

Heikki Nikali

THE SUBSTITUTION OF LETTER MAIL IN TARGETED COMMUNICATION

HELSINKI SCHOOL OF ECONOMICS

ACTA UNIVERSITATIS OECONOMICAE HELSINGIENSIS

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Abstract

We all receive letters, ads, bills and invoices. While all this mail may seem to be increasing, it is in fact mainly the personalized advertisements sent by aspiring direct marketers that we get more often, whereas many orders, bills and invoices have been routed electronically through redesigned business processes. By that, ordinary business mail have already been replaced by telefax and electronic data interchange (EDI), and the same substitution effect will hit us customers as soon as companies switch to call centers and the Internet for electronic commerce.

The objective of this thesis is to find out, first, the impact of the expansion of electronic communication on letter services and second, the most important criteria for selecting a communication mode. We focus on targeted communication, leaving out mass communication. More specifically, the communication modes studied are ordinary letter, hybrid letter, telephone, telefax, electronic mail (eMail), EDI and the Internet. The methods used are econometric modeling based on operator statistics and survevs based on user interviews.

The results indicate that about 40 percent of 1st and 2nd class letter mail has already been replaced by electronic communication means in Finland, and the substitution process will continue at an increasing pace. The most important substitute so far has been telefax, but eMail is expected to take over soon. As a counter-argument against the substitution effect has presented that some electronic communication means, especially the telephone, actually has generated further demand for letters. Our results show that this effect really has existed, but has tapered off during the last two-three decades. There is also competition between the electronic modes of communication. In particular, eMail has challenged telefax lately, indicating that the telefax machine is reaching the peak of its life cycle.

In the surveys users mentioned, the advantages of letter mail are still its data security, personal nature and legal capacity. In the case of electronic messages, there still is some distrust as to whether they will reach the intended recipient and a fear that outsiders will gain access to them. A missing legal capacity, such as the lack of an electronic signature, seems to hinder the use of many electronic devices in targeted communication.

A conclusion based on the results is that we live a transitional period before a radical change in the field of targeted communication will take place. The hybrid network solutions and information services which make use of different digital networks simultaneously will be the prevailing trend. The postal service organizations can not slow down this development nor would it pay off. Instead of relying on the survival of the traditional letter mail services alone, the postal organizations should develop new hybrid communication services and through partnerships offer even purely electronic communication services.

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All errors are due to my imperfection.

Helsinki, May 1998

Heikki Nikali

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1 Introduction

We have all become adjusted to the idea that the volume of letter services more or less follows the tides of economic activity, i.e. we see the upturn in businesses in the number of invoices and advertisements we will receive by post. As late as the 1980's the increase of letter volume exceeded the development of the gross domestic product (GDP), but although all economic factors are today very positive the volume of letter mail is decreasing. The reason for this development is the substitution effect of letters by electronic communication such as replacement of bills by data communication or private letters by electronic mail (eMail).

The focus of this thesis is on the changes that have taken place in the targeted communication market and its future prospects. The study concentrates on targeted communication, leaving mass communication out of the examination. The communication modes studied in this research are: ordinary letter, hybrid letter (ePost), telephone, telefax, eMail, electronic data interchange (EDI) and the Internet. In the case of targeted communication the number of recipients of a given message is limited, but with the new communication means, eMail, ePost and the Internet the borderline between targeted and mass communication has become diffuse. Hence ordinary letter, telephone and EDI are still the pure targeted communication means. Because of the liberalization of telecommunication and postal services in Finland the examination of the effect of competition between these services is both valuable and important.

The substitution models of this study represent the first quantitative results of competition between physically transported and electronically transmitted targeted messages published in the literature.

1.1 Background to the Study

Since the late 1970's new modes of targeted communication have appeared on the market challenging letter services to competition. When electronic data networks become more common, ever larger share of messages will be saved in an electronic form and to be sent and forwarded electronically. This development will affect us all. Does this mean we shall not be getting any more bills by post, when electronic payment is easier and cheaper? Why should we send messages by post any more, when by telefax and electronic mail is both faster and cheaper? The activities of organizations and households will change when previously physical letters become electronically transmitted and are received by addressees simultaneously.

