

things are required for the development of a research design  
of the units of analysis, the decision as to how to select  
for each  
behavior  
, con  
e term  
e ter  
e act  
tribute  
r  
a on  
tion  
s  
th pe  
h  
even  
e a  
alitat  
tes to  
en pe  
ith  
ount.  
is  
s, the  
e  
ed, i.  
ow  
that  
ms  
nbed  
rm "s  
t-  
y stru  
en-  
group  
dyad  
ry  
exam  
r soc  
ac-  
ple  
e l  
ens  
s (c  
for

# Studying Social Networks

A Guide to  
Empirical Research

campus

etc.), affiliations (to associations, departments, et  
(authority, etc.), and physical connections.



*Marina Hennig* is Professor for Social Network Research and Sociology of the Family at Johannes Gutenberg-Universität Mainz. *Ulrik Brandes* is Professor for Algorithmics in the Department of Computer and Information Science at the University of Konstanz. *Jürgen Pfeffer*, PhD is currently a Post-Doctoral Associate at the Center for Computational Analysis of Social and Organizational Systems (CASOS) at Carnegie Mellon University. *Ines Mergel* is an Assistant Professor of Public Administration and International Affairs at the Maxwell School of Citizenship and Public Affairs at Syracuse University.

Marina Hennig, Ulrik Brandes, Jürgen Pfeffer, Ines Mergel

# Studying Social Networks

A Guide to Empirical Research

In collaboration with

Stephen P. Borgatti, Lothar Krempel, and Michael Schnegg

Campus Verlag  
Frankfurt/New York

© Campus Verlag GmbH

We gratefully acknowledge financial support from Deutsche Forschungsgemeinschaft (DFG) under grants He 5537/1-1 (Cooperation Network “Social Network Analysis”) and Br 2158/6-1 (Reinhard Koselleck-Project “Social Network Algorithmics”).

Bibliographic Information published by the Deutsche Nationalbibliothek.

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from the publishers.

Copyright © 2012 Campus Verlag GmbH, Frankfurt-on-Main

Cover design: Guido Klütsch, Cologne

Printing office and bookbinder: CPI buchbuecher.de, Birkach

Printed on acid free paper.

Printed in Germany

This book is also available as an E-Book.

[www.campus.de](http://www.campus.de)

[www.press.uchicago.edu](http://www.press.uchicago.edu)

# Contents

Preface . . . . .	9
How to Use this Book . . . . .	11
1. Introduction . . . . .	13
1.1 The Construction of Social Networks . . . . .	13
1.2 Social Network Studies . . . . .	15
1.2.1 The Community Question . . . . .	15
1.2.2 Viral Marketing . . . . .	20
1.2.3 Corporate Networks . . . . .	21
1.3 Exercises . . . . .	25
2. Research Design . . . . .	27
2.1 Social Networks . . . . .	29
2.2 Networks as Variables . . . . .	31
2.2.1 Explanatory Variables . . . . .	35
2.2.2 Dependent Variables . . . . .	37
2.3 Typology of Networks . . . . .	47
2.3.1 Complete Networks . . . . .	49
2.3.2 Ego-centered Networks . . . . .	52
2.4 Longitudinal Network Studies . . . . .	55
2.5 Summary . . . . .	57
2.6 Exercises . . . . .	59

3.	Data . . . . .	61
3.1	Kinds of Data . . . . .	62
3.1.1	Units and Levels . . . . .	62
3.1.2	Organization . . . . .	67
3.1.3	Which Data for Which Type of Network? . . . . .	72
3.2	Data Collection . . . . .	75
3.2.1	Sources . . . . .	75
3.2.2	Boundary Specification . . . . .	83
3.2.3	Alter Recall . . . . .	85
3.3	Quality Issues . . . . .	93
3.4	Ethical Considerations . . . . .	97
3.5	Summary . . . . .	99
3.6	Exercises . . . . .	100
4.	Analysis . . . . .	103
4.1	Mathematical Representation . . . . .	104
4.1.1	Graphs . . . . .	106
4.1.2	Ego-Centered Networks . . . . .	109
4.1.3	Two-Mode Networks . . . . .	110
4.2	Indexing and Grouping . . . . .	111
4.2.1	Dyads as the Unit of Analysis . . . . .	112
4.2.2	Network Characteristics . . . . .	118
4.2.3	Centrality . . . . .	123
4.2.4	Cohesion . . . . .	130
4.2.5	Roles . . . . .	134
4.2.6	Blockmodeling . . . . .	137
4.3	Modeling . . . . .	140
4.3.1	Idealized Models . . . . .	141
4.3.2	Exponential-Family Random Graph Models . . . . .	143
4.4	Summary . . . . .	145
4.5	Exercises . . . . .	146

