin (1991)	Degree of Fragmentation by Borgatti (2006)

evaluate walks passing through a node.[65] Table 5.4 shows a cross-classification of walk property (volume vs. length) and walk position (radial vs. medial) for a number of centrality measures discussed before. Centrality measures within the same quadrant can be thought of as competitive, because they are constructed likely the same way and so substitutable. In contrary, measures from different quadrants differ in fundamental ways and should be regarded at best as complementaries with the differences in walk position being more important than the distinction of counting number of walk or evaluating their length.

[65] Or in the words of Borgatti and Everett (2006, p. 481): "Whereas radial measures assess group membership, medial measures assess bridging, reminiscent of the distinction in the social capital literature of bonding social capital and bridging social capital, or closed versus open ego networks."

5.3.5 Network Constraint and Brokerage Concepts

After discussing basic measures on the individual, relational, and network level as well as measurement concepts of prominence, now a focus is set on two relational approaches of measurement. So in the following, first Burt (1992, 2000) network constraint concept in networks with structural holes is presented before a more focused measurement concept aiming at the capacity of brokerage of actors in networks with non-overlapping subgroups by Gould (1989) or Gould and Fernandez (1989) is shown. Following Marsden (2002, pp. 417–418) or Borgatti and Everett (2006, p. 474), both measurement concepts can be considered as being closely related to the already above discussed measures of betweenness-based centrality applied to ego-centric networks.

5.3.5.1 Network Constraint Concept

According to Burt (2000, pp. 346–355), a variety of network mechanisms make contradictory predictions about social capital. First, network models of prominence (as shown in the last section) argue that well connected actors perceive a high amount of social capital from their position, because they get all information available most directly. Second, if the risks associated with incomplete information provision are high, close networks, where everyone is connected with each other are generating a trustworthy environment, which creates social capital. By opposing this idea of the network closure argument, Burt (1992) described social capital as a function of brokerage opportunities in networks with structural holes separating nonredundant sources of information. Therefore, actors spanning structural holes are better off, being able to monitor and process information under their control as a source of social capital.

In order to quantify his theory of social capital in networks with structural holes, Burt (1992, pp. 51–56, 1998:Appendix, 2000:373-375 and Appendix) developed (1) a measure of *effective network size* NS_k and (2) a *network constraint index* NC_k to describe the extent to which a social network structure around k is constrained by a multitude of redundant contacts with other actors.

Following Burt (1992, pp. 51–54), *effective network size* NS_k for an actor k can be defined as

$$NS_k = \sum_{i=1|i\neq j\neq k}^{N} \left(1 - \sum_{j=1|j\neq i\neq k}^{N} p_{kj} v_{ij}\right) \forall\, k \tag{5.42}$$

with

$$p_{kj} = \frac{\left(z_{kj} + z_{jk}\right)}{\sum_{i=1|i\neq j\neq k}^{N} \left(z_{ki} + z_{ik}\right)} \forall\, k, j \tag{5.43}$$

as the proportion of k's network time and energy invested in the relationship with another actor j to whom actor i has strong ties and

$$v_{ij} = \frac{\left(z_{ij} + z_{ji}\right)}{\max\left(z_{il} + z_{li}\right)} \quad \forall\, j \neq i \neq l \tag{5.44}$$

as the marginal strength of i's relations with contact j where $\max\left(z_{il} + z_{li}\right)$ is the largest of i's relations with anyone else denoted by l. Actually, NS_k measures the amount of non-redundant contacts, as the bracketed term equals 1 if i is completely disconnected from all other primary contacts in the network. If relations between i and other contacts strengthen, the bracketed term approaches p_{ki}, indicating that i is completely redundant with other contact in k's network. Therefore, NS_k varies between 1, indicating the network only provides a single contact, and N, indicating that every contact in the network is non-redundant.

Thinking again of k engaged in a relationship with another actor i, his *contact-specific constraint* can be expressed as

$$c_{ki} = \left(p_{ki} + \sum_{j=1|j\neq i\neq k}^{N} p_{kj}\, p_{ji}\right)^2 \quad \forall\, k, i \tag{5.45}$$

where

$$p_{ki} = \frac{z_{ki}}{\sum_{j=1|j\neq i\neq k}^{N} z_{kj}} \quad \forall\, k, i \tag{5.46}$$

is the proportion of k's time and energy invested in a direct relationship with i and the other fraction in parentheses is an expression for the proportion of k's relationships in redundant contacts j, because k invested in other direct relationships with third actors j at the same time, who in turn invested in a relationship with i, too.[66] Being a squared sum of these valuations of direct and indirect relationships between k and i, c_{ki} varies from a minimum constraint of p_{ki}^2 (i is disconnected from all other contacts of k) up to maximum constraint equal to 1 (if i is the only contact). Summing up all these contact-specific constraints of k leads to the *network constraint index* NC_k with

$$NC_k = \sum_{i=1|i\neq k}^{N} c_{ki} = \sum_{i=1|i\neq k}^{N} \left(p_{ki} + \sum_{j=1|j\neq i\neq k}^{N} p_{kj}\, p_{ji}\right)^2 \quad \forall\, k\,. \tag{5.47}$$

[66] See Burt (1992, pp. 54–55), Burt (1998, Appendix) or Burt (2000, Appendix) for further details.

Following Burt (2000, p. 373), NC_k is high if actors in a social network structure are directly connected to each other (like in a dense network) or indirectly connected via a central actor (like in a hierarchical network) or in his words:

> "More constrained networks span fewer structural holes, which means less social capital according to the hole argument. *If networks that span structural holes are the source of social capital, then performance should have a negative association with network constraint*. More constraint means more network closure, and so more social capital according to the closure argument. *If network closure is the source of social capital, then performance should have a positive association with constraint.*"

Furthermore, it can be shown that NC_k varies in three other measures of social network structure, namely (1) network size, (2) network density and (3) network hierarchy. By binomial expansion, c_{ki} and NC_k can be restated as

$$c_{ki} = p_{ki}^2 + 2p_{ki} \sum_{j=1|j \neq i \neq k}^{N} p_{kj}\, p_{ji} + \left(\sum_{j=1|j \neq i \neq k}^{N} p_{kj}\, p_{ji} \right)^2 \ \forall\, k, i \tag{5.48}$$

and

$$NC_k = \sum_{i=1|i \neq k}^{N} p_{ki}^2 + 2 \sum_{i=1|i \neq k}^{N} p_{ki} \sum_{j=1|j \neq i \neq k}^{N} p_{kj}\, p_{ji} + \sum_{i=1|i \neq k}^{N} \left(\sum_{j=1|j \neq i \neq k}^{N} p_{kj}\, p_{ji} \right)^2 \ \forall\, k. \tag{5.49}$$

Then, the last expression can be regarded as a sum of three components called *NC-size*, *NC-density* and *NC-hierarchy*.[67] All these three components reach a high value for an actor k being constrained and can be interpreted as follows:

- First, constraint is more severe in smaller networks, because if there are only few members in a network structure they have few alternative contacts to provide information and opportunistic play against the others. Furthermore, p_{ki} decreases on average as the total number of relationships increases. The *NC-size* component captures this fact as a Herfindal index measuring the extent to which k's relationships are concentrated in a single contact.
- Second, constraint is more severe in more dense network structure, because this contains, in effect, fewer alternative contacts. Furthermore, strongly intertwined contracts are more likely to provide identical information, and it is then more difficult for each actor to play opportunistically against another. In a more dense network, there are more indirect relationships, which can be quantified either by *ND* or by the *NC-density* component measuring the extent to which k's strongest relationships are strongly tied to his other contacts.

[67] Cf. Burt (1998, Appendix, 2000, Appendix).

- Third, constraint is more severe in more hierarchical network structures, because they again contain, in effect, fewer alternative contacts. As network structure is more hierarchical to the extent that it is organized around a single contact, k is more constrained when this contact has exclusive relations with k's other relationships. Therefore, the *NC-hierarchy* component measures the extent to which k's contacts concentrate their relations on one central contact in the network.[68]

5.3.5.2 Brokerage in Networks with Non-overlapping Subgroups

Gould and Fernandez (1989, pp. 92–102) (1) proposed a formal definition of brokerage in networks with non-overlapping subgroups, (2) showed that these structures correspond to intuitive and meaningful brokerage roles and (3) developed a set of quantitative measures based on the concept of betweenness.

In first instance, any brokered relationship between two actors (one called *sender* or *first-party* denoted as p_i and one *receiver* or *second-party* denoted as p_j) can be seen as a set of relations forming a triad where the third actor (denoted as p_k) is involved in their relationship as a *third-party* in-between called intermediary, agent or broker.[69] Assuming that there is no other direct relationship between p_i and p_j, a two-step path with (p_i, p_k) and (p_k, p_j) is a set of brokerage relations forming the triad. Summing up these two-step paths for e.g. a particular p_k leads to *individual raw brokerage scores* standing for total capacity for brokerage. Following Freeman (1977) concept of betweenness, a *partial brokerage score* can also be defined to reflect the extent to which p_k is in control of the path (p_i, p_k) and (p_k, p_j) given any p_i and p_j. But two possible situations have to be taken into account: (1) p_k is the only intermediary between p_i and p_j with maximum control and partial brokerage score of 1 or (2) there are k intermediaries between p_i and p_j, each with a partial brokerage score of $1/k$.[70] Which form of brokerage measure is employed in an analysis of brokerage roles depends on the focus of an analysis (Gould and Fernandez (1989, p. 98)):

> "If the researcher is interested in the number of brokerage relations an actor is capable of mediating, the appropriate measure is the absolute number of paths on which the actor lies; this corresponds to the individual's total capacity for brokerage. If, on the other hand, the central issue is the degree to which the actor actually controls brokerage relations in the network, then the appropriate measure is the partial [brokerage] score."

[68] Burt (1998, Appendix, 2000, Appendix) proposed two alternative measures of network hierarchy: (1) the Coleman-Theil disorder index applied to contact-specific constraint scores as developed first in Burt (1992, pp. 70–71) and (2) the betweeness-based measure of point centrality $C_b(p_k)$ by Freeman (1977) as already defined in the last section measuring the extent to which one contact stands in between all others.

[69] Strictly speaking, the terms sender and receiver imply to some extent directed relations from a sender to a receiver. So in the following, the terms first- and second-party instead of sender and receiver are used in order to indicate that these relations may be mutual.

[70] Cf. Gould (1989, p. 537) or Gould and Fernandez (1989, p. 98).

In addition to this, the three actors forming a triad can be members of distinct non-overlapping subgroups, so that exactly five structurally different types of brokerage relations can occur as shown in Fig. 5.2: [71]

- All actors may belong to the same subgroup, so that the brokered relationship is completely internal to the group, and the intermediary therein involved can be regarded as a *local broker* or *coordinator*.
- If both p_i and p_j belong to the same subgroup while p_k is staying outside as a member of another subgroup, then the intermediary can be called an *itinerant broker* or *cosmopolitan*.
- If the p_j and p_k form a subgroup and p_i is in another, the intermediary is considered as a *gatekeeper*, acting as a second-party's agent *vis-à-vis* the first-party.

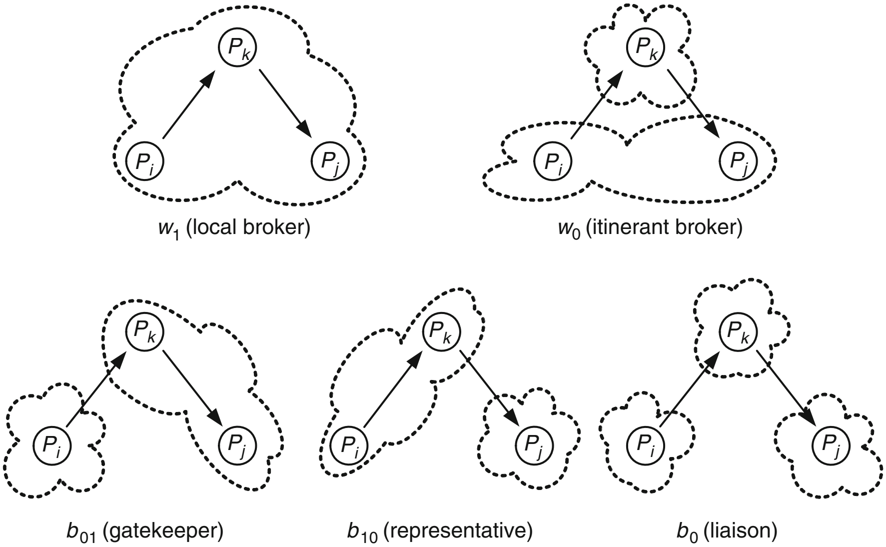

Fig. 5.2 Graphic representation of five different types of brokerage. (Source: adapted from Gould and Fernandez (1989, p. 93))

[71]Notably, this classification of brokerage roles draws heavily reference to individual communication roles in organizations as defined by Rogers and Agarwala-Rogers (1976, pp. 132–140) proposing a four-fold typology with (1) gatekeepers, (2) liaison, (3) opinion leaders and (4) cosmopolites or boundary spanners. Whereas the gatekeeper and liaison role is defined exactly in the same way as in Rogers and Agarwala-Rogers (1976) and the opinion leader corresponds to the local broker or coordinator, they defined the cosmopolite or boundary spanner as an individual who has a relatively high degree of communication with the outside environment of an organization so that it corresponds at best with the representative role as defined by Gould and Fernandez (1989). Further, as Rogers and Agarwala-Rogers (1976) set a focus on communication networks in organizations, they did not define a counterpart to Gould and Fernandez (1989) itinerant broker or cosmopolitan.

- Conversely, if p_i and p_k form a subgroup excluding p_j, the intermediary is called a *representative*, because he is the agent of the first-party representing him *vis-à-vis* the second-party.
- Last but not least, all three actors can be members of different subgroups, so that the intermediary's brokerage role is simply to act as a third-party to link two members of distinct subgroups in a *liaison*.

These five types of brokerage represent specific structural positions as concrete brokerage roles in triads that actors can occupy forming a social network structure. But it is worth to mention that while any given brokerage relationship falls into one of these five categories, an individual actor having several relationships with other actors can serve of course different brokerage roles simultaneously.

In order to construct now measures for brokerage roles, Gould and Fernandez (1989) defined an *actor's total raw brokerage score* for the kth intermediary

$$T_k = w_{1k} + w_{0k} + b_{01k} + b_{10k} + b_{0k} \;\forall\; k \tag{5.50}$$

as the sum of five *individual raw brokerage scores* for the kth intermediary

$$w_{1k} = \sum_{i=1|i\neq k}^{N} \sum_{j=1|j\neq i\neq k}^{N} w_1(ij)\, o(ij)$$

with $o(ij) = 1$, if $z_{ij}(o) = z_{ik}(o) = z_{kj}(o) = 1$ and $w_1(ij) = 1$ if a set of relations is between p_i, p_k and p_j, and else 0

$$w_{0k} = \sum_{i=1|i\neq k}^{N} \sum_{j=1|j\neq i\neq k}^{N} w_0(ij)\, o(ij)$$

with $o(ij) = 1$, if $z_{ij}(o) = 1$ but $z_{ik}(o) = z_{kj}(o) = 0$ and $w_0(ij) = 1$ if a set of relations is between p_i, p_k and p_j, and else 0

$$b_{01k} = \sum_{i=1|i\neq k}^{N} \sum_{j=1|j\neq i\neq k}^{N} b_{01}(ij)\, o(ij)$$

with $o(ij) = 1$, if $z_{kj}(o) = 1$ but $z_{ij}(o) = z_{ik}(o) = 0$ and $b_{01}(ij) = 1$, if a set of relations is between p_i, p_k and p_j, and else 0

$$b_{10k} = \sum_{i=1|i\neq k}^{N} \sum_{j=1|j\neq i\neq k}^{N} b_{10}(ij)\, o(ij)$$

with $o(ij) = 1$, if $z_{ik}(o) = 1$ but $z_{ij}(o) = z_{kj}(o) = 0$ and $b_{10}(ij) = 1$, if a set of relations is between p_i, p_k and p_j, and else 0

$$b_{0k} = \sum_{i=1|i\neq k}^{N} \sum_{j=1|j\neq i\neq k}^{N} b_0(ij)\, o(ij)$$

with $o(ij) = 1$, if $z_{ij}(o) = z_{ik}(o) = z_{kj}(o) = 0$ and $b_O(ij) = 1$, if a set of relations is between p_i, p_k and p_j, and else 0

(5.51)

for all k corresponding to each different type of brokerage defined above where $z_{ij}(o) = 1$ stands for p_i and p_j being in the same subgroup and $z_{ij}(o) = 0$ for p_i and p_j being in different subgroups, respectively.