Written communication has a history of hundreds of years, whereas the oldest electronic communication means, the telephone, has been in widespread use only over the last 50 years. As a result, the life cycle curve of letters has reached its saturation stage and the total volume of letters currently declines. Hence, while the volume of communication will increase rapidly, letter services will no more be able to correspond to all of new user requirements.

The volume of different forms of communication in Finland has been recorded from 1850 onwards. Figure 1.1 shows the volumes for different forms of communication since 1900 (collected from different sources and statistics). Telecommunication volumes include turnovers from both Sonera (the former Telecom Finland) and private telephone companies.

The volume of letter services has, with only the exceptions of post-war periods, grown throughout its history. Otherwise the growing trend of letter services has not slowed down until the 1970's. Recently, of course, the severe economic recession of the 1990's has hindered the growth and the substitution of letter mail by electronic communication forms has reversed the development.

At the close of the 19th century, telegraph volume and income approached the volume of letter services after which the introduction of telephone services has reduced the telegram services curve to a minor factor. The volume of the telephone services has grown rapidly and continuously except for a short first world war period, even though a part of data services is still registered under telephone services. Telex services were destined also to a short-lived form of communication.



Figure 1.1 The Shares of the Total Volume of Targeted Communication in Finland in the 20th Century.

The various factors effecting the development of letter volume are described in Figure 1.2. These elements are economic activity, price policies of letter and competing services as well as substitution and generative effects. The difficulty of demand modeling is that all these factors have a simultaneous but different impact. Firstly, the development of letter volume depend directly on economic activity (growth of GDP). Secondly, the increasing real prices of letter services decrease the demand for letter services, and increasing prices of competing services have an activating impact on letter services. There are also competitive effects between the prices of 1st and 2nd class letters. Thirdly, the substitution of letter services by electronic communication usually means a decrease in the volume of letter mail. The generative effect of electronic communication on letters services has the opposite effect, e.g. phone calls

generate extra letters. The substitution and generative effects are not constant over time but vary with the penetration of different electronic communication means.



Figure 1.2Dependence of Letter Volume on Economic Growth and Competition
Effects as well as the Possible Generative and Substitution Effects.

No matter how strong the substitution and generative effects may be, the total volume of letter services may not deviate from the trend, because of compensating marginal effects. This has been, in fact, the situation in Finland in the past. But changes of letter volume can also be very dramatic depending on the changes in economic and competition effects, and the relationship between letter volume and these factors.

The new communication modes have a wide influence on both the internal and external communication of companies as well as on communication between companies and households. Not only do letter services compete against electronic communication but also the different forms of electronic communication compete against each other. For example eMail is in direct competition with telefax machines. Indeed, it seems that telefax machines will in the next five years reach the top of their life cycle curves. Telefax machines will never be widespread in households.

1.2 Objectives of the Study

The aim of this study is to analyze the changes in the targeted communication market. Since this study considers both past and future perspectives, it will be focused on three basic objectives:

- 1. To find out the impact of the expansion of electronic communication on the use of letter services, considering the substitution and generative effects as well as economic growth and the pricing of communication services.
- 2. To classify and evaluate the criteria for the selection of communication modes.
- 3. To specify the implications of competition between the different communication means, considering the technical quality and standard of service, location in the targeted communication market in the next decade and an overview of the long-term future of the letter services.

In this research competition between written and electronic communication has been studied from four different point of views:

1. Substitution effect

How differences in penetration rate of telecommunication equipment in different parts of the country can be detected in the structure of letter services has been estimated with cross-sectional material.

2. Generative effect

Long term (more than one hundred years) and short term (30 years) demand models, which estimate the generative effect on letter services of electronic communication has bee estimated with time series analysis.

3. Demand models

The yearly replacement level for letter services has been estimated with demand models for 1st and 2nd class letters.

4. Selection criteria

The factors affecting the choice of different communication modes have been studied with a view to the present and near future communication strategies of organizations. Selection criteria are examined separately from the point of view of factors relating to the sender and recipient of the message, and the operator transmitting the message. Factors relating to communication technology are included in the selection criteria studied from the point of view of the sender, because the sender has to assess these factors mainly taking into consideration his/her own needs. Choice of factors is made on the basis of the sender of the message.