---

5. Visualization . . . . .	149
5.1 Graphical Representation . . . . .	151
5.1.1 Sociogram . . . . .	151
5.1.2 Sociomatrix . . . . .	155
5.1.3 Two-Mode Network Representations . . . . .	159
5.2 Multivariate Information Visualization . . . . .	162
5.2.1 Substance-Based Layout . . . . .	165
5.2.2 Other Graphical Variables . . . . .	169
5.3 Information Layering . . . . .	169
5.3.1 Filtering . . . . .	170
5.3.2 Level of Detail . . . . .	174
5.3.3 Micro/Macro Reading . . . . .	175
5.4 Summary . . . . .	177
5.5 Exercises . . . . .	179
6. Summary . . . . .	183
List of Figures . . . . .	189
List of Boxes . . . . .	191
About the Authors . . . . .	193
Bibliography . . . . .	195
Index . . . . .	211





# Preface

Network paradigms are on the rise. Over the past two decades, they have diffused from sociology, anthropology, and social psychology into countless other disciplines. More and more phenomena are being conceptualized as networks because it appears that they are better suited to representing and explaining some complex dependencies that are not captured in population samples and feature vectors.

Accordingly, an increasing number of books about networks and network analysis is also being published. In our view, however, these are often centered on substantive problems addressed using network perspectives, on theoretical reflections about the role and function of networks, or on models and methodological contributions for the analysis of networks and complex systems in general. What appears to be missing is a textbook that builds on and updates the widely known and instantly classical texts by Wasserman and Faust (1994) and Scott (2000) but is more directly tailored to application in empirical studies.

The idea to put together an interdisciplinary group of researchers to address this apparent gap arose in a discussion between Marina Hennig and Ines Mergel during the Sunbelt XXVI Social Networks Conference (25–30 April 2006, Vancouver, BC). Steve Borgatti, Ulrik Brandes, Marina Hennig, Lothar Krempel, Ines Mergel, and Michael Schnegg then outlined a structure that would follow the empirical research process and include learning goals, examples, and exercises. This initial design was refined and implemented by the present authors. An important aspect of our approach is that we do not focus on networks in a specific domain or methods of a particular kind; instead, our intention is to provide a compact guide to the utilization of network approaches in the social sciences, in the broadest possible sense.

Many of these aspects have been shaped by the valuable feedback we received from participants in courses we have taught in various formats,

disciplines, and locations. Additional input was provided by numerous colleagues and students within and outside of our working groups. We have also learned from each other, and sincerely hope that readers will feel that they benefit from this book as much as we did from the experience writing it.

Our heartfelt thanks go to everyone who has contributed to the completion of this project. The *Deutsche Forschungsgemeinschaft* (DFG) supported us financially with a Cooperation Network grant to Marina Hennig and a Reinhart Koselleck project grant to Ulrik Brandes. The Social Science Research Center Berlin provided administrative management support, and we are particularly grateful to Elisabeth Hamacher, Susanne Grasow, and Claudia Buchmann. We thank Susan Cox for copy-editing and Christine Agorastos for assistance in preparing the final manuscript. Jutta Allmendinger and Kathleen M. Carley provided much-appreciated guidance and support, and our own personal networks bore with us.