Accordingly, an *actors's total partial brokerage score* for the kth intermediary can be defined as

$$T_k^* = w_{1k}^* + w_{0k}^* + b_{01k}^* + b_{10k}^* + b_{0k}^* \ \forall\, k \tag{5.52}$$

being again a sum of five *individual partial brokerage scores* for the kth intermediary

$$w_{1k}^* = \sum_{i=1|i \neq k}^{N} \sum_{j=1|j \neq i \neq k}^{N} \frac{w_1(ij)}{p_{ij}(p_k)}\, o(ij)$$ with $o(ij) = 1$ if $z_{ij}(o) = z_{ik}(o) = z_{kj}(o) = 1$ and $w_1(ij) = 1$ if a set of relations is between p_i, p_k and p_j, and else 0

$$w_{0k}^* = \sum_{i=1|i \neq k}^{N} \sum_{j=1|j \neq i \neq k}^{N} \frac{w_0(ij)}{p_{ij}(p_k)}\, o(ij)$$ with $o(ij) = 1$, if $z_{ij}(o) = 1$ but $z_{ik}(o) = z_{kj}(o) = 0$ and $w_0(ij) = 1$, if a set of relations is between p_i, p_k and p_j, and else 0

$$b_{01k}^* = \sum_{i=1|i \neq k}^{N} \sum_{j=1|j \neq i \neq k}^{N} \frac{b_{01}(ij)}{p_{ij}(p_k)}\, o(ij)$$ with $o(ij) = 1$, if $z_{kj}(o) = 1$ but $z_{ij}(o) = z_{ik}(o) = 0$ and $b_{01}(ij) = 1$, if a set of relations is between p_i, p_k and p_j, and else 0

$$b_{10k}^* = \sum_{i=1|i \neq k}^{N} \sum_{j=1|j \neq i \neq k}^{N} \frac{b_{10}(ij)}{p_{ij}(p_k)}\, o(ij)$$ with $o(ij) = 1$, if $z_{ik}(o) = 1$ but $z_{ij}(o) = z_{kj}(o) = 0$ and $b_{10}(ij) = 1$, if a set of relations is between p_i, p_k and p_j, and else 0

$$b_{0k}^* = \sum_{i=1|i \neq k}^{N} \sum_{j=1|j \neq i \neq k}^{N} \frac{b_0(ij)}{p_{ij}(p_k)}\, o(ij)$$ with $o(ij) = 1$, if $z_{ij}(o) = z_{ik}(o) = z_{kj}(o) = 0$ and $b_0(ij) = 1$, if a set of relations is between p_i, p_k and p_j, and else 0

(5.53)

for all k and $p_{ij}(p_k) \neq 0$ corresponding to each different type of brokerage defined above, where $p_{ij}(p_k)$ is the number of two-step paths with p_k between p_i and p_j, $z_{ij}(o) = 1$ again stands for p_i and p_j being in the same subgroup and $z_{ij}(o) = 0$ for p_i and p_j being in different subgroups.[72]

[72]This mathematical expression of the kth intermediary's raw brokerage scores is adapted from Gould (1989), which is a refinement of the original formulation by Gould and Fernandez (1989). Further, it is worth to mention, that w_{1k} and w_{0k} are not expressed in the most parsimonious way, but this is done to show a consistent set of equations.

To show that these formal expressions make sense, let us look a little bit closer at b^*_{01k} as one out of five individual partial brokerage scores of the kth intermediary. There, three actors, namely a first-party (denoted as p_i), a second-party (denoted as p_j) and the intermediary (denoted as p_k) form a triad. The brokerage role of the kth intermediary is a between-group brokerage of the gatekeeper-type (indicated by b standing for between-group brokerage) with the intermediary and the second-party belonging to the same subgroup ($z_{kj}(o) = 1$, indicated by the subscript 1), whereas the first-party is a member in another distinct subgroup ($z_{ij}(o) = z_{ik}(o) = 0$, indicated by the subscript 0).

Next, it is easy to see that each of these five measures can be split up in two different subgroups: (1) *within-group brokerage scores* w_{Ik} and w_{Ok} (or w^*_{Ik} and w^*_{Ok}) on one hand and (2) *between-group brokerage scores* b_{OIk}, b_{IOk} and b_{Ok} (or b^*_{OIk}, b^*_{IOk} and b^*_{Ok}) on the other which can be summarized by

$$w_k = w_{1k} + w_{0k} \text{ or } w^*_k = w^*_{1k} + w^*_{0k} \quad \forall\, k \tag{5.54}$$

and

$$b_k = b_{01k} + b_{10k} + b_{0k} \text{ or } b^*_k = b^*_{01k} + b^*_{10k} + b^*_{0k} \quad \forall\, k \tag{5.55}$$

for each actor with respect to both his brokerage roles and his subgroup memberships. In addition to this, each individual raw brokerage score can be summed up to get *global raw brokerage scores* as well as *global partial brokerage scores* on the complete network level:

$$\begin{aligned}
W_1 &= \sum_{k=1}^{N} w_{1k} & W^*_1 &= \sum_{k=1}^{N} w^*_{1k} \\
W_0 &= \sum_{k=1}^{N} w_{0k} & W^*_0 &= \sum_{k=1}^{N} w^*_{0k} \\
B_{01} &= \sum_{k=1}^{N} b_{01Ik} & B^*_{01} &= \sum_{k=1}^{N} b^*_{01k} \\
B_{10} &= \sum_{k=1}^{N} b_{10k} & B^*_{10} &= \sum_{k=1}^{N} b^*_{10k} \\
B_0 &= \sum_{k=1}^{N} b_{0k} & B^*_0 &= \sum_{k=1}^{N} b^*_{0k} \\
W &= W_1 + W_0 & W^* &= W^*_1 + W^*_0 \\
B &= B_{01} + B_{10} + B_0 & B^* &= B^*_{01} + B^*_{10} + B^*_0.
\end{aligned} \tag{5.56}$$

Unfortunately, all these measures of brokerage roles depend heavily on network size, type of brokerage and size of subgroups under observation, but Gould and

Fernandez (1989, pp. 102–115) developed a test statistic which is assumed to follow sufficiently a standard normal distribution for large networks of about $N = 15$ for global scores and $N = 30$ for individual scores.

5.4 Summary and Concluding Remarks

In this part of the book, a closer look on contemporary social network analysis was offered. After reviewing shortly the various streams of research that led to contemporary social network analysis, the level of analysis and the graph-theoretic expression of measures to assess social network structures were presented with a focus laid on (1) actors and their personal network around them (micro- or ego-centric perspective) as well as (2) network structures as a whole (macro- or socio-centric perspective). For both levels of analysis, several distinct measurement concepts were outlined and discussed.

All in all, this wide field of contemporary social network analysis can look back to a tremendous development since initial treatments by Simmel (1908) with a highly accelerating speed after the mid 1970s, as e.g. Borgatti and Foster (2003) showed by counting publications indexed by Sociological Abstracts containing 'social network' in the abstract or title. What is left to do is to indicate, how these measures can be best applied to empirical data of social network structures. This seems to be a rather neglected field of research only with a few notes e.g. about applicability of centrality measures by Borgatti (1995, 2005), a discussion of personal networks by McCarty and Wutich (2005) or measurement issues of social capital by Borgatti et al. (1998) and Täube (2002, pp. 134–201, 2004) which will be outlined now.

First, Borgatti (1995, 2005) attempted to interpret centrality measures by their underlying network flow in order to show which measure is fully applicable to which specific network flow. Doing this, Borgatti (2005) distinguished between two dimensions of variation, namely (1) the kinds of trajectories that traffic may follow (geodesics, paths, trails or walks) and (2) the method of spread (serial or parallel duplication and transfer) which collapses to a matrix in the context of this work as shown in Table 5.5.[73] There, four representative network flow processes are mentioned:

- Betweenness- as well as closeness-based measures of centrality by Freeman (1979) imply a *package delivery process* with fixed destination or target. Whereas *closeness centrality* can be interpreted as an index of expected time-until-arrival of something flowing through a network structure, *betweenness centrality* stands for frequency of arrival: It provides expected values for how often something

[73]The category of serial duplication refers to network flows of miotic reproduction, viral infection or gossip and is therefore not of interest in the context of this work.

Table 5.5 Network flow typology of centrality measures (Source: adapted from Borgatti (2005))

	Parallel duplication (Broadcast)	**Transfer** (Movement)
Geodesics	–	**Package Delivery:** Betweenness by Freeman (1979), Closeness by Freeman (1979)
Paths or trails	**Information diffusion:** Closeness by Freeman (1979), Degree by Freeman (1979)	–
Walks	**Attitude influence:** Closeness by Freeman (1979), Bonacich (1972a, 1972b, 1987) IEC by Friedkin (1991), Katz (1953), Hubbel (1965), Taylor (1969), Stephenson and Zelen (1989)	**Money exchange:** Newman (2005), Noh and Rieger (2004)

passes a given point (Borgatti, 1995). The package itself can be regarded as a solid, indivisible object that can only be once in one place at a time like a parcel or documentary paperwork, which moves (hopefully) on the shortest possible path through a network.

- As the image of the *money exchange process* is a solid, indivisible object like a banknote following a random walk process, the refinements of *random-walk closeness* (Noh and Rieger, 2004) or *random-walk betweenness* (Newman, 2005) fit best to this kind of network flow.
- In an *information diffusion process*, a message spreads by replication (serial as well as parallel duplication) rather than by transference and normally does not pass the same link twice but can pass the same point multiple times.[74]Therefore, *degree centrality* as well as *closeness centrality* by Freeman (1979) are recommenced with degree centrality as a measure of immediate influence or the probability of receiving something that is randomly distributed in a network structure which is entirely a function of the number of relations that a given actor has.
- If parallel duplication is assumed to take place via unrestricted walks rather than being constrained by trails, paths or geodesics, it can be regarded as an *attitude influence process*: The idea is that even if an actor influences just one other actor, who influences many others who themselves influence still more others (and so on), then the first actor is highly influential. Again *closeness centrality* by Freeman (1979), together with its refinements by Stephenson and Zelen (1989) or Friedkin (1991), is proposed. Furthermore, *rank-based centrality measures* by Bonacich (1972a,b, 1987) as well as other *measures of prestige* by Katz (1953), Hubbel (1965) or Taylor (1969) based on eigenvector constructs can be employed, which catch the essence of this influence process.

[74]More definite, trails are paths, where a point may be reached more than once in a sequence of points but not adjacent ones, see e.g. Borgatti (1995).

Table 5.6 Measures for social capital (Source: adapted from Borgatti et al. (1998))

Measure	Graph-theoretic description	Relation to social capital
NS_{ego}	The number of alters that an ego is directly connected to	Positive: The more people you have relationships with, the greater the chance that one of them has the resource you need
ND	The proportion of pairs of alters that are connected	Negative: If all your alters are tied to each other, they are redundant. Given limits on relational energy, need to put eggs in more than one basket
NS_k	The number of alters, weighted by strength of tie that an ego is directly connected to	Positive: The more different regions of the network an actor has ties with, the greater the potential information and control benefits
NC_k	The extent to which all of ego's relational investments directly or indirectly involve a single alter	Negative: The more constrained the actor, the fewer opportunities for action
$C_B(p_k)$	The number of times that ego falls along the shortest path between two other actors	Positive: Actors with high betweenness link together actors who are otherwise unconnected, creating opportunities for exploitation of information and control benefits
$C_C(p_k)$	The total graph theoretic distance from ego to all others in network	Negative: The greater the distance to other nodes, the less the chance of receiving information in a timely way
$C_R(p_k)$	The extent to which ego is connected to nodes who are themselves high in eigenvector centrality	Positive: An actor has high eigenvector scores when they are connected to well-connected others

Second, McCarty and Wutich (2005) discussed arguments for including or excluding an ego from structural analyses of personal networks. For them, there are three possibilities present: (1) leaving ego out, (2) including ego with forced ties to all alters and (3) including but allowing null ties between ego and some subset of alters. Which one is right, depends again on the type of network flow under observation. As in the first option ego is excluded, his role in such a network structure can be regarded as a totally passive one – having no control over network flow and therefore being just a receiver of information and/or resources. In contrary to this, if ego is connected to all alters, he (or she) will dominate the network structure and therefore this approach should only be followed if his (or her) overwhelming influence is a valid question. As (1) and (2) imply special cases of network flow, the third option seems to be the most appropriate approach to personal network structure as it allows ego to have no direct relationship with some alters.

The third topic is about approaches to measure social capital. Unlike the relational and structural aspects of embeddedness which are directly covered by various measures from this section, the identification and measurement of social capital is not as clear. However, Borgatti et al. (1998) suggested several measures already presented that might be used to formalize the notion of social capital.[75] Assuming social capital to be a network structure effect as the value of an individual's social relationships (Burt, 1992), they proposed NS_{ego} and ND to describe ego's personal network, NS_k and NC_k to cope with the impact of structural holes and $C_B(p_k)$, $C_C(p_k)$ as well as $C_R(p_k)$ to explore ego's network position as shown in Table 5.6, together with their relationship to social capital according to conventional wisdom. Furthermore, Täube (2002, pp. 134–201, 2004) showed, how social capital can be measured employing the brokerage roles concept by Gould (1989) or Gould and Fernandez (1989). Dividing the characteristics of social capital in (1) support capital of strong ties for which locals are particularly important and (2) leverage capital of weak ties as well as structural holes which is the domain of cosmopolitants, he asserted locals to be of a coordinator or representative type with cosmopolitans to serve liaison, gatekeeper and itinerant brokerage roles. By making use of Hummel and Sodeur (1987) census of triadic role patterns, he demonstrated how these brokerage roles can help to identify locals (coordinators or representatives) and cosmopolitans (itinerants or gatekeepers) in social network structures. Alternatively, $C_C(p_k)$ is used for the general distinction between brokers and non-brokers on one hand and for the differentiation between locals and cosmopolitans on the other with a rank ordering of $C_C(\text{locals}) > C_C(\text{cosmopolitans}) > C_C(\text{non-broker})$. Furthermore, $C_B(p_k)$ allows to distinguish between itinerants and gatekeeper types of cosmopolitans as $C_B(\text{itinerant}) > C_B(\text{gatekeeper}) > C_B(\text{coordinator}) > C_B(\text{liaison and others})$.

[75] More precisely, they proposed measures for three different conceptions of social capital of which only one is of interest in this context.

Chapter 6
Freight Forwarder's Personal Network in Multimodal Transport Chains: An Empirical Investigation

So far in this piece of work, the topic of freight forwarding in multimodal transport chains with a leg by sea or air was described and theoretically reflected from different perspectives. After reviewing the forwarding business from a legal and functional point of view, contemporary multimodal chains with a leg by sea or air were described based on desk research in Part 2 as a status quo for further theoretical treatments. In Chapter 3 freight forwarder's intermediary role as a strange hybrid providing all kinds of transport and logistics services as well as financial intermediation on behalf and account of his clients was clarified well grounded in NIE, MMT and ITF. Seeing that such multimodal transport chains cannot be considered as a conglomerate of isolated bilateral or trilateral relationships, a network perspective of freight forwarding in multimodal transport chains with a leg by sea or air was developed in Chapter 4. There, the social network approach with SNA as a measurement concept showed the highest usability in the context of this work and therefore, relevant measurement concepts of e.g. network size and density, centrality or brokerage capacity and their connection to the notion of social capital were worked out in Chapter 5. Now it is time to show, whether actual business practice supports the assertions made and conclusions drawn before. This is done by analyzing empirical social network structure data from freight forwarders engaged in multimodal transport chains including a leg by sea or air in Germany and Austria.

6.1 Survey Design

In the following, a generic multimodal transport chain model is derived from insights generated during the predecing research process of finding a suitable theoretical framework in Chapters 3 and 4 of this work. Then, levels of analysis are determined and appropriate analytical instruments are discussed to unveil the social

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network structure as well as the amount of social capital employed. Furthermore, as freight forwarding in such multimodal transport chains takes place in an overall complex international to global environment, environmental control parameters are introduced which help to approximate the heterogeneity of the international to global environment where these freight forwarders are operating.