There are many advantages to carrying out this research in Finland even from the point of view of international readers, because both written and electronic communication is extensive business worldwide:

- Finland has a tradition for compiling comprehensive statistics on communication. The time series for letter and telecommunication services extend over more than one hundred years and accurate data are available despite the fact that as late as the 1950's there were hundreds of telephone companies.
- New information technology has been extensively adopted in Finland, ranking forth in the world after the USA, Sweden and Norway. For example, the proportional share of Internet users and the number of mobile phones in Finland are the highest in the world.
- Telecommunication services have been deregulated in Finland gradually since the end of the 1980's and totally since 1 July 1994. The hidden taxes the state at the same time gradually abandoned. As a result the real prices for telephone services dropped 70 percent in 20 years.
- Finland has been among the first in the world to liberalize the postal services. This happened in practice since 1 July 1991 but in reality since 1 January 1994 on the basis of the Act on Postal Services (Leskinen 1997). However, the first private license was accorded only in 1997 and an account of the license payment no private business operator has yet started operations. The fact that competition within letter services has not been realized to any large extent may work in favor of electronic communication.

The laws on postal and telecommunication functions, which cover those services in Finland, regulate these businesses separately and do not at all comprise competition between physically transported and electronic communication forms. Naturally the relationships between these service branches are self-directing and so the competition under consideration is completely free and unregulated.

1.3 Outline of the Thesis

This thesis is organized as follows. The second chapter provides a survey of the field of research. The definition of communication as well as the classification and prevalence of different communication modes are also discussed. Finally the chapter closes with a review of the literature on the subject of this study.

The third chapter introduces the substitution models by electronic communication for 1st and 2nd class letters¹ (Nikali 1995a). The letters are divided into four content categories on the basis of the types of electronic communication assumed to have been replaced. The categories and their electronic alternatives are:

- bills, replaceable by data communication;
- notices, replaceable mainly by telefax;
- messages, replaceable mainly by electronic mail; and
- magazines, books and goods, which are not expected to be replaced by electronic communication means.

Volume of letter mail to the year 2010 has been forecast by the substitution models in question and by diffusion models for electronic communication means.

The fourth chapter discusses the generative effect of electronic communication on letter mail². The generative effect has been studied using long and short term econometric models. The long term model covers the whole 150 years period during which electronic communication forms have existed and the short term model covers only the last three decades when the telephone has been in widespread use in households and new communication forms have appeared on the communication market.

In the fifth chapter, the substitution effect of letter mail by electronic communication is studied using time series analysis³. The demand models for 1st and 2nd class letters were estimated. The assessment takes into consideration all essential factors that have

² Based on material used in a presentation at an international conference (Nikali 1995d).

¹ Published earlier as "Replacement of Letter Mail by Electronic Communications to the Year 2010 (Nikali 1995a).

³ Published earlier as "Demand Models for Letter Mail and Its Substitutes: Results from Finland" (Nikali 1997a).

an impact on demand, including the price elasticity and the development of electronic communication.

The sixth chapter considers the selection criteria for different communication modes⁴. The criteria are examined separately both from the point of view of the sender and the recipient of the message, and the operator transmitting the message.

The seventh chapter presents the implementation of the research. First the realization of the replacement model presented in chapter three is examined, then the different communication means are compared by estimating the technical quality and standard of service. The status of different communication means over ten years is also estimated using the replacement models. The chapter closes with a discussion on the policy of Finland Post and some analyses of scenarios for the future.

The conclusions of the thesis including the summary of key results and a survey of the future of targeted communication as well as its implication for future research are discussed in chapter eight.

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Published earlier as "Demand Models for Letter Mail and Its Substitutes: Results from Finland" (Nikali 1997a), except sections 5.6 and 5.7 which are based on material used in a presentation at an international conference (Nikali 1996b).

2 **Overview of Targeted Communication**

This chapter presents the volume development of targeted communication in Finland in the 20th century. The definition of targeted communication as well as its structure is also discussed and the communication means under consideration are presented. The chapter closes with a comparative overview of international studies of this subject.