*Berlin/Mainz, Konstanz,  
Vienna/Pittsburgh, Syracuse  
July 2012*

*Marina Hennig  
Ulrik Brandes  
Jürgen Pfeffer  
Ines Mergel*

# How to Use this Book

---

Each chapter starts with a paragraph like this stating the learning goals of the chapter. Its purpose is to provide a concise overview of what to expect in the subsequent sections.

In this very short chapter, you will learn about our reasons for organizing this book in the way we did and how we think you can get the most out of it. This includes suggestions for additional material such as software tools.

---

This book is written for students, researchers, and practitioners in all disciplines. It provides an introduction to the process of carrying out an empirical network study, assuming that you are familiar with – or familiarize yourself with by other means – the general principles of empirical research. In a nutshell, we roughly assume the following steps, possibly with iterations:

1. *Research question* (examples in Chapter 1)
2. *Substantive theory*
3. *Hypotheses*
4. Research design (Chapter 2)
5. Data collection (Chapter 3)
6. Exploration and analysis (Chapter 4)
7. *Interpretation* and presentation (Chapter 5)

A scientific paradigm is a combination of theories and corresponding methods. Since there can be no universal substantive network theory, the network approach is actually a family of paradigms which are mostly distinguished by their domain-specific theories. The items shown above in *italics* are specific to a domain and perspective, and not, therefore, cov-

ered in this book. For compactness, we also restrict the exposition to methods specific to network representations.

You are strongly encouraged to use one of the available software tools for network analysis to actively try out the concepts presented in this book. Some more widely used tools are: UCINET,<sup>1</sup> Pajek,<sup>2</sup> visone,<sup>3,4</sup> Tulip,<sup>5</sup> ORA,<sup>6</sup> NodeXL,<sup>7</sup> and the sna package<sup>8</sup> of R. Many more are listed in a dedicated Wikipedia article.<sup>9</sup> Some tools are accompanied by example data sets, and several collections of network data on the Internet provide realistic examples for reproduction and further analysis.<sup>10</sup>

Grey boxes separate additional material from the main text. These are often pointers to well-known network studies that we suggest for further reading. Following at least some of these pointers will give you a better understanding of the nature and scope of network studies. Instructors may find them useful in the compilation of seminar reading assignments.

Each chapter ends with a collection of exercises. Some are rather involved and require the extensive review of material presented in the chapter, and many are formulated as open-ended questions to encourage further self-study. Instructors may want to use them as inspiration for homework assignments or student projects.

Overall, our intention is to provide you with a frame of reference rather than a complete list of aspects and techniques. We hope that you find this book inspiring, and perhaps even fun. Enjoy!

---

1 <http://www.analytictech.com/ucinet/>

2 <http://pajek.imfm.si/>

3 <http://www.visone.info/>

4 Network diagrams in this book have been produced with visone.

5 <http://tulip.labri.fr/>

6 <http://www.casos.cs.cmu.edu/projects/ora/>

7 <http://www.codeplex.com/nodexl/>

8 <http://erzuli.ss.uci.edu/R.stuff>

9 [http://en.wikipedia.org/wiki/Social\\_network\\_analysis\\_software](http://en.wikipedia.org/wiki/Social_network_analysis_software)

10 A good starting point which includes pointers to other repositories is Vladimir Batagelj's list at <http://pajek.imfm.si/doku.php?id=data:index>

# 1 Introduction

---

Social network studies entail the use of network representations to understand social phenomena. Social networks do not exist as such but only as concepts. This is illustrated by means of three example studies which also delineate the scope of this book.

---

Relations matter. You knew this, of course – Why else would you be interested in learning about social network analysis? The real questions are: How, where, when, and why do they matter? And, more pragmatically, how can you show that they do?

This book is organized along the process of an empirical study of social networks. It thus provides a guideline and orientation. While we concentrate on the things that are not treated in textbooks on empirical studies of population samples (i.e., non-relational studies), we still think that the book is largely self-contained.

So, what is the subject of a network study?

## 1.1 The Construction of Social Networks

It has become commonplace to refer to interacting or otherwise dependent entities as networks. The phenomena described as networks range from the social interactions of human beings and the flow of goods between countries to gene regulation and railroad infrastructures. What do these examples have in common that leads us to think we can model and analyze them in similar ways?