6.1.1 A Generic Multimodal Transport Chain Model

Referring to the inherent network structure of multimodal transport chains including a leg by sea and air, some efforts can already be remarked:

- In Sect. 2.2.1, three distinct general approaches to analyze transport chains according to Beplat (1970:17–25) were described (namely functional, institutional and a combination of both).
- In Sect. 2.2.4, the inter-organizational interaction and cargo movement at sea and airports were shown, following the approach of Martin and Thomas (2001).
- In Sect. 4.4.2, a stylized model of hierarchical network structures in multimodal transport chains based on a system of schematic diagrams by Casson (1993, 1997a, 1997c) was established.

Now, for the following empirical investigation, a generic multimodal transport chain model is needed which allows to assess the social network structure around a freight forwarder. It follows the combined approach by Beplat (1970:17–25)

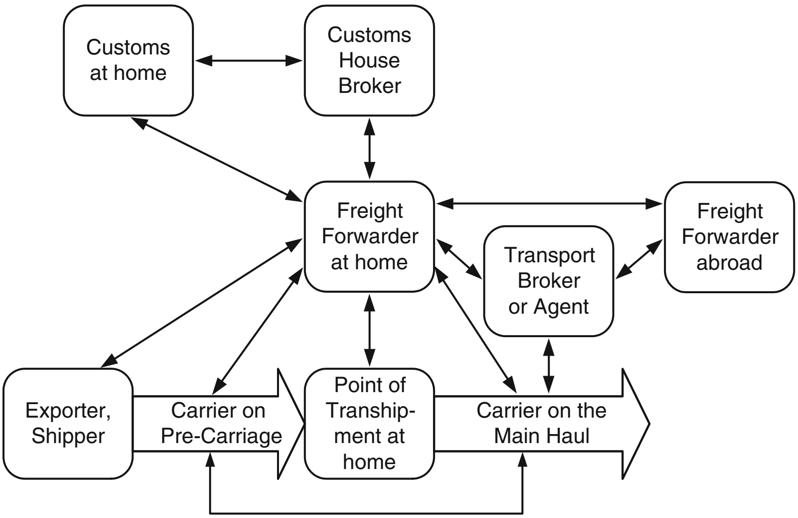

Fig. 6.1 Freight forwarder's personal network in export operations

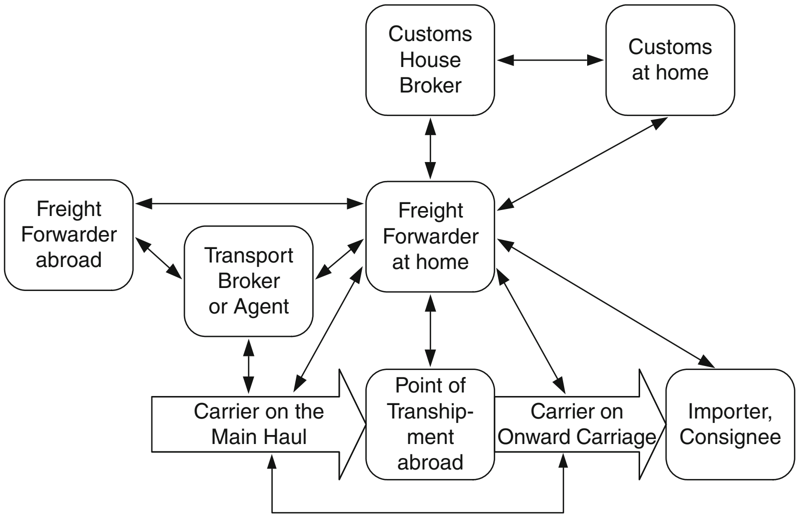

Fig. 6.2 Freight forwarder's personal network in import operations

as depicted in Figs. 6.1 and 6.2. Here again, nodes are standing for persons or institutions being part of a multimodal transport chain which were connected by two types of lines: (1) big arrows as directed transport links indicating physical movement of shipments by some carrier from one place to another without further determining the mode of transport employed and (2) bidirectional lines representing all kinds of business relationships apart from simple exchange of cargo and their accompanying documentary paperwork. At the bottom, the subsequent steps of physical goods movement in a multimodal transport chain originating from a shipper (exporter) to a consignee (importer) are shown with carriers and transhipment terminals in between. Above this, the freight forwarder at home as "The Architect of Transport" is considered to act upon request as a full service intermediary between his principal (usually the shipper or consignor) and the other participants involved in actual goods movement, organization of shipment flow and/or handling documentary paperwork needed.

Being quite puzzling in first instance, this stylized model framework of a multimodal transport chain as shown in Figs. 6.1 and 6.2 can be used for both multimodal transport chains under consideration in this contribution, because apart from different naming of the participants, unit loads used, mode specific legal regimes and special business usances (see Table 6.1), both show principally the same social network structure. This is especially true, if we compare full-container-loads (FCL) and air freight consignments as multimodal door-to-door shipments from a shipper towards a consignee without break-bulk cargo or stuffing and stripping seagoing containers or unit load devices in transit.

Of course, much more other possible multimodal transport chain participants can be taken into consideration, but these depicted here seem to be the most crucial

Table 6.1 Comparison of multimodal transport chains with a leg by sea or air

Stylized model framework	SEA	AIR
Transport mode on the main haul	Main haul by sea	Main haul by air
Carrier on the main haul	Shipping company	Airline
organizational forms on pre- and onward carriage legs	Carrier haulage or merchant haulage	Airline trucking, shipper or agent trucking
Points of transhipment	Container terminal at seaport	Cargo terminal at airport
Main actor at transhipment	Terminal operator	Ground handler
Types of transport brokers	Loading broker, discharging broker or non-vessel operator	Air freight broker or non-vessel operator
Types of transport agents	Shipping or liner agent	IATA sales agent
Unit loads used	Seagoing containers	Unit load devices
Legal regime	Hague, Visby or Hamburg Rules	Warsaw or Montreal Convention
Accompanying transport document	Bill of Lading (B/L) or sea waybill (SWB)	Air waybill (AWB)
Applicable trade terms according to INCOTERMS 2000	EXW, FCA, FAS, FOB, CFR, CIF, CIP, CPT, DES, DEQ, DAF, DDU, DDP	EXW, FCA, CPT, CIP, DAF, DDU, DDP
Applicable trade terms according to INCOTERMS 2010	EXW, FCA, FAS, FOB, CFR, CIF, CIP, CPT, DAP, DAT, DDU, DDP	EXW, FCA, CPT, CIP, DAP, DAT, DDP

ones, as shown by Cisic et al. (2000a, 2000b), Pocuca et al. (2000), Kylaheiko et al. (2000), Neiberger (2007, 2008) or UN/CEFACT (2000)[1]:

- By analyzing goods and documentary paper flows in a sea transport chain well documented in Cisic et al. (2000a, 2000b), Pocuca et al. (2000) and Kylaheiko et al. (2000) a similar network structure evolved with buyer, seller, shipper, forwarder, shipping agent, customs broker, shipping company and cargo handling company being the most active and central participants therein.
- In a survey about freight forwarding companies engaged in air cargo operations at Frankfurt-on-Main and Schiphol, Neiberger (2007, 2008) ended in an analogue network structure of goods and communication flows with the air freight forwarder as the central figure in between the exporter, consignee, overland transportation carriers for pre- and onward carriage, warehousing service providers for temporary storage, ground handling agents and airline actual transporting cargo on the main haul.

[1]Notably, Stefansson (2004, 2006) developed a collaborative logistics management model to describe logistics outsourcing setups likely in the same way, where three groups of third-party service providers (namely carriers, logistics services providers and logistics service intermediaries) offer their services to the clients denoted by shipper and receiver. But apart from analyzing material and information links between actors, he conducted a series of case studies and focused on the interfaces of these links and their attributes.

- Last but not least, the Business Process Analysis Working Group (BPAWG) of the United Nations Centre for the Facilitation of Procedures and Practices for Administration, Commerce and Transport (UN/CEFACT) worked out their BPAWG Model for international supply chains based on UN/CEFACT Unified Modelling Methodology.[2] It covers "all stages following the recognition of need by a customer for a product or service to the fulfilment of an order by a supplier and the resulting financial settlement [and] it incorporates any necessary activities carried out by intermediaries and authorities." (UN/CEFACT 2000). While modelling about 31 different actors (and defining their roles) potentially engaged in such international supply chains between buyer and seller and their goods movements or data flows in between, the BPAWG Model shows again the freight forwarder as one of the key intermediaries in international goods movements.[3] Other actors engaged in goods movements are carriers (and their agents) on the main haul by road, rail, sea, air or postal service, transhipment points like sea or airports (denoted by receiving authorities in export and import) as well as customs and health authorities in the country of the buyer and seller.[4]

A quite natural approach of modelling such network structures – apart from just visualizing them in form of a graph – is to quantify these points and their connections in order to describe them mathematically, which will be assessed in the next sections.

6.1.2 Levels of Analysis and Analytical Instruments

As the business relationships between the actors on this generic multimodal transport chains model as shown in Figs. 6.1 and 6.2 sum up to an undirected graph, several analytical instruments from contemporary social network analysis on the actor level as well as the network level as outlined in Sect. 5.3 can be employed, which will be described in the next two sections. After that, four environmental

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[2]This is a further development of the former UN/CEFACT International Trade Transaction Model (ITT), see UN/CEFACT (2000). Further, for more about the underlying UN/CEFACT Unified Modelling Methodology see http://www.untmg.org/specifications/.

[3]According to UN/CEFACT (2000), a freight forwarder is "[an] intermediary employed by buyer or seller (depending on the terms of trade [sic!]) who may carry out a variety of tasks concerned with the movement of goods. These can include collection and transport of goods and the completion of an export declaration on the exporter's behalf."

[4]According to UN/CEFACT (2000), a receiving authority in export is "[a] body (normally a Port or Airport Authority) who has responsibility for receiving the goods, for their safe storage and the loading of the goods onto the transport," whereas in import it is "[a] body within the maritime regime (normally the Port Authority) who has responsibility for the safe unloading of the goods from the vessel." Designating them as "receiving authorities" may point to the fact, that sea- or airports can be regarded as private intermediaries and public authorities at the same time, see e.g. Martin and Thomas (2001) or Sect. 2.2.4.2.

control parameters are derived to assess possible impacts of different countries of destination or departure on the sample.

6.1.2.1 Personal Network Structure and Position

Whereas the unit of analysis in contemporary social network analysis can vary between micro, meso and macro perspective, analytical instruments can be divided in a relational and a positional approach (see Tables 5.1 and 5.2). Following this taxonomy, ego's personal network structure of a freight forwarder can be described by measures of network size and density (NS_{ego} and ND) as well as by measures of prominence ($C_D(p_k)$, $C_B(p_k)$, $C_C(p_k)$ and $C_R(p_k)$) that give information about his position therein. Furthermore, Table 6.1 offers a network flow typology of measures which help to interpret values of $C_D(p_k)$, $C_B(p_k)$, $C_C(p_k)$ and $C_R(p_k)$ in a transport chain context. Moreover, most of these measures can be at the same time easily interpreted as an expression of the underlying social capital as already shown in Table 6.2. This offers a way to develop testable propositions about social capital issues in the context of freight forwarding in multimodal transport chains with a leg by sea and air as follows:

- As NS_{ego} is an expression of the number of alters (transport chain members) that an ego (freight forwarder) is directly connected to, high values of NS_{ego} give an indication that he possesses a high amount of social capital as he is well embedded in the underlying social network structure.
- Conversely, as ND stands for the proportion of alters (transport chain members) connected to each other, high values of ND indicate that freight forwarders as egos in social network structures possess a lot of redundant contacts or stem simply from the fact that he might not be the central actor in the transport chain at all. Both assertions lead to consider ego to have a low amount of social capital if ND shows high values.
- Being defined as a function of the number of direct relations ego has, a high $C_D(p_k)$ indicates strong immediate influence on alters directly connected to him. If we think of an information diffusion process, high $C_D(p_k)$ means that ego serves as a well connected hub and direct source of information for his direct neighbourhood which indicates again a high amount of social capital for him.
- $C_R(p_k)$ then goes a step further as it is defined as the extent to which ego is connected to others who are themselves well connected. This can be interpreted as an influence process, where ego exerts influence not only on alters directly connected to him but on all other transport chain members, too. Therefore, it can be asserted that a high amount of social capital is present if $C_R(p_k)$ is high as ego is able to influence other members in a transport chain to a high extent.
- $C_B(p_k)$ is the number of times ego falls along the shortest path between two alters. If the network flow is regarded to be a package delivery process or documentary paper flow moving along the transport chain, a high $C_B(p_k)$ indicates a high amount of social capital as ego serves a highly frequented intermediary

position connecting transport chain members. Following Granovetter's (1973, 1982) and Burt's (1992, 1997, 1998) weak tie argument, this coincides with the structural view of social capital where high social capital comes along with ability of ego to bridge and exploit structural holes in a social network structure (see Sect. 4.6.1.2).

- Last but not least, $C_C(p_k)$ can be interpreted in different ways. When looking on the expected time until arrival of something in documentary paper flows, information diffusion or parcel delivery processes, $C_C(p_k)$ increases in the total graph theoretic distance from ego to all others in the network. Therefore, a high (low) $C_C(p_k)$ indicates low (high) amount of social capital which is fully in line with Coleman's (1988, 1990) and Krackhardt's (1992) strong tie argument of relational social capital which is especially high in a tight, cohesive group with extensive personal bonds among its members (see Sect. 4.6.1.2).

To sum up these propositions, high values of NS_{ego}, $C_D(p_k)$, $C_R(p_k)$ and $C_B(p_k)$ as well as low values of ND and $C_C(p_k)$ indicate a high amount of social capital for ego which is the freight forwarder in a multimodal transport chain in the context of this work. The same is valid for $C'_D(p_k)$, $C'_B(p_k)$ and $C'_C(p_k)$, too, as these prominence measures are just normalized versions of $C_D(p_k)$, $C_B(p_k)$ and $C_C(p_k)$ with values varying between 0 and 1.

6.1.2.2 Intermediary Roles

Regarding intermediary roles of a freight forwarder, the brokerage roles concept by Gould (1989) or Gould and Fernandez (1989) can be employed to identify different intermediary roles of (1) being a local broker (or coordinator) linking two parties within one organization, (2) being an intinerant broker bringing two parties of one organization together as an outside third-party intermediary, (3) serving as a gatekeeper for the second-party *vis-à-vis* the first-party, (4) being a representative for the first-party *vis-à-vis* the second-party or (5) being an intermediary in a liaison relationship triad, where all parties come from different organizations. To clarify the usefulness of this classification, one may think of an indirect conclusion of affreightment as shown in Fig. 2.1: There the international freight forwarder is an intermediary (third-party) between a shipper (first-party) and a carrier (second-party) actually performing the resulting goods transport. If all three parties (shipper, freight forwarder and carrier) belong to different organizations, the brokerage role of the freight forwarder is of the liaison type. However, if the freight forwarder conducts the resulting goods transport as a performing carrier, too, he is then a gatekeeper as third-party and second-party belong to same organization and so on.

Furthermore, Täube (2002:134–201, 2004) showed how social capital can be measured by dividing the characteristics of social capital in (1) support capital of strong ties and (2) leverage capital of weak ties as well as structural holes (see Sect. 5.4). In the case of support capital, locals of the coordinator or representative type are important, whereas cosmopolitans of the liaison, gatekeeper or itinerant type stand for leverage capital. The distinction between these two forms of social capital within a given social network structure can be made via $C_C(p_k)$ with a rank ordering of C_C(locals) $>$ C_C(cosmopolitans) $>$ C_C(non-broker). Moreover, $C_B(p_k)$ allows to distinguish between itinerants and gatekeeper types of cosmopolitans as C_B(itinerant) $>$ C_B(gatekeeper) $>$ C_B(coordinator) $>$ C_B(liaison and others).

Keeping this in mind, the differences between freight forwarding and integrator activities can directly be compared. The integrator stands for a fully integrated transport chain of door-to-door shipment services as usually offered by integrators like DHL, FedEx, UPS or TNT. Investing heavily in own transport capacity as well as transhipment hub facilities, they mainly conduct all tasks necessary to move their client's shipments on own account while minimizing the employment of other independently operating transport chain members. Ideally, the resulting network structure is then concentrated in one central intermediary standing between the shipper and the consignee which does everything on own account and therefore does not employ any other independently operating transport chain members. This leads in the context of this work to $C'_D(p_k) = C'_B(p_k) = C'_C(p_k) = 1$ and $ND_{alter} = 0$ for both export and import operations.