2.1 The Volume of Targeted Communication

The volume of letter services has increased very satisfactorily (by three percent per annum) in Finland over the last 20 years. The three most important factors involved in this development have been: (1) GDP has risen fast (2.1 percent/year), (2) the real prices of letter services has remained stable and (3) the service quality of letter services has stayed at a high level: 94 percent of 1st class letters and 96 percent of 2nd class letters arrive in time (1st class one weekday and 2nd class 3 weekdays). However, the real prices of long distance telephone calls have dropped to one tenth of what they were 20 years ago. The competing information technology is today very advanced in Finland, as well, and not least for a fairly new, recently digitalised telecommunication network. It has made possible to use telecommunication equipment effectively and reliably.

The volume of targeted communication is 1700-times greater in Finland today than it was 150 years ago which means an average growth of 5.1 percent a year. But the volume increased enormously until this decade. The volume of total communication has an index value of one in 1900, the volume level is 130-times greater today, as can be seen from the index values in Table 2.1.

Indeed the growth has been rapid only during the last 70 years. The average growth for this decade has been 5.3 percent a year and over the last 70 years it has been 6.6 percent a year. The most rapid growth periods were after the world wars when economic growth began once again to take place: from 1920 to 1945 the annual change was

+10.0 percent a year and from 1950-1970 it was +7.5 percent a year. After 1970 the average growth has been 4.2 percent a year. As can be seen from Table 2.1, it can be assumed from the development of communication volume that the rate of growth will accelerate. Total volume is thus expected to double in ten years by 2005.

Table 2.1The Volume of Targeted Communication in Finland in the 20th Cen-
tury and a forecast up to the year 2005.

Year	Volume index
1900	1
1925	2
1950	11
1975	61
1985	89
1995	130
2000	180
2005	260

This forecast is based on a follow-up of communication trends and the appraisals of different communications' experts as to what the potential development alternatives are.

Since nearly 90 percent of letters in Finland are send by organizations and almost the half of them go to other organizations, the shift from written communication to electronic forms will most evidently occur first in this business sector. When the volume of letter services decreases, companies may not also need separate mailing departments. The postal functions of companies will disperse to several organization units or they will be bought from an outside provider. Indeed, Finland Post has understood that, too. Finland Post aims to serve its own customers by offering better all-inclusive logistic services, and nowadays by providing also electronic communication services.

In Finland about 800 million 1st and 2nd class letters were handled by the Post in 1997, and about 770 million items in 1991. The distribution of those letters by sender-recipient categories are presented in Table 2.2.

Table 2.2Sender-Recipient distributions of 1st and 2nd class letters in Finland
in 1997 and 1991 (Nikali 1992a and 1997b).

Sender	-	Recipient	Proportion in 1997	Proportion in 1991
Organization	-	Organization	36 %	46 %
Organization	-	Private person	50 %	42 %
Private person	-	Organization	4 %	3 %
Private person	-	Private person	10 %	9 %
TOTAL			100 %	100 %

The share of letter services between organizations dropped significantly in the 1990's, from 46 percent in 1991 to 36 percent in 1997. At the same time, telefax machines, eMail and EDI have become much more common in organizations.

2.2 Definition of Communication

Communication can be determined: Communication is the exchanging of messages between sender and recipient. The definition includes the following factors:

- 1. a sender of a message;
- 2. a recipient of a message;
- 3. a message; and
- 4. a channel for communication.

Without a recipient, communication becomes information. Communication can be divided into two sections: targeted and mass communication. The borderline is not very clear, but in targeted communication the system as a whole is compact e.g. the recipients of a message must be members of a certain "community" concerning the message process in question.

The above mentioned simply communication model is called syringe-model or Stimulus-Response (S-R) model. Although the S-R model has been conceived for a long time as a very defective description, there are still many people, who believe in it and will also use it (Wiio 1994). However, factors which are dependent on a human being (organism) constantly affect communication processes, so a better description of a communication process would be the Stimulus-Organism-Response (S-O-R) model. Shannon (1949) suggested the communication model shown in Figure 2.1.



Figure 2.1 Shannon's Communication Model (Shannon 1949).