Some of the phenomena referred to as networks are real in the sense that their existence does not depend on our perspective. Online social

networking services, for example, are technology-enabled products. As such they have well-defined elements. A friending protocol specifies the sequences of actions that yield a link between two user accounts. The immanent meaning of such a link is unambiguous. We may refer to the web of linked accounts as a network or not, in any case, it is represented in the service provider's databases.

However, the social network of human beings who own accounts in the above system is an inferred, construed object. It has no independent existence and is thus always subject to interpretation. In these cases, the use of the term network is that of a model or metaphor; it does not denote an unambiguous object but a perspective.

As a metaphor the term "network" is very graphic, immediately evoking images of points and connecting line segments.<sup>1</sup> Metaphors are very useful for memorization and creative thinking. However, it is not necessarily obvious which aspects of a metaphor correspond to actual properties of that which is represented, and which aspects do not.

Another pitfall of metaphors and models alike is the use of similar representations for weakly related phenomena. By abstracting from the non-essential (with respect to a specific perspective), otherwise invalid commonalities and conclusions may emerge. To illustrate this point, consider (statistical) "distributions" as another example of a representation. If both the distribution of life-expectancy in the east of Austria and the household income in a suburb of Berlin are unimodal (i.e., have a single peak), does this imply that there is a relation between these two phenomena? We assume that you would not think so, but it appears to be much more tempting to speculate about such relations when two networks exhibit similar features because it is more easily forgotten that they are simplifying and homogenizing, reductionist representations.

The study of social networks is, hence, the study of a particular type of representation in social science contexts (Freeman 1989). Therefore, social networks are constructs and do not exist as such. They are representations, in which aspects of a social phenomenon – aspects that seem to be relevant in a specific context and for a specific purpose – are expressed in ways more amenable to scientific scrutiny.

Since there are no social networks per se, it is a linguistic simplification when we say that we are studying social networks. In fact we are studying social phenomena by means of network representations. This is carried

---

<sup>1</sup> It appears that the term "social network" was coined in Barnes (1954), in which precisely this image is evoked.

out by gathering data about aspects of a phenomenon and organizing the data in a convenient form, by applying methods that produce additional, derived data, and translating these back to the realm of the phenomenon. Clearly, this is no different from other empirical investigations. What is distinct in network analysis, however, are the kinds of data and methods, and the reasoning that motivates network representations and justifies the interpretation of results.

## 1.2 Social Network Studies

We consider an empirical investigation a network study, if the underlying theory, the data, or both, focus on pair-wise relationships. Hence, the commonalities of network studies lie not so much in the phenomena under scrutiny but in the conceptual focus on relations. The following three examples illustrate this position and many other studies are outlined in grey boxes throughout this book.

### 1.2.1 The Community Question (Wellman 1979)

The growth of cities and the associated modernization processes constitute an important topic in urban sociology research. Community sociology-based urban research, in particular, often described processes of change as loss events: loss of familiarity, belonging, neighborhood, community, and small social networks. Within this tradition of community research, “urbanism” per se is equated with the development towards an “anonymous mass society” (cf. Wirth’s classical essay of 1938).

In the course of urban modernization processes (for example, in the form of urban rehabilitation projects) and the associated residential mobility, the majority of affected residents experienced loss and grief reactions of varying intensity, which were explained in terms of the loss of spatial identity and the networks of relationships that had developed over generations (Fried 1963; and summary in Mühlich, Zinn, Kröning, and Mühlich-Klinger 1978).

The lament over “community lost,” which has been a fundamental theme of social scientific urban research (cf. Wellman and Leighton 1979) since the 1930s, is combined here with an excessive romantic elevation of the patterns that have disappeared. As a counter thesis to the loss of



community the assumption emerged that neighborhood and family solidarity continues to exist in developed industrial-bureaucratic social systems. This position, which is known as the “saved argument,” asserts that, due to its ongoing effectiveness, community solidarity lives on in the provision of support and sociability and the community demand for informal social control and environmentally-friendly integration into homogeneous residential areas and places of work. The saved argument attained a new orthodoxy in the 1960s through the publication of studies such as “Urban Village” (Gans 1962), Greer’s (1962) theoretical development of post-war survey research, and Jacobs’ (1961) comments on the vitality of the density of diverse city centers.