When looking now on dominant intermediary roles in the context of this work, the integrator should be a gatekeeper in export operations and a representative in import operations, whereas freight forwarders should be mostly intermediaries of liaison type if they only organize multimodal transport operations but not act on own account. Therefore, C'_C(integrator) $>$ C'_C(freight forwarder) and C'_B(integrator) $>$ C'_B(freight forwarder) should be the case if we normalize $C_C(p_k)$ and $C_B(p_k)$ to adjust for differences in network size as the social network data under observation are drawn from different samples.

6.1.2.3 Environmental Control Parameters

Taking modern information processing technologies like the Internet into consideration, there is always seen a 'death of distance' for communication and information transmission. But regarding distribution of physical goods as the main purpose of multimodal transport chains, geographic distance still matters. Moreover, distance has also cultural, administrative (or political) and economic dimensions, as Ghemawat (2001) proposed. To operationalize this, he put them in a conceptual framework called CAGE in order to identify and access the impact of distance on various industries along these dimensions.[5] In the following, these different concepts of distance are further developed with administrative (or political) and economic distance put together as one complex. The aim of this task is to construct environmental control parameters, which quantify possible impacts on network

[5] CAGE is simply an abbreviation for cultural, administrative, geographical and economic distances.

structure stemming from different countries of destination (departure) in export (import) operations in the sample.

Geographic Distance

Looking at macro-economic trade surveys, increasing geographic distance always lead to lower level of exchange of goods within and across countries.[6] According Ghemawat (2001), geographic distance affects the costs of transport as well as communication and it is of particular importance for companies that deal with heavy or bulky goods or whose operations require a high degree of coordination between highly dispersed people and/or activities.[7] Furthermore, physical attributes of goods like perishability or special handling requirements add complexity to cross-border transport chains.[8] Moreover, geographic distance is not simply the transport distance between a source and a sink denoted in miles or kilometres, because the physical size of a country, average within-country distances to borders, access to waterways and the ocean, topography of the landscape and even the level of transportation and communication infrastructure might have to be taken into account.[9] Another aspect is capital bound of goods in transit, which is more and more an important decision factor in transport mode selection.[10] Therefore, transport time in days or even hours instead of transport distance seems to be an alternative measure for geographic distance.

For the purpose of the survey, both measures of geographic distance were taken into account and so two Geographic Distance Indexes, namely GD_{hf} standing for transport distance and GD'_{hf} for transport time with h the home country, f the country abroad and (certainly) $h \neq f$ were raised. First, transport distances on the main haul between country, sea- or airport of departure and destination given in the questionnaire were calculated, employing data sources freely available on the Internet.[11] Due to sea or airports abroad not directly asked for in the questionnaire, the most important ones in terms of cargo throughput (denoted in TEUs for sea or tons for air cargo shipments) for the country of departure or destination were used

[6] See Frankel and Romer (1999), Rose (2000), Irwin and Terviö (2000), Frankel and Rose (2000, 2002) only to name the most recent ones.

[7] Cf. Ghematwat (2001:139–140).

[8] See Kummer et al. (2010:34–41) with further references.

[9] Cf. Ghemawat (2001:145). Following Rose (2000) or Frankel and Rose (2000, 2002), common land borders raise bilateral trade by about 80% and landlocked countries have about 40% less trade in comparison to other countries.

[10] See Kummer et al. (2010:41–43) with further references.

[11] The sources for distance measures were databases at http://www.distances.com for sea and http://www.webflyer.com for air transport operations. These distances, originally provided in nautical miles (1 nm = 1.853167447 km) or statute miles (1 sm = 1.612377598 km), were transformed into kilometers as a common measurement unit.

as a proxy.[12] To calculate transport time on the main haul, all transport distances were multiplied by a fixed factor depending on the mode of transport. Doing this, an average speed of 20 kn for sea and 500 mph for air cargo transport operations was assumed, leading to quite reasonable average transport times on the main haul.[13] Of course, actual transport time of a shipment by sea or air is heavily influenced by routing decisions, frequency of service, ports of call or transhipment points on the way, time needed at customs for release of cargo as well as distances and mode of transport on the pre- and onward-carriage legs, but assessing all these factors is beyond the scope of this work.[14] To conclude this section, it can be assumed that with increasing GD_{hf} or GD'_{hf}, geographic distance between two countries is getting bigger leading to diminishing cross-border trades and/or add complexity to transport operations.

Cultural Distance

To Ghemawat (2001:140–141), cultural distance between two countries determines heavily how people interact with each other and with companies and institutions. Some straight forward examples to this are common ethnic heritage, language, social norms and/or religious beliefs. At least three different streams of contemporary cultural research activity in the field of economics and business can be distinguished: (1) a rather qualitative, descriptive anthropologist-like approach, (2) a merely subjective psychologist-like approach centering around individual perceptions on perceived cultural differences and (3) a more objective sociologist-like approach focusing on people's values from different cultures.

[12]This seems to be a viable approach, because in each country (with the United States as one notable exception) being observed, there is always one most important sea- or airport for international shipments, serving a hub function. In the case of the United States, there are of course several sea- or airports possible, depending on the original source or sink of a shipment observed. Having no better information available, the Port of New York – New Jersey and the John F. Kennedy International Airport were chosen as the most important sea- and airports on the east coast range, which lead at least to some underestimation of geographic distance for the United States.

[13]Strictly speaking, transport distances by sea were divided by 20 and air by 100, taking into account that an air cargo shipment stays on average about 80% of total transport time at airport premises (see e.g. Reinheimer and Bodendorf (1999) or Vahrenkamp (2002:17–18)). In the first instance, this seems to be a very crude approach, but the figures obtained by this calculations were checked against average travel times of container ships and non-stop flights operated by Lufthansa.

[14]Constructing a similar measure of geographic distance, Linnemann (1966) took the shortest navigable between the main ports of respective countries plus the overland distance form the ports to the economic centres of gravity for each pair of countries concerned. But he noted that "a somewhat subjective element has slipped into the analysis in determining the economic centre of gravity of the various countries, and the corresponding hinterland distance of the ports. General geographical knowledge and encyclopædia information resulted in the selection of ports and the estimates of hinterland [...]" (Linnemann 1966:71).

In the first approach, culture is regarded as being some external factor and people going abroad or getting into contact with people from other cultures have to adjust themselves. Having this picture of culture in mind, authors like Hall (1960, 1976), Ricks (1993) or Weiss (1994a, 1994b) provided a lot of anecdotes to their readers and gave hints for best practice in inter-cultural business situations but never quantified their findings as a starting point for further cross-cultural comparisons.

The second approach is centred around the concept of "psychic distance" which was heavily used by researchers of the Uppsala School around Jan Johanson, Jan-Erik Vahlne and Finn Wiedersheim-Paul describing internationalization processes of Swedish firms.[15] Johanson and Vahlne (1977:24) defined it "...as the sum of factors preventing the flow of information from and to the market." Later on, O'Grady and Lane (1996:330) expanded this concept defining it as ..." a firm's degree of uncertainty about a foreign market resulting from cultural differences and other business difficulties that present barriers to learn about the market and operating there." But all these authors have in common that, using "psychic distance" merely as a metaphor and employing merely weak indicators, they failed to operationalize their constructs.[16] Therefore, Müller and Köglmayr (1986) and Müller (1991) proposed a first dedicated measurement approach by constructing cognitive maps in order to visualize subjectively perceived distance between countries.[17] But with their empirical research being restricted only to a sample of a few typical countries, this measure of "psychic distance" was not quite useful for the purpose of this work.

In the third approach, culture is regarded to be an endogenous factor, a "software of the mind"[18], which can be metered by statistical evaluation of people's values coming from different countries. It is closely related to an extensive research agenda by Geert Hofstede, who participated in a series of empirical surveys at IBM (and validated them later on at the IMD Lausanne) in the 1960s and 1970s on work-related values.[19] Based on his findings, Hofstede (1980) formulated four cultural dimensions, namely "power distance", "individualism", "masculinity" and "uncertainty avoidance", which were joined by a fifth dimension called "long term orientation", originally based on the Chinese Values Survey (see

[15]See Johanson and Wiedersheim-Paul (1975), Johanson and Vahlne (1977), Andersen (1993), O'Grady and Lane (1996) or Barkema et al. (1996) with further references. But following these authors, the term "psychic distance" was already used in prior research like Beckermann (1956) or Linnemann (1966) with the last calling it "economic horizon" (see Linnemann (1966:27–28)).

[16]Cf. Müller and Köglmayr (1986), Stöttinger and Schlegelmilch (1998), Dow (2000), Child et al. (2002), Müller (2002) or Müller and Kornmeier (2002:522–523).

[17]See also Stöttinger and Schlegelmilch (1998) or Müller and Kornmeier (2002:542–552).

[18]See Hofstede (1991:4) referring to the subtitle of this book. Further, he distinguished between the above already described anthropologist conception and his view of culture as "the collective programming of the mind which distinguishes the members of one group or category of people from one another," see Hofstede (1991:5).

[19]See Hofstede (1980, 1991, 2001) for an exhaustible description of methodology and data sampling issues.

The Chinese Culture Connection (1987), Hofstede and Bond (1988) or Hofstede (1991:159–174)). Following Hofstede (2001:29), these five cultural dimensions can be described shortly as follows:

"1. Power distance [PDI], which is related to the different solutions to the basic problem of human inequality.
2. Uncertainty avoidance [UAI], which is related to the level of stress in society in face of an unknown future.
3. Individualism versus collectivism [IDV], which is related to the integration of individuals into primary groups.
4. Masculinity versus femininity [MAS], which is related to the division of emotional roles between men and women.
5. Long-term versus short-term orientation [LTO], which is related to the choice of focus for people's efforts: the future or the present."

Of course, Geert Hofstede is not the only one who conducted such inter-cultural research in this way[20] and there is an ongoing dispute about the validity of his approach to cultural differences.[21] But his work seems to have the strongest impact on the development of cross-cultural studies in economics, sociology, psychology as well as other fields of social sciences.[22]

According to Kogut and Singh (1988), deviations in the four cultural dimensions from Geert Hofstede adjusted for differences in variances can be averaged to a Cultural Distance Index CD_{hf} with

$$CD_{hf} = \frac{1}{4}\sum_{c=1}^{4}\frac{(CI_{ch} - CI_{cf})^2}{CV_c} \ \forall\ h \neq f \tag{6.1}$$

where CI_{ch} and CI_{cf} stand for values of Hofstede's first four cultural dimensions (as given in Hofstede (2001:500–502)) and CV_c for their overall variance in the sample indexed by h for the home country, f for each country abroad and c for one

[20]Other large-scale value surveys of this kind are e.g. the Schwartz Value Survey (Schwartz (1992, 1994, 1999) or Schwartz and Sagiv (1995)), the World Values Surveys (Inglehart et al. (1999), Inglehart (2000) or Inglehart and Baker (2000)), the Trompenaars' Database (Trompenaars (1993) or Trompenaars and Hampden-Turner (2002)) and many other authors cited in Hofstede (2001:29–34).

[21]See Yeh and Lawrence (1995), Shenkar (2001), Søderberg and Holden (2002), McSweeney (2002a) and the following by Smith (2002), Hofstede (2002), McSweeney (2002b) and Williamson (2002) with further references – only to name a few.

[22]See Søndergaard (1994) or Hofstede (2001:461–466, 2002) with an overview and some comments on contributions refering to Hofstede (1980). Actually, this first edition and Hofstede (1991) together were subject to many replications or extensions to other countries not part of the original sample as well as numerous cross-cultural studies matching his findings with other data, so that in the second revised edition, the author could list about 280 surveys with correlations to the five cultural dimensions (Hofstede (2001:503–520)), provide data for additional 16 countries (Hofstede (2001:502)) and give about 877 references of contributions for the time after 1980 (Hofstede (2001:525)).

of the four cultural dimensions under observation.[23] In conformity with Euclidean distance as the square-root of the squared deviation of each country abroad with the home country, an alternative Cultural Distance Index CD'_{hf} with

$$CD'_{hf} = \sum_{c=1}^{4} \sqrt{\frac{(CI_{ch} - CI_{cf})^2}{CV_c}} \; \forall \, h \neq f \tag{6.2}$$

can be calculated.[24] Although both distance measures rely on different concepts, they follow the same direction: A low score of CD_{hf} or CD'_{hf} indicates a low cultural distance between two countries, which can be interpreted as cultural similarity, making things easier in cross-border trade as well as transport operations.

Administrative, Political and Economic Distance

As they seem to be closely related to each other, administrative or political differences and economic differentials between countries can be interpreted together as a third dimension of distance. Recently, Rose (2000) or Frankel and Rose (2000, 2002) explored empirically in a sample of over 200 countries or dependencies, that historical and/or political ties between countries greatly affect trade.[25] Especially, friendly ties remaining from colonialism, preferential trading arrangements, common currency, or political unions boost cross-border activities between countries.[26] Conversely, tariff and non-tariff measures raised on cross-border traded goods as well as capital flows impose considerable barriers of trade, leading to less cross-border economic activity between countries.[27] Furthermore, weak legal infrastructure and political instability may depress cross-border trade and/or direct investment in a country because high risks shy away outside countries doing business there. On the opposite, countries can get very attractive for foreign companies, if they open their economy and facilitate cross-border economic activities. Another important aspect is corruption in its many facets, which seems to be

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[23] Although this construct is a rather simplistic aggregate based on Hofstede's cultural dimensions, it got wide-spread application. Further see Shenkar (2001) or Müller and Kornmeier (2002:529–530) for critical comments on Kogut and Singh (1988). Further, Müller (2002) or Müller and Kornmeier (2002:523-529) discussed other constructs of cultural distance.

[24] Cf. Barkema and Vermeulen (1997).

[25] See also Ghemawat (2001:138) citing Frankel and Rose (2000).

[26] According to their estimates, former colony-colonizer relationships increase bilateral trade by 700%–900%, a common colonizer by 150%–190%, common regional trading blocks by 290%–350%, common currency by 300%–390% and common polity by 260%–300% in comparison to other countries, see the tabulated values in Rose (2000:16), Ghematwat (2001:138) or Frankel and Rose (2000:28, 2002:441).

[27] Cf. Ghemawat (2001:142-144).

more likely in countries with a weak legal infrastructure in connection with low income-levels.[28]

Referring explicitly to economic distance, wealth or income of consumers seems to be the most important economic attribute that creates distance between two countries affecting both direction and amount of trade.[29] Rich countries, e.g. with a high income level denoted by Gross National Product (GNP) per capita, engage more in cross-border economic activity than poorer ones for many reasons.[30] Following Krugman (1995:332–337), at least four new aspects of modern world trade can be identified, which have much in common with these wealth differentials. First, the exploitation of comparative advantages of cost and/or price differentials between countries as theoretically well reflected in mathematical models of the neoclassical trade theory create huge trade flows originating from poorer, new-industrializing countries. Second, there is an ongoing trend in manufacturing to slice up the value chain by producing goods in a number of stages in a number of locations, adding a little bit of value at each stage which leads in sum to a tremendous increase in cross-border trade. Third, a high proportion of world trade today is intra-industry and occurs between rich countries or trade blocks like the European Union, the North American Free Trade Area as well as Japan and South Korea, well known under the term "the triad".[31] And last but not least, some small countries in the world like Hong Kong, Singapore, Malaysia, Belgium, Ireland or the Netherlands accumulate wealth as being "supertrading economies" with an overwhelming share of exports in comparison to their Gross Domestic Product (GDP).[32]

One short-cut approach to quantify these various aspects of administrative, political and economic distance is the employment of already existing country indexes. Of course, such country indexes are by far exhaustible in describing the administrative, political and economic situation of a particular country, but they seem to be a good indicator for this complex of influences on cross-border trade

[28]See e.g. Shleifer and Vishny (1993), Bardhan (1997), Müller (2001) or the annually published Global Corruption Report by Transparency International (http://www.transparency.org) for further discussion about different forms of corruption and their impact on economy.

[29]Cf. Ghemawat (2001:145–147). Further, Beckermann (1956) e.g. surveyed intra-European trade in terms of economic distance with the mark-up between average FOB-value of exports of specific goods and their corresponding CIF-value in the country of destination as a proxy. Doing this, he came to the conclusion, that high mark-ups indicating greater distance lead to lower trade volumes and vice versa.