Shannon initially developed his communication models for telephone traffic. He introduced for that work terms like bit, channel capacity, noise and feedback. The noises or disturbances in Shannon's model mean factors which change the message from its original meaning and lead to a distortion of the message (Wiio 1989). The disturbances can be internal (on the part of the sender or recipient) or external (in the channel). Feedback means that the sender of a message will get a response from the recipient. This term also includes the character of two-way communication. If we imagine that each exchange of messages between persons and/or organizations includes communication, we can never measure the total volume of communication. However, we can be sure that the total volume has increased enormously in this century. New communication modes have changed the world enormously like new means of transportation (e.g. auto) have made mobility very much easier,. Today the communication world is completely different from what it was ten years ago.

In its simplest form, communication does not require any organization or equipment. It is only a question of personal contact between two or more people. However, understanding other people is a different matter altogether, and that is not the subject of this research. In cases other than in personal contacts we need some organization to transmit the message from the sender to the recipient. The sender and recipient are usually located in different places and the messages need not be accepted by the recipient immediately they are sent. This flow is illustrated in Figure 2.2, where p refers to place and t to time.



Figure 2.2 Communication Flow between Sender and Receiver (Väyrynen 1981).

The classification of different communication modes can be done dividing communication into the following dimensions: direction, time and form. Communication can also be either one-way or two-way. This categorizes the feedback as simultaneous (the telephone) or modes with a time lag (other communication means). Of course it is a big difference in the response time depending on the transfer speed if letter services or electronic communication modes are used. In general, the categorization into one-way and two-way communication modes has been easy among both targeted communication and mass media means, but during the last few years, modes like the Internet, which are possible both ways, have entered the market. In this regard the changes will be very dramatic in the near future, as will be discussed in Chapter 7.

The message can be conveyed by the following means (message type): voice, picture, text and bit. Or it can also be a combination of these. The possibilities of further utilization depend on using all these forms, and whether the message is saved or not. In considering the market for communication we must classify both senders and recipients. In both cases the categories are households and organizations.

With four dimensions (sender/recipient, message type, the transfer technology of communication and feedback) we can classify the structure of communication flow between the sender and recipient. The structure is presented in Figure 2.3.



Figure 2.3 The Structure of Communication.

In considering the time for transferring the message, we must study whether the message is received immediately when it has been sent or whether there is a time lag. Only when communication uses physical transportation there is a time lag (letter mail). However, time can also be studied from the point of view of whether or not the recipient must be there to receive the message when it is being sent. With earlier electronic forms of communication, the recipient had to be on hand (telephone) as messages arrived. Now we can also use electronic forms of communication for which the recipient can choose the time (s)he will accept the message (eMail, telefax, Internet, telephone answering machine and text-messages by mobile phone).

2.3 Classification of Different Communication Modes

Different communication modes can be classified in the way presented in Table 2.3, in which the modes studied in this research have been highlighted. Personal contact is technically the easiest communication mode. It takes place between two or more people in the same place, at the same time, and always as a two-way event. It does not need any technical communication modes or communication organization. Personal contact as a communication mode does not in fact belong to the modes under consideration in this study. It will only form a part in some comparisons.

Table 2.3	The Classification of Communication Modes (bas	ed on Wiio	1989).
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	Technical communication method					
	Imprint communication			Simultaneous communication		
	Mechanical communica- Ele		ectronic communication			
	tion					
The object of	Printed com-	Record	ing com-	Electric wire	Radio com-	
use	munication	munication		communication	munication	
Targeted com-	- Letter mail	- Photograph		- Telephone	- Mobile	
munication	- Copy	- Taped recording		- Telegraph	phone	
		for ow	n use	- EDI		
				- Telefax		
	- ePost			<= - ePost - eMail		
	=>			- Internet		
Mass communi-	- Newspaper	- Record	1	- Cable television	n - Radio	
cation	- Periodical	- Film			- Televi-	
	- Book			sion		
				- Internet		

The different communication modes considered in this research are as follows:

Ordinary letter is a physical dispatch which usually includes a written message. It can also include a CD-ROM or a tape and thus the message type can be text, picture, voice or bit (Figure 2.4). It is important, however, that letter mail always needs physical transportation from sender to recipient/recipients. The recipient can always him-/herself choose the time s(he) opens the letter. The possibility of further message utilization depends on the way the message is saved. Regularly organized letter services have been operating since 1638 in Finland, when Finland Post was founded.