Whereas the culturally pessimistic line in the interpretation of urban processes of change laments the disintegration of a positive attitude to life – or “sense of community” in the sense used by Sarason (1974) and Glynn (1981) – an opposing pattern of interpretation sees the opportunity for and beginning of a “community liberated” in the disintegration of life forms dictated by tradition: The overcoming of cramped conditions and density, which contain both ties and social control, represents an important precondition for the individualization of persons. They gain the possibility of associating with people of their own choice, freeing themselves from rigid status allocations, and entering into and organizing relationships in accordance with their own voluntary needs. In the loose relationship ties that can be terminated at any time, scope for action arises that is characteristic of the urban subject. Most commentators, who participated in the “community” debate using the “lost,” “saved,” and “liberated” arguments viewed this as something akin to an alternative description of the “reality” of contemporary life, or the developmental succession from the pre-industrial saved community to the lost community, which was replaced, in turn, by the post-industrial liberated community (Wellman, Carrington, and Hall 1988: 135).

In the course of the many community analyses carried out, however, the fundamental structural concern about the question of community was often transformed into a search for local solidarity instead of one focusing on functioning primary relationships. It was assumed a priori here that a significant proportion of urban primary relationships are organized locally. Hence, Wellman (1979) suggests that the community question be studied from a network-analytic perspective. The benefit of the network perspective consists in the fact that it does not take supposed – local or kinship – solidarities as its starting point and does not aim primarily to

find and explain the persistence of feelings of solidarity. Instead, it is interested in presenting the structure of relationships and flow of activities so that the focus in the community debate is no longer on normative and spatial preferences but on the fundamental structural issues raised by the community question.

To this end, the question as to the effects of the differentiated social structure of the macro level on the significant social connections and relationships between individuals on the micro level is reformulated. For Wellman, social integration is not the community that is integrated via normative orientations but an integration achieved through the nature of the relationship structures. Forms of solidarity communities that can be closely defined spatially are no longer sought but, instead, strong relationships that are not characterized by spatial delineation but by their integrating function. Wellman et al. (1988) formulated the theoretical positions from community research in three theories – community lost, community saved, and community liberated – and applied the forms of the structural characteristics fostered as ideal types (see Figure 1) for an ego-centered network analysis and analyzed them in an empirical study on East York.

In 1968, Coates and Wellman surveyed 845 ego-centered networks in the Toronto neighborhood of East York (Wellman 1993: 426). A name generator was used for the purpose: “I’d like to ask you a few questions about the people outside your home that you feel closest to; these could be friends, neighbors or relatives.” (Wellman 1979: 1209)

Of the named alteri, only the first six were recorded and taken into account for the remainder of the survey. Ego was then asked whether the named alteri had the same relationship with each other, i.e., whether they were close to each other. The role of the alteri for ego, the alteri’s gender, the nature and frequency of contact between them (i.e., telephone, letter, or face-to-face), place of residence and distance between alter’s and ego’s residences, and the guaranteeing of everyday and emergency assistance from the alteri were also surveyed (Wellman 1979; Wellman, Carven, Whitaker, Stevens, Shorter, DuTroit, and Bakker 1973; Wellman and Hiscott 1985). An example is shown in Figure 2.