[30]See Frankel and Romer (1999) or Irwin and Terviö (2000) for some recent empirical evidence.

[31]See Kummer et al. (2010:71–72) for this contemporary interpretation of the term originally coined by Ohmae (1985, 1989).

[32]According to Krugman (1995:334–335), their share of export exceeded GDP by more than 50% with Singapore having an export share of 174% of GDP, Hong Kong 144%, Malaysia 78%, Belgium 70%, Ireland 64% and the Netherlands 52% in 1990.

and/or investment. For the purpose of this study, four country indexes with figures as of 2003 were chosen:[33]

1. The Index of Economic Freedom (IEF) from the Heritage Foundation provides an examination of ten factors (namely trade policy, fiscal burden of government, governmental interventions in the economy, monetary policy, capital flows and foreign investment, banking and finance, wages and prices, property rights, regulations and black market activity) based on 50 independent economic objectives contributing to economic freedom and prosperity in 161 countries.[34]
2. The Economic Freedom of the World Index (EFW) from the Fraser Institute measures the degree of economic freedom in five major areas (size of government, legal structure and property rights, access to sound money, freedom to exchange with foreigners and regulation of credit, labour and business) for 123 countries, compiling 38 objectives from third-party statistical data.[35]
3. The Corruption Perception Index (CPI) from Transparency International is a composite index derived from surveys of business people and assessment by country analysts from 13 independent institutions, focusing on extensive perceptions of corruption within 133 countries under observation.[36]
4. The Globalization Index (GI) from A.T. Kearney and Foreign Policy Magazine, which makes use of 13 indicators spanning information technology, finance, trade, personal communication, politics and travel to determine a country ranking in terms of global integration among 62 countries.[37]

To sum up these four economic risk indexes, basically the same procedure as in the case of Hofstede's cultural dimensions was applied to obtain an Economic Distance Index ED_{hf} with

$$ED_{hf} = \frac{1}{4}\sum_{e=1}^{4}\frac{(EI_{eh} - EI_{ef})^2}{EV_e} \;\forall\, h \neq f \tag{6.3}$$

[33]Of course, many other similar country indexes are provided through the World Competitive Yearbook of the IMD Lausanne (http://www.imd.ch/wcy), the Global Competitive Report of the World Economic Forum (http://www.weforum.org), the International Country Risk Guide Rating System of the Political Risk Service Group (http://www.icrgonline.com) or the Business Risk Service from the Business Environment Risk Intelligence (http://www.beri.com) or the Riskwire Service from the Economist Intelligence Unit (http://riskwire.eiu.com). But common to all these country indexes is, that they (1) are not publicly available, (2) cover less countries than needed and/or (3) are used as sources in the country indexes chosen.

[34]Each of the ten factors is scored within a range of one to five, and these scores are averaged to obtain a final IEF score for each country with a value around one for the most freest countries and five for the most economically repressed ones, see Beach and O'Driscoll (2003), Eiras and Schaefer (2003) or http://www.heritage.org for further methodological issues.

[35]See http://www.freetheworld.com/ for more information about the EFW.

[36]See http://www.transparency.org/policy_research/surveys_indices/ for more information about the CPI.

[37]See Foreign Policy (2003), http://www.foreignpolicy.com or http://atkearney.com for further information about sampling and methodological issues.

where EI_{eh} and EI_{ef} stand for one of the four economic indexes as described above and EV_e for their overall variance in the sample, again indexed by h for the home country, f for the country abroad and e for one of the four economic indexes under observation. Again, an alternative Economic Distance Index ED'_{hf} based on the Euclidean concept can be calculated:

$$ED'_{hf} = \sum_{e=1}^{4} \sqrt{\frac{(EI_{eh} - EI_{ef})^2}{EV_e}} \; \forall \, h \neq f. \tag{6.4}$$

Before applying these formulae, the rankings of IEF and GI were standardized into scores from one to ten and the scores of EFW and CPI had to be reversed in order to get a common direction of impact. Doing this, low (high) scores of ED_{hf} or ED'_{hf} are standing for low (high) economic distance between two countries, indicating an economic environment supporting (depressing) cross-border trade and transport operations.[38]

6.2 Sample Design and Preliminary Analysis

During 2003, several surveys among freight forwarding companies in Austria (about 600 full members of the freight forwaders'specialist association at the Austrian Chamber of Commerce called Wirtschaftskammer Österreich (WKO), Fachverband Spedition und Logistik), Hamburg (342 members of the regional freight forwarders' association Verein Hamburger Spediteure e.V. (VHSp)), Bremen-Bremerhaven (165 members of the regional freight forwarders' association Verein Bremer Spediteure e.V. (VBSp)) were conducted to obtain social network data as shown in Table 6.2.

In the first and the second survey (FCL-A and FCL-HH), the already above mentioned freight forwarder associations distributed a cover letter and a five-page, double column questionnaire from the author attached to their monthly email-newsletter directed to the head of each member firm. In the case of Bremen-Bremerhaven (FCL-HB), an announcement appeared in the VBSp monthly circular letter, followed by a cover letter and a questionnaire sent directly to the freight forwarding companies by mail. All freight forwarders were asked to fill in and send the questionnaire back by facsimile or mail – alternatively, they could fill in and submit the questionnaire online as it was hosted on a web-server at Dresden University of Technology, too. A reminder was send about three weeks later by

[38]Notably, there were three interesting country indexes, namely (1) the Access Index by SRI International and FedEx (http://about.fedex.designcdt.com/our_company/publications_and_reports) from 2006 and 2008, (2) the Logistics Performance Index (LPI) by the World Bank (http://www.worldbank.org/lpi) as of 2007 and 2010 and (3) the Enabling Trade Index (ETI) (http://www.weforum.org/en/initiatives/gcp/GlobalEnablingTradeReport/index.htm) annually published since 2008. But as the survey was already in 2003, they could not be employed, although they address directly main environmental issues in international transport chains.

Table 6.2 Sampling frame

Sample	Sample region	Main haul	Sampling method
FCL-A	Austria	By sea	With WKO-newsletter
FCL-HH	Hamburg (D)	By sea	With VHSp-newsletter
FCL-HB	Bremen (D)	By sea	Questionnaire by mail
FCL-D	FCL-HH and FCL-HB	By sea	Various, see above
SEA	All regions	By sea	Various, see above
AIR	Vienna (A)	By air	Structured interviews

facsimile, containing again the cover letter with a link to the web-server, where the original questionnaire and the corresponding online version were provided. Last but not least, a sample of 24 Austrian air freight forwarders (AIR) was raised by conducting structured interviews by telephone among 130 members of the Wirtschaftskammer Österreich (WKO), Fachverband Spedition und Logistik considered to be engaged in air freight forwarding with a special focus on companies engaged at the Vienna International Airport.

In all above described surveys, the questionnaire was split into four sections:

- In an introductory section, several company-specific questions were raised like fields of activity, regional focus, status of the company site and number of subsidiaries inland and abroad.
- In the next section, the respondents were asked to think of a typical export shipment and describe this in the following. First, some key information about the shipment itself (e.g. point of exportation, country of destination, trade terms used, type of transport documentation and value-added services offered) were asked for, before the social network of their contacts in this case from their client's order (usually by the exporter or shipper) to the carrier on the main haul or even the freight forwarder receiving the shipment abroad was mapped along several dimensions like duration, intensity or mode of communication.
- The third section was about a typical import shipment the respondents should think of and after a similar set of general questions about the shipment itself, the task was again to map the accompanying import operations from a client's order to their subsidiary in Germany or Austria to the point of destination analog to the preceding section.
- In the final section, some personal information about the respondents was demanded: position served, number of years working in the company and in the forwarding business.

Unfortunately, the response rates of the first two surveys were very low with 1.0% for FCL-A, 2.0% for FCL-HH, so that the amount of useful observations obtained in comparison to the freight forwarders asked for seems to be negligible. Only the FCL-HB survey with a response rate 6.7% and the AIR survey with 18.5% were within the range of survey response rates of contributions in the *Transportation Journal*, *Journal of Business Logistics* and *International Journal of Physical Distribution and Logistics Management* as reported by Griffis et al. (2003),

Table 6.3 Survey respondents

Sample	No. of Resp.	No. in export	No. in import
FCL-A	6	4	4
FCL-HH	6	5	4
FCL-HB	11	9	10
FCL-D	18	14	14
SEA	23	18	18
AIR	24	23	22

Larson and Poist (2004) or Larson (2005).[39] Testing for non-response bias between early and late respondents as proposed by Armstrong and Overton (1977) was rather inconclusive with the actual sample sizes being indeed very small and the within-sample variations reflecting merely heterogeneity of the respondents and their operations rather than indicating a systematic non-response bias.

All in all, a total of 48 responses could be sampled, with 24 for each main haul mode. Because of missing values in some questionnaires, not all of them could be included in the following analysis. At the end, there were 18 to 23 observations of transport chains including a leg by sea or air available for further assessment which can be further split in export and import operations (see Table 6.3). Some of several reasons for this poor outcome might be:

- First, there might exist an overall resistance of Austrian and German freight forwarding companies to response to such surveys – some of them were so kind to communicate to the author that they are fed up with work and so they are not able to follow such a proposal.
- Second, the research design requested the respondents to fill in a five-page, double column questionnaire in order to obtain a minimum of information about their social network structure which in turn might have been too long and boring.
- Furthermore, the distribution of questionnaires by email-newsletters as a low-cost survey method for data collection for the first two samples (FCL-A and FCL-HH) turned out to be a bad alternative in comparison to more conventional sampling methods like mail survey approach with pre-notification in the FCL-HB survey and structured interviews by telephone in the case of the AIR survey.
- Another viable reason for this poor outcome for the first three samples might be that in Austria and even at the two big German seaports, there are not so many freight forwarding companies engaged in door-to-door FCL-shipments. Moreover, it seems to be quite common for large-scale shippers, exporters and/or importers to contact directly the sales representatives of carriers on the main haul in order to save costs and they are at the same time willing to organize all tasks needed to end in a door-to-door shipment service.

[39] Kaltenbrunner (2005:59) reported that only 46 air cargo freight forwarding companies are active at the Austrian market and even four of them are double countings as they are wholly owned subsidiaries of other freight forwarding companies aready included in that figure. Therefore, the response rate in the AIR sample is an underestimation of actual population coverage.

6.3 Presentation of Empirical Results

In this section, first sample characteristics are thorougly discussed, before personal network structure and position as well as intermediary roles of the freight forwarders in the sample are assessed. In order not to overload this section with tables and graphs, detailed data as well as results of statistical tests are tabulated in the appendix.

6.3.1 Sample Characteristics

In the following, first, the respondents and their companies are described, before a general description of typical shipments and their organization is given. Whenever available, a comparison to other surveys is offered. The section closes with further comparisons based on statistical tests.

6.3.1.1 Respondents and Their Companies

Taking the whole sample, most of the survey respondents (53.2%) stated that their position is either being company owner, chief executive officer (Geschäftsführer in German) or general manager (Prokurist in German).[40] Furthermore they showed considerable work experience with an average of 21.80 years in forwarding business and 12.20 years in their company with a maximum of 50 years (!) for both figures. Moreover, the respondents of the SEA sample could be regarded to be slightly more experienced than in the AIR Sample with 23.26 versus 19.71 years working in the forwarding business and 14.07 versus 10.71 years in their company.

Taking the number of offices as a proxy for company size, a freight forwarding company in the AIR sample has on average 3.50 sites in Austria and 49.71 subsidiaries abroad.[41] In the SEA sample, it has on average 7.74 sites in Austria and Germany respectively and 80.04 subsidiaries abroad (see Appendix to Question 2). But looking more closely on the distribution of these figures, the majority of freight forwarder firms are tiny with 10 single site companies and 21 companies without any subsidiary abroad – only 16 companies in the total sample (and 10 out of 14 or 71.4% in FCL-D) had more than 10 subsidiaries in total. This is in line with findings of e.g. DSLV (2005), where 85% of all freight forwarders in Germany with more than one single site have less than 10 subsidiaries and even only 4%

[40]See Appendix to Question 8 for this and the following.

[41]By counting employees, Kaltenbrunner (2005:60–63) can partly confirm this with 82.7% of his respondents having less than 50 employees in Austria with 81.8% less than 50 of them engaged in air cargo operations. In contrary to this, 50.0% have more than 1,000 employees and even 31.8% more than 5,000 employees working for them abroad.

of them have more than 20.[42] Furthermore, the respondents defined their office in 60.4% of all cases as a single company, with the other being either a main office (Hauptniederlassung), branch office (Zweigniederlassung) or trade office (Handelsbüro).

Referring to the respondents' company fields of activity, they seem to be very specialized with a combination of sea, air and/or international freight forwarding as well as customs brokerage and warehousing usually offered by 66.7% or more on average in the total sample (cf. Appendix to Question 1 for further reference):

- In the SEA sample, the companies are mainly focused on sea cargo forwarding (79%) as well as international freight forwarding (67%). In addition to this, other services usually offered are customs brokerage (83%), followed by forwarding of project cargo (71%), air cargo forwarding (67%), warehousing (67%) and groupage service (54%). Furthermore, 46% act as a NVO, 42% offer packaging services and 38% stuffing and stripping of containers.[43]
- In the AIR sample, the companies are focused on air cargo forwarding (67%), followed by international freight forwarding (58%), customs brokerage (54%) and sea cargo forwarding (50%), too. Apart from this, they usually offer warehousing (67%), road transport on own account (79%), groupage service (75%) and are engaged in parcel or express services (46%), affreightment of hauliers (46%), act as an IATA cargo sales agent (46%) or removal agent (46%) as part of their business.
- Comparing the AIR and FCL-A sample with WIFI (1993), the respondent companies can be regarded as freight forwarding specialists, as they usually offer on average more international freight forwarding, customs brokerage and warehousing than Austrian freight forwarding companies according to WIFI (1993). Moreover, their activity in groupage service as well as road transport on own account is higher than in WIFI (1993).
- Comparing the FCL-D sample with DSLV (2005), the respondents from Hamburg, Bremen and Bremerhaven show a real specialization on a combination of sea, air and/or international freight forwarding in connection with customs brokerage, warehousing and project cargo forwarding usually offered, whereas groupage service, road transport on own account and affreightment of road hauliers are of minor interest. In contrast to this, at least some of them (35%) offer more affreightment of railway operators and forwarding in inland

[42] Markides and Holweg (2006) obtained similar results in their survey of international freight forwarding companies in the UK with an average of 3.2 offices and 1.1 warehouses per firm.

[43] Moreover, Murphy and Daley (2001) in the USA as well as Markides and Holweg (2006) in the UK give further support for the main fields of activity in the SEA sample. Following Murphy and Daley (2001), 81.0% of the international freight forwarding companies in their sample offer customs brokerage and 57.0% NVOCC service, whereas 48.0% of the companies in Markides and Holweg (2006) offer customs brokerage, 58.4% NVOCC, 48.1% warehousing and 42.9% packaging services.

navigation than the average German freight forwarding company according to DSLV (2005).

- A comparison between FCL-HH, FCL-HB and DSLV (2005) adds nothing special than that the respondent companies from Hamburg more often offer warehousing, groupage service and affreightment of hauliers than their colleagues from Bremen and Bremerhaven coming along with more offers in packaging services and project cargo forwarding.

Last but not least, the share of turnover generated by sea, air and international freight forwarding was asked for. Most respondents (79.1% in the AIR sample and 81.8% in the SEA sample) stated that more than 50% of the turnover of their business operations fall in the fields of international freight forwarding, and freight forwarding in shipping and/or air freight operations. Furthermore, 50.0% of all companies in the AIR sample and 36.3% in the SEA sample can be regarded as highly specialized as they generate more than 75% of their turnover in these fields of operation.

6.3.1.2 General Description of Typical Shipments

As already indicated in Sect. 6.2, the respondents were asked for a typical shipment.