Figure 2.4 The Message Types of Different Means of Communication (B = Bit, T = Text, P = Picture, V = Voice).

Hybrid letter (ePost) is a letter-mail item that is transmitted in electronic form part of the way from sender to recipient. The idea is that the sender transfers the ePost in electronic form to the sorting center of the Post from where it is sent in electronic form to the nearest recipient's sorting center. There it will be printed on paper and delivered to the recipient. ePost resembles ordinary letter mail also in that the recipient can decide the time (s)he opens the letter, but generally ePost messages are not ready for further utilization by automated mean. The ePost service has been developed in Finland since the beginning of the1980's.

Telephone is a mode of communication whereby messages are transferred in real time from senders to recipients, the communication is two-way, but the recipient can not him-/herself decide the time s(he) receives the message. However the possibilities for further utilization of telephone messages are very restricted, although in addition to communication based on the voice, messages based on bits (information and orders through the agency of computers) by telephone and text-messages by mobile phones can be sent today, too. By means of a telephone answering machine the recipient can him/herself decide the message receiving time, but then the communication changes from two-way to one-way. The telephone was invented in 1875 by Alexander Bell. Telephone services commenced in Finland in 1877.

Telefax is a mode of communication whereby the messages are transferred simultaneously from senders to recipients, but the communication is not two-way in real time. The recipient can him-/herself choose the time s(he) receives the message, but the possibilities of further utilization are limited. Telefax traffic started in Finland at the begin of 1980's.

Electronic mail (eMail) is a mode of communication whereby the message is transferred in electronic form from the sender's computer to the recipient's computer. The message is almost received simultaneously by the recipient and s(he) can him/herself decide the time s(he) will receive the message. Possibilities for further processing are good. An eMail message can include text, picture and even voice. The first eMailconnections in Finland were made in the middle of the 1980's.

Electronic data interchange (EDI) means data communication between organizations and refers to the transfer of documents by means of electronic data transfer. In practice it reminds of eMail, but the messages have to bee formatted for further processing and EDI has the drawback of not being able to reach as many recipients as eMail. Data communication has, generally speaking, existed in Finland since the middle of the 1970's.

Internet is a world wide communication network for deliver many kinds of information and for sending own messages to any Internet user in the world. As a communication channel, Internet can be seen as a diversification of eMail, but in addition to that it is a channel for deliver and search for versatile information. In this study the Internet has been examined mainly from a communication channel perspective. The Internet was originally developed in the 1960's for military purposes, but in its widespread use as an open system for everybody, it has been only in this decade. Personal contact is today of course the most important communication mode not only for banal dealings but also for communication between organizations and the third most important mode for organization-household communication, as can be seen from Figure 2.5. In the latter case telephone and ordinary letters are more important. When organizations were asked if they would replace personal contact with letters and electronic communication, 20 percent said they would use letters and 40 percent electronic forms (Nikali 1995b). Corresponding proportions for households were 40 percent and 20 percent, so the figures were just the reverse (Nikali 1994).



Figure 2.5 The Significance of Different Communication Modes for Communication between Organizations as well as between Organizations and Households (5 = decisive, 4 = important, 3 = reasonable, 2 = small, 1 = non-existent) (Nikali 1996c).

Letter mail with a 360 year-old history was the only organized means of communication in Finland until the 1855 when the telegraph services were started. Letters' share of total communication is more than a half, if we do not take into account personal contact and the telephone. Almost all organizations use ordinary letters (Nikali 1995b and 1996b) and all households send postcards, 90 percent of them also letters (Nikali 1994).

Although ePost has been developed in Finland, it is not at present a very important communication mode. Only 10 percent of organizations use it and its share of organizations' total communication is only two percent. In Finland about 800 million letters are sent per year and about 30 million (4 percent) of them are ePost letters. About half of them contain an invoice.

All organizations and 97 percent of households have a telephone. In Finland, with a population of 5.1 million, there are 2 million mobile phones. The ratio of mobile phones to population is the highest in the world. The telephone is the second most important communication form for organizations in communicating with other organizations and the most important mode for households..