Wellmann found hardly any network structures in his East York study that could be clearly classified in accordance with the “lost” theory. The surveyed networks tended to correspond to the forms of the other two theories, however they could not easily be classified. Most of the networks displayed elements of both theories. In addition to these find-

<i>community characteristics</i>	lost	saved	liberated
size of networks	very small	very large	large
origins	friends, organizations	kin, neighborhood	friends, workplace
duration	short	long	mostly short
roles	acquaintances	kin, neighbors	friends, co-workers
socio-physical context	public, private	communal spaces	private spaces
residential separation	somewhat dispersed	local	highly dispersed
frequency of contact	low	high (much in person)	high (much phone use)
structural embeddedness	none	very high	high
network context	dyads	large group	small clusters
density	very low	very high	moderate overall, with dense clusters
cluster overlap	low	one big cluster,	low
number of network pieces (components + isolates)	many small fragments and isolates	one big cluster, no isolates	several small clusters and isolates
cluster dominance	no	yes, by one	yes, by several
abundance of aid	low	high	moderate
variety of aid	low	high	high
articulation with large-scale social systems	little (companionship only)	defensive coping with demands companionship	ways of accessing resources, companionship
specialization	specialized ties	multistranded ties	specialized ties
reciprocity	low, only dyadic	high, communal	high, within circles

*Figure 1: Ideal types of ego-centered networks according to Wellman, Carrington, and Hall (1988: 130–184).*

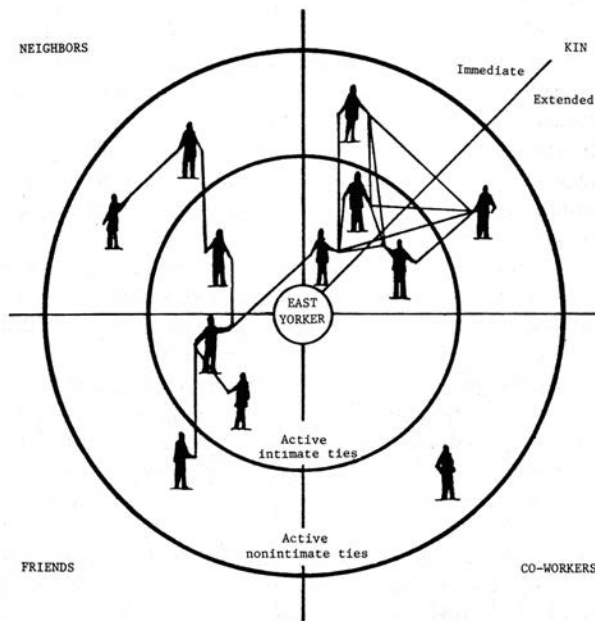


Figure 2: Personal network of an East Yorker (reproduced from Wellman and Berkowitz 1988: 27).

ings, what is interesting about Wellman's study is his reconceptualization of the community question, which was initially formulated in macro-sociological terms, in network-analytic terms with a view to making it applicable to a micro-sociological study (cf. Diaz-Bone 1997: 156). Wellman's use of ego-centered networks here reflects personal, experienceable circumstances of the micro level that can arise simultaneously in a society, which can be used in the description of the macro structure by generalizing them (cf. Diaz-Bone 1997: 156). With Wellman's help, this can be used to demonstrate the personal networks of important relationships (cf. Wellman 1979; Wellman et al. 1988).

This example clearly demonstrates how network analysis provides the basis for a discourse on the effects of societal modernization on the individual, the development of familiar life forms, and social relationships, and shows that, although one model or another can dominate in a social system, it is more likely that all three models are present in current reality, at least in part. This means that a personal community can consist

of a mixture of close-knit core clusters and a few loose-knit relationships, which also have connections with other groups and their resources.

### 1.2.2 Viral Marketing (Hill, Provost, and Volinsky 2006)

Hill et al. (2006) presents the results of a *network-based marketing* study. It analyzes the impact of a direct marketing campaign on different customer segments. In particular, the interest is in the importance of consumer networks for the adoption of a new product. In 2004, a telecommunications company conducted a direct-marketing campaign to sell a new “high tech” service to their customers. To obtain the best possible success rate by keeping the costs of the campaign as low as possible, the company decided to select a limited number of people as the target group of the marketing efforts. The company created 21 different segments based on demographic attributes and history with the costumers (e.g., loyalty). In addition to the segments of the company, the involved researchers added a second dimension to grouping the costumers—whether a person was directly connected through its telephone communications network to people that already used the particular new service or not. Consequently, the customers were separated for the analysis into four groups.