The resulting export shipment can be characterized as follows (see Appendix to Question 4 for further reference):

- USA was the most mentioned country of destination for export shipments, with a share of 52.2% in the AIR and 38.9% in the SEA sample, followed by various destinations in the Far East like Japan, South Korea, People's Republic of China, Taiwan or Indonesia with 43.5% (AIR) and 38.9% (SEA).
- The majority of air freight shipments in the AIR sample departed at Vienna International Airport (56.5%), followed by Frankfurt-on-Main (21.7%) and Linz (13.0%). In the SEA sample, main sea ports of departure for export shipments were Hamburg (55.5%) followed by Bremerhaven (27.8%).
- Referring to INCOTERMS used, 43.5% of all export shipments in the AIR sample were EXW (ex works) and 34.8% FCA (Free Carrier) with the rest being either DDU (duty delivered unpaid) or DDP (duty delivered paid). As the consignor was the freight forwarder's client for all export shipments in AIR, it can be concluded that most of the exporting shippers were not interested too much in being involved in the arrival and final delivery of their export shipments in the country of destination.[44] In case of the SEA sample, various INCOTERMS from EXW to DDP were used with no clear favourite.
- According to transport documents used, all AIR shipments in export were accompanied by an AWB (air waybill) and 61.1% of the SEA shipments by a B/L

[44] See Neiberger (2007, 2008) with a similar discussion about the growing trend towards EXW and FCA in air cargo transport operations.

(Bill of Lading) which are at the same time the dominant types of accompanying transport documents on air and sea transport operations. But in a considerable number of cases, other transport documents were employed for export shipments with the main haul by sea, too, like CBL (Combined Bill of Lading) or FBL (FIATA Bill of Lading), indicating the onward carriage leg to the final destination to be a rather complex undertaking organized by the respondents.
- Other services like coverage of cargo insurance, export packaging and documentary collection were mentioned in the case of export shipments with cargo insurance mostly offered to their clients (91.3% (AIR) and 55.6% (SEA)). Interestingly, export packaging as well as documentary collection was more often offered by the companies of the AIR sample with 52.2% and 43.5% of all export shipments than in the case of SEA with each mentioned only in 22.2% of all cases.

Last but not least the respondents stated that their typical export shipment as described occurs 2,662 times per year in AIR and 383 times per year in SEA on average, which gives some evidence that they should be very typical ones. But a considerable spread in the answers cannot be negated with a standard deviation of 5,013 in the case of AIR and 834 for SEA.

Accordingly, the import shipments can be characterized as follows (cf. Appendix to Question 6 for further reference):

- Referring to the country of origin, USA was again most mentioned with 27.3% of all responses in AIR and 44.4% in SEA. But the overall majority of import shipments came from the Far East (e.g. Japan, South Korea, People's Republic of China or Hong Kong) with 63.6% in AIR and 27.8% in SEA.
- In the AIR sample Vienna International Airport (68.2%) was again in lead as the airport of arrival, followed by Frankfurt-on-Main (9.1%) and Linz (9.1%). Furthermore, Hamburg (61.1%) followed by Bremerhaven (16.7%) were again mentioned as the main sea ports of arrival in the SEA sample.
- In the AIR sample, EXW (54.6%) and FCA (22.7%) were again the INCOTERMS mostly mentioned. The fact that the consignee was the freight forwarder's client for 95.6% of the import shipments in AIR reinforces the initial guess from above that export shippers generally are not too much interested being involved in arrival and final delivery of their shipments. In the case of SEA, EXW (33.3%) is in the lead, closely followed by FOB (free on board) with 27.8% of all responses. Furthermore, for 66.7% of the import shipments, arrangements for onward carriage had to be made on behalf of the importer which again indicates that the majority of these import shipments were just dispatched at the sea port of departure and send to them without further involvement by the exporter abroad.
- All import shipments in the case of AIR were again accompanied by an AWB. In the SEA sample, the majority came in with a B/L (61.1%), but also SWB (sea waybill), CBL as well as FBL were used as an accompanying transport document.

- Concerning other services offered, coverage of cargo insurance was again mostly mentioned with 90.9% in AIR and 33.3% in SEA. Furthermore, documentary collection was arranged for 36.4% of the incoming air cargo and 16.7% of the sea cargo shipments and in 22.2% of all SEA cases, the incoming container was stripped.

As the respondents stated that their import shipment as described occurs on average 2, 362 times per year in AIR and 148 times per year in SEA, again it can be regarded as typical, although the standard deviation of 3, 715 (AIR) and 305 (SEA) is again rather high.

6.3.1.3 Organization of Typical Shipments

The arrangements made in case of a typical export shipment are as follows (see Appendix to Question 5 for further reference):[45]

- In the case of all export shipments in AIR and 77.7% in SEA, the freight forwarder was assigned by the shipper or exporter, mainly based on written contracts. The amount of contacts per year were 361.6 in AIR and 252.2 in SEA on average, which seems to be rather high and dense with at least one contact per working day.[46]
- The pre-carriage arrangement in AIR was either transport on own account (30.4%) or by some other haulier (60.9%) than the freight forwarding company with another 8.7% of the export shipments being transported even by the airline itself called airline trucking. Furthermore, the majority of these arrangements was closed on the basis of a written contract relationship. In the case of SEA, again various alternatives were employed like carrier haulage (37.5%), merchant haulage (25.0%) as well as other sorts of hauliers (31.3%).[47] With 367.9 (AIR) and 224.8 (SEA) on average, the amount of contacts per year is again rather high with at least one contact per working day.
- Customs procedures were mainly completed manually in AIR (60.9%), where as in the case of SEA, the majority of the freight forwarding companies employed electronic procedures (61.1%). This outcome stems from the fact that at Hamburg as well as Bremen/Bremerhaven, freight forwarding companies have direct

[45] In the SEA sample, for each relationship coming along with organizing an export or import shipment additional statements had do be judged with the help of a 6-point Likert scale. The results thereof were rather inconclusive and are therefore only recorded in Appendix to Question 5 without further efforts of interpretation.

[46] Assuming that in 50 weeks each year, a freight forwarding company may open its office Monday to Friday, there are about 250 working days per year. This rough estimation is also in line with official labour regulations in Germany as well as Austria where office clerks may work 5 days with 8 h per day.

[47] Other hauliers might be there some container trucking companies or intermodal railway transport operators.

access to the cargo community systems DAKOSY and DBH which eases the handling of paperwork for export shipments to a high extent. Furthermore, they have about two times per working day contact to customs officials or customs agent employed, which count up to 584.5 (AIR) and 666.7 (SEA) contacts per year on average. Moreover, the contractual basis of their relationships is mostly personal and/or occasional in AIR and oral and/or occasional in SEA in comparison to other stages of an export shipment.[48]

- Referring to the terminal at the sea or air port of departure, the contacts per year are much higher in AIR (741.9) than in SEA (204.1) on average, which again gives some evidence that e.g. the cargo community systems of DAKOSY and DBH are working very efficiently in automatizing information processing at both sea ports. In the case of export shipments by air, there seems to be much more need in direct communication – about three times per working day on average. In addition to this, the majority of freight forwarding companies in the SEA sample declared that their relationship to the terminal at the sea port of departure is occasional whereas in the AIR sample, the relationship to the terminal at the airport of departure is more often based on a written or oral contract which fits well to the above mentioned assertions.
- In the AIR sample, the main haul is mainly arranged either via the carrier agent like an IATA cargo sales agent (47.8%) or direct booking at the airline (39.1%), whereas in case of SEA, direct booking at the shipping company is done in 38.9% of all cases, with employing transport intermediaries like carrier agent, own NVO, other NVO or even others being a more common way to close the arrangement with the shipping companies for the main haul. This part of the organization of an export shipment seems to be very personal driven, as the contacts per year with the airline, shipping company or transport intermediaries in between are on average 523.5 (AIR) and 508.5 (SEA). Furthermore, the majority of all main haul arrangements are based on written contracts which show the importance of holding good, long lasting relationships with the carrier on the main haul or the transport intermediary in between.
- Regarding arrangements for onward-carriage for export shipments, the majority of freight forwarding companies in the AIR sample was not involved (52.2%), which is in line with an already above observed potential resistance of shippers to be involved in transport arrangements of their shipments from the airport of destination to the consignee. In the SEA sample, correspondence relationships (44.4%) might be a dominant way to arrange onward-carriage of export shipments, but a closer look on the data reveals that this outcome stems from the fact that 66.7% of respondents from the FCL-HB sample alone employed correspondence relationships where the other two (FCL-A and FCL-HH) were

[48] In this context, occasional means that the respondents have no special relationship with customs authorities or their customs agents with written contract, oral contract or personal contact determined as more tighter forms of relationship.

more often not involved, counting up to 27.8% in the whole sample.[49] Asking about the contacts per year with the partners abroad (if there were any), the respondents declared that they have 145.6 (AIR) and 299.1 (SEA) contacts on average, which can be regarded as rather low in comparison to the other figures mentioned.

- Concerning the modes of communication, traditional ones like telephone and fax are heavily employed by the respondents in both samples but email is gaining ground being second after telephone. Other modes of communication mentioned are postal correspondence and EDI – especially in the case of the SEA sample. This can be explained by the need for traditional paperwork e.g. in the case of B/Ls as negotiable documents of evidence on one hand and well established cargo community systems like DAKOSY and DBH on the other.[50] In the AIR sample, EDI was not employed at all and telephone was the outmost important mode of communication followed by email and fax despite there is no need for physical presence of AWBs as accompanying transport documents and TRAXON (among other cargo community systems in the airline industry) can be used for all kinds of electronic exchange.[51]

In case of typical import shipments the results are as follows (see Appendix to Question 7 for further reference):

- The freight forwarding companies' client was mainly the consignee or importer of that import shipment with 95.5% (AIR) and 66.7% (SEA) of all cases and this relationship was mainly based on a written contract. The contacts to their clients seemed to be on average more intensive in the AIR sample with 589.4 times per year than in the case of SEA with 267.7 contacts per year.
- The same holds true regarding the amount of contacts per year on average with the sea- or airport of arrival: 601.9 (AIR) versus 268.4 (SEA). The basis of relationship was defined to be either occasional, based on oral or written contract without indicating a clear trend.
- Customs procedures in the AIR sample were mainly arranged manually (81.8%) and in the case of SEA, the majority of the freight forwarding companies employed electronic procedures (50.5%) or authorized intermediaries like own declarants or customs brokers to deal with customs authorities on their behalf. Furthermore, the relationship to them was very often regarded as occasional. Moreover, the contacts with customs authorities or agents employed were very

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[49] In addition to this, in both samples (SEA and AIR) two times joint ventures were mentioned as a partner to arrange onward-carriage of export shipments. Moreover, these correspondence as well as joint venture relationships are either based on a written or oral contract.

[50] This is in line with findings of e.g. DSLV (2005:45) that 43% of all freight forwarding companies in Germany use cargo community systems like DAKOSY, DBH or TRAXON and hold contact to customs authorities via ATLAS. Further, the traditional paperwork in maritime shipping is burdensome and steps to reduce them significantly are demanded, see e.g. Frankel (2002) or Stopford (2002).

[51] See Kaltenbrunner (2005) or Gillis (2008) for more detailed empirical evidence about this.

intensive, especially in the case of SEA with 812.6 times per year (or more than three times a working day) on average with freight forwarding companies in the AIR sample having only 340.4 times per year contact to them on average.
- Concerning onward-carriage, 36.4% of all import shipments were transported to the consignee on own account and 50.0% by other hauliers in AIR based on a written contract, whereas in the SEA sample, the results are mixed with carrier haulage (27.8%), merchant haulage (27.8%) or other haulier (38.9%) mostly mentioned.[52] Accordingly, the contacts per year to the carrier of the onward-carriage are more intensive in AIR (471.0) than in SEA (166.9) on average.
- Assessing the modes of communication, the findings from the export shipments are merely reinforced: Again telephone, fax as well as email are heavily employed in both samples (AIR and SEA). But in the case of the SEA sample other modes of communication seem to be important at least for some respondents. Whereas postal correspondence occurs in all stages, telex (as the predecessor of fax) was mentioned as a mode of communication *vis-à-vis* the terminal at the sea port of arrival, and EDI was used if electronic customs procedures like ATLAS were employed in the case of FCL-HH and FCL-HB.

All in all, these descriptions of typical export and import shipments from AIR and SEA mirror the general statements about contemporary sea and air transport operations made in Sect. 2.2.4 given that at time of the surveys in 2003, usage of electronic customs procedures (although applicable, see Kummer et al. (2010:222–226)) were non-obligatory and cargo community systems like TRAXON in air cargo transport operations may get more attention in the meantime.

6.3.1.4 Further Comparisons

As the size of the social networks under observation was considerably below $N = 15$ and an overwhelming majority of parameters turned out to show a non-normal standard distribution after testing it with the One-Sample Kolmogoroff–Smirnov Test (Kolmogoroff (1933), Smirnov (1939a, 1939b)) with a correction factor by Lilliefors (1967) as well as the Shapiro–Wilk Test (Shapiro and Wilk 1965) at the 5% level, only simple nonparametric test methods for independent samples (namely Mann-Whitney-U Test (Wilcoxon 1945; Mann and Whitney 1947), Two-Sample Kolmogoroff–Smirnov Test (Kolmogoroff 1941), Several-Sample Kruskal–Wallis Test (Kruskal 1952; Kruskal and Wallis 1952) and Several-Sample Median Test (e.g. Westenberg 1948 or Siegel (1956:179–184)) well implemented in SPSS

[52]Looking more closely to the figures, FCL-HH seemed to favour carrier haulage, FCL-HB merchant haulage and FCL-A other hauliers like container trucking companies or intermodal railway transport operators. But regarding sample size ($N = 14$ in total but only $N = 4$ in the case of FCL-HH and FCL-A), this findings cannot be generalized.

could be applied to the samples.[53] The findings from intensive non-parametric testing of all samples were as follows (all differences shown turned out to be statistically significant at the 5% level, see Appendix of Statistical Tests for further reference):

- Testing AIR vs. SEA, it can be asserted that outgoing air cargo shipments generally move to more distant destinations than shipments by sea in every aspect (geographic, cultural as well as economic distance), whereas incoming air cargo shipments come only from more geographic distant origins. In contrary to exporters of seagoing cargo, exporters of air cargo shipments want to be involved primarily in despatching. Therefore, they prefer EXW and FCA as an INCOTERM. Moreover, the freight forwarders engaged in air cargo shipments account for significantly more shipments per year of the same kind and hold more formal relationships with their customers in both directions (export and import). Focusing on the amount of contacts per year, the air cargo freight forwarders have on average a significantly higher amount of contacts per year with the cargo terminals at the airport in export and import and with their clients in import, but a significantly less amount of contacts per year with customs offices or agents coping with them. This reflects actual business practice where the air cargo freight forwarder always needs to supervise and direct air cargo shipments whereas seagoing shipments are processed with the help of CCSs like DAKOSY and DBH. Last but not least, the status of the respondent persons' position in the AIR sample is higher on average than that of their counterparts engaged in freight forwarding operations including a leg by sea on the main haul.
- Comparing FCL-D vs. FCL-A, there seem to be no statistically significant differences between German and Austrian freight forwarding operations including a leg by sea on the main haul except for ED_{hf} in export. But considering the sample size, no general conclusions can be drawn from this.
- Looking more closely on the data and comparing FCL-A vs. FCL-HH vs. FCL-HB, some statistically significant differences between them can be argued, like the formalism of relationships with the terminals in export and import as well as the relationships with their clients in import. Moreover, the respondents' number of years employed with their company differs significantly.

[53] All parameters tested are at least ordinal scaled with "Status of Responding Company Site" showing a meaningful descending rank ordering of status with values from 1 (single company) to 2 (main office), 3 (branch office) and 4 (trade office), "INCOTERMs used..." as a trade term can be rank ordered with designating values from 1 (EXW) to 13 (DDP) indicating an increasing involvement of an exporter in the shipment, "Basis of Relationship to ..." can be ordered in a decending order of formalism with values from 1 (written contract), 2 (oral contract), 3 (personal contact) to 4 (occasional), and 'Position of Respondent' again can be interpreted as decending order of status with values from 1 (company owner), 2 (chief executive officer), 3 (general manager), 4 (division manager) to 5 (other position).

- Finally, testing FCL-HH vs. FCL-HB, freight forwarders from Hamburg seem to have less contacts per year with the local customs office (or agents acting on behalf of them) in the case of export shipments and hold less formal relationships to the terminals in export as well as their clients in import than their counterpart from Bremen and Bremerhaven. But the overall statistical support for this is rather weak. However, the respondents from Hamburg are significantly less years employed with their company.

All in all, not too many statistically significant differences between the samples could be identified, which may mainly stem from the fact that the overall sample size is rather small and the group of respondents is very heterogeneous referring e.g. to company size and a huge variety of typical shipments in export and import were assessed.

6.3.2 Personal Network Structure and Position

Based on Question 5 and 7, several measures of network structure (namely NS, NS_{ego}, ND, $ND'$and ND_{alter}) and position ($C_D(p_k)$, $C_B(p_k)$, $C_C(p_k)^{-1}$, $C_R(p_k)$, $C'_D(p_k)$, $C'_B(p_k)$ and $C'_C(p_k)$) can be calculated and compared with the benchmark of a fully integrated transport chain of an integrator (see Sect. 6.1.2).

First, ego's personal network structure can be described by measures of network size and density (e.g. NS_{ego} and ND) as shown in Tables 6.4 and 6.5. A first look at Table 6.4 reveals significantly higher NS and lower ND' in export operations for FCL-HB in comparison to FCL-HH, which indicates that freight forwarders from Bremen or Bremerhaven may have a higher amount of social capital than their counterparts from Hamburg , although NS_{ego} and ND turned out to be not

Table 6.4 Network size and density in export

Sample	NS	NS_{ego}	ND	ND'	ND_{alter}
FCL-A	7.00	5.00	0.28	0.28	0.08
	(1.00)	(0.82)	(0.04)	(0.04)	(0.02)
FCL-HH	6.80	5.20	0.30	0.30	0.05
	(0.45)	(0.84)	(0.02)	(0.02)	(0.04)
FCL-HB	7.78	5.22	0.28	0.26	0.09
	(0.46)	(0.83)	(0.03)	(0.02)	(0.03)
FCL-D	7.43	5.21	0.28	0.27	0.08
	(0.65)	(0.80)	(0.03)	(0.02)	(0.04)
SEA	7.35	5.17	0.28	0.28	0.08
	(0.70)	(0.79)	(0.03)	(0.03)	(0.04)
AIR	7.22	5.39	0.28	0.28	0.04
	(0.67)	(0.58)	(0.03)	(0.03)	(0.04)
Integrator	7.00	6.00	0.29	0.29	0.00

Table 6.5 Network size and density in import

Sample	NS	NS_{ego}	ND	ND'	ND_{alter}
FCL-A	5.50	4.00	0.37	0.37	0.05
	(0.58)	(0.00)	(0.04)	(0.04)	(0.06)
FCL-HH	4.80	3.60	0.43	0.43	0.02
	(0.58)	(0.58)	(0.06)	(0.06)	(0.00)
FCL-HB	5.00	3.78	0.40	0.40	0.04
	(0.33)	(0.44)	(0.02)	(0.02)	(0.07)
FCL-D	4.93	3.71	0.41	0.41	0.03
	(0.47)	(0.47)	(0.04)	(0.04)	(0.06)
SEA	5.06	3.78	0.40	0.40	0.04
	(0.54)	(0.43)	(0.04)	(0.04)	(0.06)
AIR	5.00	3.74	0.40	0.40	0.01
	(0.44)	(0.83)	(0.04)	(0.04)	(0.03)
Integrator	5.00	4.00	0.40	0.40	0.00

significantly different in magnitude.[54] The same is true if we look at Table 6.5, where for import operations NS is significantly higher and ND' as well as ND is significantly lower for FCL-HB in comparison to FCL-HH.[55] This can be interpreted again as a higher amount of social capital for freight forwarders at Bremen or Bremerhaven than for their counterparts at Hamburg. Furthermore, FCL-D offers a slightly higher NS and lower ND as well as ND' in comparison with FCL-A for import operations, so that German freight forwarders tend to show a higher amount of social capital there than the Austrian ones.[56] Unfortunately, these results for measures of network size and density are not really convincing, as differences in NS_{ego} are non-significant for all samples. Again, this seems to be a matter of an overall high heterogeneity of responses paired with low sample sizes.

Second, measures of prominence (e.g. $C_D(p_k)$, $C_B(p_k)$, $C_C(p_k)$ and $C_R(p_k)$) can give information about ego's network position as shown in Tables 6.6 and 6.7. Looking again first at export operations, Table 6.6 shows that freight forwarders engaged in air transport have a higher amount of social capital as their $C_C(p_k)^{-1}$, $C_R(p_k)$, $C'_B(p_k)$ and $C'_C(p_k)$ are significantly higher than that of their counterparts engaged in maritime shipping.[57] Furthermore, freight forwarders at Bremen or Bremerhaven tend to have a higher social capital as $C_C(p_k)^{-1}$ and $C'_C(p_k)$ is higher

[54]Statistically significant at the 5% level for NS according to Mann-Whitney-U ($z = -2.758$, $\rho = 0.006$) as well as Kolmogoroff–Smirnov ($z = 1.394$, $\rho = 0.041$) and for ND' according to Mann-Whitney-U ($z = -2.460$, $\rho = 0.014$), see Appendix Statistical Tests.

[55]Statistically significant at the 5% level for NS, ND and ND' according to Mann-Whitney-U ($z = -2.169$, $\rho = 0.030$), see Appendix Statistical Tests.

[56]Statistically significant at the 10% level for NS, ND and ND' according to Mann-Whitney-U ($z = -1.889$, $\rho = 0.059$), see Appendix Statistical Tests.

[57]Statistically significant at the 5% level for $C_C(p_k)^{-1}$ according to e.g. Mann-Whitney-U ($z = -2.425$, $\rho = 0.015$), $C_R(p_k)$ according to e.g. Mann-Whitney-U ($z = -2.580$, $\rho = 0.010$) $C'_B(p_k)$ according to e.g. Mann-Whitney-U ($z = -2.109$, $\rho = 0.035$) and $C'_C(p_k)$ according to

Table 6.6 Centrality measures for complete network in export

Sample	$C_D(p_k)$	$C_B(p_k)$	$C_C(p_k)^{-1}$	$C_R(p_k)$	$C'_D(p_k)$	$C'_B(p_k)$	$C'_C(p_k)$
FCL-A	5.00	14.50	7.50	2.51	0.88	0.95	0.92
	(0.82)	(4.20)	(1.29)	(0.36)	(0.10)	(0.05)	(0.07)
FCL-HH	5.20	13.40	6.40	2.50	0.89	0.95	0.84
	(0.84)	(2.51)	(0.55)	(0.31)	(0.10)	(0.04)	(0.08)
FCL-HB	5.44	17.28	8.89	2.4	0.80	0.88	0.77
	(0.92)	(3.57)	(0.76)	(0.07)	(0.11)	(0.12)	(0.09)
FCL-D	5.36	15.89	8.00	2.44	0.83	0.90	0.82
	(0.84)	(3.63)	(1.41)	(0.19)	(0.11)	(0.10)	(0.11)
SEA	5.28	15.58	7.89	2.46	0.83	0.90	0.82
	(0.83)	(3.7)	(1.37)	(0.23)	(0.10)	(0.09)	(0.10)
AIR	5.43	15.57	8.83	3.19	0.88	0.95	0.92
	(0.59)	(3.63)	(0.94)	(0.88)	(0.10)	(0.05)	(0.07)
Integrator	6.00	15.00	7.00	2.45	1.00	1.00	1.00

Table 6.7 Centrality measures for complete network in import

Sample	$C_D(p_k)$	$C_B(p_k)$	$C_C(p_k)^{-1}$	$C_R(p_k)$	$C'_D(p_k)$	$C'_B(p_k)$	$C'_C(p_k)$
FCL-A	4.00	7.50	5.00	2.65	0.90	0.95	0.92
	(0.00)	(1.73)	(1.15)	(0.75)	(0.12)	(0.06)	(0.10)
FCL-HH	3.50	4.50	3.50	1.87	1.00	1.00	1.00
	(0.58)	(1.73)	(0.58)	(0.15)	(0.00)	(0.00)	(0.00)
FCL-HB	3.80	6.10	4.40	2.21	0.93	0.96	0.94
	(0.44)	(1.17)	(0.73)	(0.44)	(0.12)	(0.07)	(0.09)
FCL-D	3.71	5.64	4.14	2.11	0.95	0.97	0.96
	(0.47)	(1.45)	(0.77)	(0.39)	(0.10)	(0.06)	(0.08)
SEA	3.78	6.06	4.33	2.23	0.94	0.96	0.95
SEA	(0.43)	(1.66)	(0.91)	(0.52)	(0.10)	(0.06)	(0.08)
AIR	3.91	6.00	4.09	2.09	0.98	0.99	0.98
	(0.29)	(1.31)	(0.68)	(0.40)	(0.06)	(0.03)	(0.05)
Integrator	4.00	6.00	4.00	2.00	1.00	1.00	1.00

than in the case of their counterparts from Hamburg.[58] Referring to Table 6.7, freight forwarders from Bremen or Bremerhaven again show some higher amount of social capital in their import operations as both $C_C(p_k)^{-1}$and $C_R(p_k)$ are significantly higher than in the case of freight forwarders from Hamburg.[59] Last but not least,

e.g. Mann-Whitney-U ($z = -2.986$, $\rho = 0.003$), see Appendix Statistical Tests. Further, it is notable that $C_C(p_k)^{-1}$ has a positive relation to social capital as it is the inverse of $C_C(p_k)$.

[58]Statistically significant at the 5% level for $C_C(p_k)^{-1}$ according to e.g. Mann-Whitney-U ($z = -3.068$, $\rho = 0.002$), and statistically significant at the 10% level for $C'_C(p_k)$ according to Mann-Whitney-U ($z = -1.818$, $\rho = 0.069$), see Appendix Statistical Tests.

[59]Statistically significant at the 5% level for $C_C(p_k)^{-1}$ as well as $C_R(p_k)$ according to Mann-Whitney-U ($z = -2.149$, $\rho = 0.032$), see Appendix Statistical Tests.

FCL-A shows significant higher $C_R(p_k)$ but lower $C_B(p_k)$ in comparison to FCL-D which seems to be a rather inconclusive result at first sight. But taking into account that $C_B(p_k)$ indicates the degree of betweeness and $C_R(p_k)$ the influence of an actor in a social network structure, it can be presumed that their source of social capital seems to be different: Freight forwarders at Hamburg, Bremen and Bremerhaven are engaged in organizing local operations at seaports whereas Austrian freight forwarders exploit their position as a remote acting agent for their clients in the hinterland.[60] To conclude, freight forwarders engaged in air cargo operations show a higher amount of social capital than their counterparts engaged in door-to-door FCL-shipments. Furthermore, freight forwarders at Bremen and Bremerhaven possess an overall higher amount of social capital than their colleagues from Hamburg. Both outcomes may stem from the fact that these Austrian air cargo freight forwarders and freight forwarders from Bremen and Bremerhaven do not act very often on own account but employ other transport chain participants to organize their shipments.

6.3.3 Intermediary Roles

In Tables 6.8 and 6.9, averages of individual raw brokerage scores (b_{01k}, b_{0k}, b_{10k} and w_{1k}) for each freight forwarder engaged in multimodal transport chains as an intermediary k between his client i and the other transport chain participants j adjusted by the sum of all global raw brokerage scores $(B + W)$ are shown. The averages for itinerant brokerage scores w_{0k} are omitted from these tables, because they were virtually 0 for all observations. In the last column, the averages of the degree of vertical integration VI_k are shown, again with the corresponding standard normal deviations in parentheses below.[61]

The same holds true for the integrator's import operations, where he despatches incoming cargo from an overseas subsidiary (his client) as a local broker (namely

[60]Statistically significant at the 5% level for $C_R(p_k)$ according to Mann-Whitney-U ($z = -2.232$, $\rho = 0.026$), and statistically significant at the 10% level for $C_B(p_k)$ according to Mann-Whitney-U ($z = -1.940$, $\rho = 0.052$), see Appendix Statistical Tests.

[61]Keeping this inherent network structure of multimodal transport chains in mind, the degree of vertical integration VI_k can be shortly defined as the movement of door-to-door shipments as well as handling of documentary paperwork as a logistics system run in a one-stop-shopping manner, so that most of the tasks usually done by different independently operating transport chain participants are concentrated in one central intermediary standing in between the shipper and the consignee. More specifically, the degree of vertical integration of the kth intermediary VI_k can be expressed formally as the ratio between the amount of tasks done or organized by him on own account and the amount of tasks done or organized at all along the multimodal transport chain under observation. Therefore VI_k will be high, if the central intermediary in question organizes many tasks on own account with the other transport chain participants serving only a minor role or being totally disintermediated. Furthermore, maximum $VI_k = 1$ with all tasks along the transport chain under observation are done or organized by one central intermediary on own account.

Table 6.8 Brokerage scores and degree of vertical integration in export

Sample	Gatekeeper $b_{01k}(B+W)^{-1}$	Liaison $b_{0k}(B+W)^{-1}$	Representative $b_{10k}(B+W)^{-1}$	Local broker $w_{1k}(B+W)^{-1}$	VI_k
FCL-A	0.20	0.57	0	0	0.36
	(0.14)	(0.08)	–	–	(0.20)
FCL-HH	0.08	0.79	0	0	0.52
	(0.11)	(0.12)	–	–	(0.16)
FCL-HB	0.04	0.69	0	0	0.31
	(0.12)	(0.17)	–	–	(0.18)
FCL-D	0.05	0.73	0	0	0.39
	(0.11)	(0.14)	–	–	(0.19)
SEA	0.08	0.69	0	0	0.38
	(0.02)	(0.02)	–	–	(0.20)
AIR	0.12	0.74	0	0	0.33
	(0.12)	(0.12)	–	–	(0.16)
Integrator	0.80	0.20	0	0	1.00

Table 6.9 Brokerage scores and degree of vertical integration in import

Sample	Gatekeeper $b_{01k}(B+W)^{-1}$	Liaison $b_{0k}(B+W)^{-1}$	Representative $b_{10k}(B+W)^{-1}$	Local broker $w_{1k}(B+W)^{-1}$	VI_k
FCL-A	0.06	0.81	0	0	0.25
	(0.10)	(0.17)	–	–	(0.19)
FCL-HH	0.07	0.88	0	0	0.40
	(0.06)	(0.17)	–	–	(0.14)
FCL-HB	0.00	0.93	0	0	0.26
	(0.08)	(0.00)	–	–	(0.17)
FCL-D	0.02	0.91	0	0	0.31
	(0.09)	(0.15)	–	–	(0.19)
SEA	0.03	0.89	0	0	0.30
	(0.10)	(0.17)	–	–	(0.19)
AIR	0.12	0.86	0	0	0.44
	(0.16)	(0.16)	–	–	(0.21)
Integrator	0	0	0.33	0.67	1.00

transhipment and onward carriage) and cares for customs clearance as a representative. Furthermore, all average raw brokerage scores as shown in Tables 6.8 and 6.9 do not necessarily add up to 1, because in the freight forwarder samples, some of the other transport chain participants act as intermediaries, too. One of many examples to this are customs house brokers, who are sometimes engaged to clear goods at customs on behalf of their clients like shippers, consignees or freight forwarders.

A first striking feature of both tables is that all freight forwarders serve neither a representative nor a local brokerage role at all *vis-à-vis* their clients, because in all freight forwarder samples $b_{10k}(B+W)^{-1} = w_{1k}(B+W)^{-1} = 0$ for all k. Furthermore, the majority of contacts vis-à-vis their clients are of the liaison type with a maximum average $b_{0k}(B+W)^{-1} = 0.57$ if all tasks are done or organized for FCL-A export shipments and minimum average $b_{0k}(B+W)^{-1} = 0.93$ in the case of FCL-HB import shipments, spanning across different subgroups with their clients on one hand and the other participants along the transport chain on the other.

Comparing FCL-A with FCL-D in Table 6.8, there is some striking empirical evidence that in the case of export shipments, Austrian freight forwarders seem to act merely as gatekeepers rather than as brokers of the liaison type as their German counterparts do.[62] Especially freight forwarders from Hamburg engage themselves mostly in brokerage activity of the liaison type (with average $b_{0k}(B + W)^{-1} = 0.79$) which at the same time results in a considerably higher average degree of vertical integration in comparison to their counterparts from Bremen and Bremerhaven.[63] This is borne from the fact that most of them handle their customs paperwork in-house and book sea freight directly, whereas the other freight forwarders more often employ ship brokerage intermediaries with freight forwarders from Bremen and Bremerhaven heavily relying on carrier haulage services for pre-carriage.

According to Table 6.9, import shipments operations in the AIR sample come along with slightly more brokerage of the gatekeeper type than at their counterparts in the SEA sample, which results in a higher degree of vertical integration for freight forwarders in air freight import operations.[64] They more often conduct cartage service on own account, whereas for the freight forwarders in the SEA sample it seems to be more common just to dispatch incoming shipments with onward carriage organized in merchant or carrier haulage.