1. Traditionally selected customers that were not embedded in networks with existing users.
2. People that were selected twice via the traditional targeting of the company and based on the network connections to existing users.
3. People that were not part of the 21 segments but were selected by the company as, despite failing to provide demographic and historic evidence for becoming a customer of the new service, they had network connections to at least one existing user.
4. People that were not part of the marketing campaign at all but were connected to existing users.

Not very surprisingly, the second group had the highest take rates for the new service (1.25 percent). The following results were more unexpected—for the telecommunications company’s marketing staff, at least. The take rate of the third group of people, which was not profiled as possible purchasers of the product but had connections to existing customers, was three times higher than that of the first group of traditionally selected people who were not connected to existing users of the service (0.83 percent and 0.28 percent). Moreover, the third group outperformed

every one of the 21 different segments that were selected on the basis of different demographic and historic attributes. Another impressive finding was made by the authors when they looked at the fourth group of non-targeted people who had connections with existing customers. The take rate for this group was 0.11 percent. Hill et al. (2006: 269) state that “although they were not even marketed to, their take rate is almost half that for the non-NN [non-network neighbor] targets.” In addition, this is about ten times higher than the estimated 0.01 percent take rate for non-targeted people who were not connected to existing customers. In summary, Hill et al. (2006) presents convincing reasoning for the fact that when it comes to the proliferation of new products, connections to existing customers are significantly more important for successful adoption than any demographic attribute or any preceding relationships between company and customers.

### 1.2.3 Corporate Networks (Windolf 2006)

Until the last third of the 19th century, the family was a central institution in the coordination of transactions and mobilization of resources. Company management consisted predominantly of family members and the family often acted as lender of last resort. With the emergence of large companies, the familial organizational framework was exceeded. Complex transactions could no longer be controlled through familial relationships. Together with the large corporations, the network emerged as a new institution that facilitated the coordination of transactions, the supervision of management, and the social integration of the economic elite.

The network became a cross-company coordination instrument that increasingly superseded the family group. It largely freed itself from its ascriptive characteristics (family and ownership), and it became increasingly professionalized (professional supervisory board, management studies) and subject to regulation. The network constitutes an important element of this modernization process, in the course of which late 19th century capitalism was organized or rationalized.

The analyses of company networks in organized capitalism in Germany and the USA in the period from 1896 to 1938 focus on two functions which are fulfilled by the network and show that an opportunity structure was created through the network that made it possible to pursue different interests. These include the supervision function, on the one hand, and the regulation of competition, on the other.

### *Control Function*

The relationship between the owners and managers in big corporations with thousands of shareholders is hampered by a principal-agent problem: managers have more information and competence. Hence the monitoring of managers became a central problem for corporations.

The function for controlling ownership was replaced by the social control in peer groups. The mutual presence of top managers in the supervisory bodies may be understood as a declaration that the company complies with business ethical standards and the shareholder is not being deceived.

The network provides social infrastructure, in the context of which the compliance with standards can be monitored. In this sense, the members produce a public good, the network's moral capital.

The company network is part of a comprehensive coordination and control system, to which large industrial concerns, universal banks and interest groups belong. Rudolf Hilferding coined the term "organized capitalism" to describe this institutional system. Organized capitalism is based on predictability, continuous profit yields, the bureaucratization of large companies, and the replacement of charismatic entrepreneurship by academically trained management.

Only when economic transactions are rationalized in this way can banks guarantee the reliable and continuous financing of large companies and capital-intensive mass production.

Whereas the banks in the USA provided loans, the banks in Germany were direct shareholders in companies.

### *Regulating the Competition*

Companies that compete in a market make greater profits if they coordinate their behavior with each other.

Two different forms of coordination emerged in the USA and Germany, namely the trust and the cartel. The cartel is federal in structure: Member companies retain their legal and economic independence. Collective control prevents an individual company from gaining a monopoly. Price is often dictated by the weaker members of a group. The trust tends to lead to a centralized monopoly under uniform leadership. The member companies relinquish not only their economic independence but also their legal autonomy. Competition is not regulated in the trust but tends to be eliminated.