Comparing these empirical results with the benchmark case of a fully integrated transport chain, the situation is totally reversed: For outgoing export shipments, the integrator mainly serves as a gatekeeper for his own highly standardized logistics system, whereas import shipments coming from own subsidiaries abroad are mainly handled in-house and so brokerage of the representative or local type occurs.[65] This sums up to a maximum degree of vertical integration.

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[62] Statistically significant at the 5% level for $b_{01k}(B + W)^{-1}$ according to Mann-Whitney-U ($z = -2.031$, $\rho = 0.042$) and for $b_{0k}(B + W)^{-1}$ according to Mann-Whitney-U ($z = -2.156$, $\rho = 0.043$), see Appendix Statistical Tests.

[63] Statistically significant for Export VI_k at the 5% level according to Mann-Whitney-U ($z = -2.602$, $\rho = 0.009$) and at the 10% level according to Kolmogoroff–Smirnov ($z = -1.268$, $\rho = 0.080$). Furthermore, statistically significant at the 10% level for Import VI_k according to Mann-Whitney-U ($z = -1.8520$, $\rho = 0.069$) as well as Kolmogoroff–Smirnov ($z = -1.235$, $\rho = 0.095$), see Appendix Statistical Tests.

[64] Statistically significant at the 5% level for Import VI_k according to Mann-Whitney-U ($z = -2.165$, $\rho = 0.030$), see Appendix Statistical Tests.

[65] Statistically significant at least at the 10% level for VI_k, $b_{01k}(B + W)^{-1}$ and $b_{0k}(B + W)^{-1}$ in export as well as VI_k and $b_{0k}(B + W)^{-1}$ in import according to Mann-Whitney-U testing integrator benchmark case against SEA, AIR as well as total sample, see Appendix Statistical Tests for detailed test statistics. In the case of testing the integrator benchmark case against FCL-A, FCL-D, FCL-HH and FCL-HB, the sample sizes seemed to be too small to give overall statistically significant support according to Mann-Whitney-U for VI_k, $b_{01k}(B + W)^{-1}$ and $b_{0k}(B + W)^{-1}$ in export as well as VI_k and $b_{0k}(B + W)^{-1}$ in import, but the results weakly support such assertions.

Last but not least, considering the values of $C'_C(p_k)$ and $C'_B(p_k)$ in Tables 6.6 and 6.7, the proposition of C'_C(integrator) $>$ C'_C(freight forwarder) and C'_B(integrator) $>$ C'_B(freight forwarder) can be supported, albeit the differences shown there turned out not to be of statistical significance as some of the freight forwarders in the sample actually integrated operations like cartage service, customs declaration or affreightment via own NVO otherwise executed by other transport chain members (see Sect. 6.3.1.3). Nevertheless, reflecting Täube's (2004) framework of social capital it can be reasoned that freight forwarder's social capital is some sort of leverage capital which stems from his ability to bring transport chain members together like bridging structural holes in a social network.

Chapter 7
Final Conclusions

In these concluding sections, first main findings from the previous parts of this book are briefly summarized before the contribution of this work to extant research and managerial implications are outlined. Finally, limitations are addressed and suggestions are given for further research.

7.1 Summarizing Main Findings

As an overall guiding principle of this work, role theory as outlined in Sect. 1.2 was employed which offers a body of definitions concerning role, position and status of a person or organization. Both entities were treated as equal in the context of this work as the freight forwarding business is a truly people-driven service industry. In the following, main findings are presented along the three research questions as initially stated in Sect. 1.2.

7.1.1 What Is the Intermediary Role of Freight Forwarders in Multimodal Transport Chains Including a Leg by Sea or Air?

This was encountered from three different perspectives as shown in Fig. 3.1. First a *legal and functional perspective* of freight forwarding was outlined in Chapter 2 which served as status quo or reference point for more elaborated theoretical and empirical treatments. Then an *intermediary perspective* was developed in Chapter 3, followed by a *network perspective* in Chapter 4. Finally in Chapter 6, a survey was conducted in order to show empirical evidence in the case of freight forwarders from Germany and Austria in 2003. Concerning the intermediary role of the freight forwarder in the context of this work, it can be concluded that he is

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truly "The Architect of Transport" as this is reflected in all perspectives. Its role-set covers all necessary functions to organize shipments and to provide ancillary financial, transport and logistics services upon request, its position is one of a focal actor between shippers, consignors, consignees and the other participants along a multimodal transport chain and his status seems to be high.

7.1.2 Which Body of Theory May Help to Explore Its Intermediary Role Theoretically?

Two perspectives based on economic theory and/or economic sociology were thoroughly reviewed in Chapters 3 and 4 of this work, namely (1) an *intermediary perspective* consisting of *New Institutional Economics* (NIE), *Market Microstructure Theory* (MMT) and *Intermediation Theory of the Firm* (ITF) and (2) a *network perspective* with *Network Models in Operations Research and Management Science*, *Strategic Networks*, *Dynamic Networks*, *Entrepreneurial Networks*, *Industrial Networks* and *Social Networks* as a selection of existing network theories which were regarded as relevant in the context of this work.

Comparing these two bodies of theory with the initially made observations of the *legal and functional perspective* in Chapter 2 the *intermediation perspective* showed that a freight forwarder may be best described as a strange hybrid providing transport, logistics and financial services in addition to his basic intermediary function of organizing physical goods movements on behalf and account of his clients as being somehow the core of freight forwarding business. In terms of ITF, he has a widespread range of intermediary role-sets from being a market maker, matchmaker, information producer, -guarantor or certificator as well as agent for delegated expertise, bargaining, contracting and/or monitoring. Concerning the *network perspective*, it can be concluded, that a freight forwarder's intermediary role in multimodal transport chains with a leg by sea or air can at best be described as a focal company in a social network structure.

7.1.3 Which Kinds of Measures Are Needed to Catch Its Intermediary Role Empirically?

As *Social Network Analysis* in Chapter 4 turned out to show the highest usability in the context of this work, in Chapter 5 relevant analytical concepts for both personal network structure (e.g. *network size* and *density*) and intermediary position (e.g. *centrality* and *prestige*) as well as relationships (e.g. *brokerage capacity* and *network constraint*) were thoroughly discussed and suggestions were made how to apply these measures to empirical data in order to explore social network structures as well as social capital.

Concerning the empirical results of freight forwarder's personal network structure and intermediary position among participants of a multimodal transport chain with a leg by sea or air in Part 6, freight forwarders engaged in air cargo operations show a higher amount of social capital than their counterparts engaged in maritime shipments. Moreover, freight forwarders at Bremen or Bremerhaven tend to show the highest amount of social capital followed by their colleagues at Hamburg and the Austrian ones which may stem from the fact that they do not often act on own account but employ other multimodal transport chain participants to organize their shipments. A closer look at measures of centrality indicates that their sources of social capital are different as freight forwarders at Hamburg, Bremen and Bremerhaven are engaged in organizing local operations at seaports whereas Austrian ones exploit their position as a remote acting agent for their clients in the hinterland. These assertions are further reinforced by measures of brokerage capacity according to which freight forwarders in the sample generally serve neither a representative nor a local brokerage at all *vis-à-vis* their clients of export shipments with the majority of their contacts being of the liaison type where they serve as an intermediary between their clients and other multimodal transport chain participants unless unrelated to each other. In addition to this, Austrian freight forwarders seem to act merely as gatekeepers rather than brokers of the liaison type whereas freight forwarders at Hamburg engage themselves mostly in brokerage activity of the liaison type as most of them handle their customs paperwork in-house and book sea freight directly, whereas the other freight forwarders more often employ ship brokerage intermediaries with freight forwarders from Bremen and Bremerhaven heavily relying on carrier haulage services for pre-carriage. Concerning import shipments, air cargo operations may come along with slightly more brokerage of the gatekeeper type than full container loads in maritime shipping. Freight forwarders engaged in air cargo shipments seem to conduct cartage service more often on own account, whereas in the case of maritime shipments it seems to be more common just to dispatch incoming cargo with onward carriage organized in merchant or carrier haulage. Finally comparing these empirical results with the benchmark case of a fully integrated transport chain, the situation is totally reversed: For outgoing export shipments, the integrator mainly serves as a gatekeeper for his own highly standardized logistics system, and import shipments coming from own subsidiaries abroad are mainly handled in-house and so brokerage of the representative or local type occurs. This leads to the conclusion that freight forwarding is far from being vertically integrated and further it can be reasoned that freight forwarder's social capital is some sort of leverage capital which stems from his ability to bring transport chain participants together like bridging structural holes in a social network.

7.2 Contribution to Extant Research

As this work came along with many reviews of already existing theory, there are several topics to highlight which may be useful even in other contexts.

In Chapter 2 a *legal and functional perspective* of freight forwarding was thoroughly discussed which is not too much reflected outside literature of strictly legal nature.

Developing an *intermediary perspective* in Chapter 3 deeply rooted in NIE led to strictly defined intermediary roles derived from MMT and ITF, which again resulted in a taxonomy of intermediaries and service providers in multimodal transport chains and logistics as shown in Sect. 3.3. But apart from just describing intermediary role-sets in the context of this work, NIE as well as MMT and ITF offer widespread applicability in law and economics as they help to clarify complex contractual relationships beyond simply legal considerations by introducing issues like bounded rationality, imperfect information structures as well as positive transaction costs.

Concerning the *network perspective* in Chapter 4, six relevant modelling approaches were identified. Considering their different approaches to network structures, a one-for-all approach is not available as their underlying body of theory deviates in many aspects in terms of theory objectives, drivers, actors and their linkages, line of argumentation, presumed network governance and analytical instruments offered. Especially *Social Network Analysis* (SNA) turned out to be an excellent approach to treat various sorts of network structures because it (1) allows to model a full set of possible actor roles as well as network governance without bias, (2) develops purely social aspects and/or information flows in network structures beyond strictly economic considerations and (3) allows to explore and/or quantify them directly.

Furthermore, various measurement concepts on a personal as well as overall network level from the wide prospering field of SNA are described en detail in Chapter 5. Among them, however, the brokerage role approach in social networks with non-overlapping subgroups seems to be a powerful measurement concept if intermediary relationships forming triads are present. This offers a new way to describe all sorts of network-like structures in transport and logistics operations as well as supply chain management, where up to now research on dyadic relationships is more common.

Overall, both an *intermediary* and *network perspective* has been added as theoretical background to conduct studies in the field of freight forwarding as well as the wider context of transport, logistics and supply chain management where several actors are needed to end in a joint product of transport and/or logistics service. Suggestion for further research in this directions are outlined below.

7.3 Managerial Implications

Even in such a globalized world of today, distance still matters in terms of time and costs spend on cargo movements (Frankel, 1999, 2002) as well as trade barriers and unfavourable business environments are still present in many countries as clearly shown e.g. by Ghemawat (2001), the Logistics Performance Index (LPI) of the Worldbank or the Enabling Trade Index (ETI) from The World Economic Forum.[780] As shown in this book, freight forwarder help to overcome these obstacles of international trade as quite central player serving as a bridge between several actors along multimodal transport chains by sea or air. Furthermore, as the freight forwarding business in its core is a people's business, personal social networks truly matter. While not being conscious about this, freight forwarders deal day by day with these issues of embeddedness and social capital from social network theory. Beside this, other economic theories treated in this book like NIE, MMT or ITF are worthwhile to employ as they may lead to new insights and a further understanding of freight forwarding business which then may improve strategic management thinking in this field as e.g. Stabell and Fjeldstad (1998), Håkansson and Ford (2002), Gadde et al. (2003), Spulber (2003) or Button (2005) suggested in similar contexts.

7.4 Limitations and Suggestions for Further Research

Of course, some limitations of this work have to be noted. First, the reviews about PAT, MMT and IFT in Chapter 3 – albeit extensive – are far from being complete. Furthermore, other network theories than these six reviewed ones could have be taken into account in Chapter 4 which may have been suitable in this context, too. Moreover, a focus was set solemnly on measures on a personal and overall network level in Chapter 5.

Referring to Chapter 6, the overall sample size of the surveys got too small and can be regarded as exploratory and non-representative. But comparisons of sample characteristics with empirical data raised elsewhere showed that survey respondents and their companies can be considered as typical freight forwarders engaged in multimodal transport chains with leg by sea or air in terms of company size, fields of activity as well as company turnover generated by sea, air and international freight forwarding operations. Furthermore, the organizational arrangements made in case of typical shipments given by respondents for further investigation mirror general statements about contemporary sea and air transport operations as laid out in Chapter 2 considering that application of electronic customs procedures where non-obligatory in 2003 and cargo community systems in air cargo transport operations like TRAXON got more attention in the meantime. Therefore, customs procedures for air cargo shipments in the sample were mainly handled manually, whereas long established cargo community systems like DAKOSY and DBH were frequently used to process maritime shipments. Moreover, some more elaborated measurement concepts like prestige and network constraint – albeit initially intended – could not be applied to network structure data obtained by the surveys as it had to be reduced

[780] For more information about their content and methodology see http://www.worldbank.org/lpi and http://www.weforum.org/en/initiatives/gcp/GlobalEnablingTradeReport/index.htm.

to a binary graph. May be structured personal interviews would have led to better results, but this was a matter of time and financial funding during sample raising.

In addition to this, throughout this book industry dynamics were only marginally addressed like the internationalization processes and M&A activity of freight forwarding companies, issues of dis- and reintermediation along multimodal transport chains as well as impacts of overall business environment changes which offer opportunities for further research. First, it may be good to look closer on the internationalization process of freight forwarders in multimodal transport chains (see e.g. Lommelen, 2004 or Neiberger, 2007), a topic so far mainly reflected in an European context by Hertz (1993, 1996a,b), Stahl (1995a) or Ludvigsen (2000). Furthermore, this comes often with heavy M&A activity[781], which follows typical patterns concerning country regions and main field of activity as noted e.g. by Schramm and Niedermaier (2008a,b). Moreover, dynamic aspects of vertical integration as well as dis- or reintermediation as shown exemplary in Sect. 4.4.2 have to be taken into consideration in the context of such multimodal transport chains.[782] Especially middlemen mainly economizing on searching and matching processes like real estate brokers, travel agents or brokers on financial as well as insurance markets as well as freight forwarders mainly engaged in matchmaking activity seem to be in danger of just being disintermediated.[783] But at the same time, reintermediation of such middlemen does actually occur, if they adapt quickly to the new environment and differentiate themselves successfully by offering value-adding services.[784] In addition to this, disintermediation may occur as a by-product of governmental action, as Carr and Crum (1995) showed in the customs brokerage business and Clott (2000) in case of US-American NVOCCs. This leads directly to topics of industry dynamics in a wider context, where e.g. political embeddedness and/or socio-cultural environment may have to be taken into account, as freight forwarding business as a specialized service industry is always exposed to such developments outside its sphere of control. As SNA is rather too descriptive, a case study approach to explore e.g. long-term strategic issues or longitudinal studies to research organizational developments and/or environmental dynamics would offer new insights in the freight forwarding business.

Last but not least, some authors like Beier (1989), Gentry (1996), Bask (1999, 2001), Larson and Gammelgaard (2001-2002) discussed the implications of triadic relationships in transport and logistics, where a carrier or a logistics provider is involved in a buyer–supplier or a consignor–consignee relationship. Furthermore,

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[781] See e.g. Dörrenbacher (1990), Plehwe (1999), Stone (2001), Carbone and Stone (2005).

[782] See e.g. Schlichting (1931, pp. 64–66), Stern (1938, pp. 49–52), Kirchner (1950, pp. 136–144), Seidenfus (1973, p. 2), Davies (1981) or Miller (2002), about forward or backward oriented vertical integration in freight forwarding or maritime shipping.

[783] Cf. Amely (1994), Lewis and Talalayevsky (1997), Schmidt et al. (1998), Pötzl (2000), Economides (2001), Globerman et al. (2001) or Sawyer et al. (2003).

[784] See e.g. Clemons and Hann (1999) in the case of travel agencies and Sawyer et al. (2003) for real estate brokerage.

recent works on triads of buyer–supplier–supplier as well as buyer–supplier–buyer relationships by Choi and Kim (2008), Li and Choi (2009) and Choi and Wu (2009) were added to the supply chain research agenda. Especially these research approaches seems to be very promising as triad relationships are fundamental building blocks of network structures and therefore can be used in the following to explore even more complex structures in the field of transport, logistics and supply chain management.

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Appendix

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