Telefax machines have become more common in companies during the last ten years. In 1987 only 12 percent of organizations owned a telefax machine, whereas now almost all of them have one. About 35 percent of households in Finland have a computer and about 15 percent of them also a fax-card, and so about 5 percent of households can send and receive telefax-messages through their computers (Nurmela 1998). In addition to that 10 percent of households own a separate telefax machine (Suomen Gallup Oy).

The eMail-system is used in every fourth organizations. However, because it is more common in large companies, 40 percent of all employees have an eMail at their disposal (Nikali 1997b). An eMail-connection has quickly become as more common in households as well, penetration rate from 8 percent in 1997 to 12 percent in 1998 (Suomen Gallup Oy). A total of 16 percent of households have microcomputer equipment for an eMail-connection (Nurmela 1998).

EDI is in use in about one quarter of organizations and as with eMail, EDI is more general in large companies.

In 1997 Finland is estimated to have about 280,000 daily and in all 620,000 weekly Internet users, which represents approximately 6 and 12 percent of the population (Taloustutkimus Oy, TOY Research). The number of users is increasing very fast, because the number of active users of the Internet was about 250,000 in 1996 (Pelttari 1996). Furthermore, the number of occasional users is more than double that of the active ones.

A general opinion is that new technical innovations take about 10 years to gain widespread acceptance. Hoplin (1997) has described the steps the new information technology has to take before it gains a significant position in the business environment. These steps are

- information technology;
- information systems;
- business processes;
- firms; and
- business environment.

The innovation may not take even the 10 years these days. It depends on the nature and revolutionary meaning of new technology, for example, new innovations of mobile phone technology can already be in use after just a few months or years.

2.4 Review of the Literature

In the literature research describing the quantitative results of substitution effect such as described above, have not been published before this study process. Hence the replacement models will be presented in Chapter 3 were the first concerning this theme. Some other studies approaching the use of letter mail and other communication services are discussed in country specific cases, and there is also one global study which the Universal Postal Union (UPU) has carried out.

The American Case

The change in household-level demand between 1986-1994 for postal delivery services has been studied in the USA with cross-sectional material (Wolak 1997). According to that research the price elasticity of postal services has changed from under-elastic to over-elastic. This means that after a rise in prices in the last decade the demand for postal services in households has decreased less than the prices have risen. But the situation today is quite different: when prices rise, households decrease their demand for postal services so much that after price increases the income of United States Postal Services (USPS) from households is less than it was before the price increase.

This change has led to a difficult situation: the income of the USPS increased more than 60 percent from 1986 to 1994, but the income share of households at the same time dropped from 17 percent to 10 percent. The prices should not rise from the point of view of households, rather they should decrease, but the prices could increase from the point of view of the postal services use in organizations, bringing 90 percent of USPS income. The fairness of postal pricing is put to the test under such circumstances. Because the price decrease will benefit organizations and so the problem is also political.

In Finland separate demand models for postal services in households have not been estimated. However, the households' share in the demand for postal services has not dropped nearly as much as in the USA over the same period.

According to Wolak the coefficient sign of elasticity of cross prices between postal and telecommunication services in households changed in 1986-1994. The sign of elasticity of cross prices was positive 10 years ago i.e. when the prices of telecommunication services increased, the demand for postal services increased, too. The elasticity of cross prices has been, however, negative for the last years, which means that demand for postal services has decreased when the prices of telecommunication services have risen. This inconsequent result has been explained by computers becoming more common and also their use in message sending. Every forth household in the USA had a computer in 1994. Any corresponding results have not been obtained in Finland, despite the fact that the frequency and use of computers are just as general as in the USA. 20 years ago there was a gross elasticity between the prices of long distance calls and letter services in Finland, but when the prices of calls dropped considerably, no further correlation was to be found. Instead the penetration of electronic communication means has had a negative correlation on the demand for letters in Finland. The reason for the replacement of letter services by electronic communication means relates to service quality factors as will be discussed in Chapter 6 rather than transmission prices.

The British Case

In the study carried out in the United Kingdom no substitution effect on letter services by electronic communication could be shown (Nankervis etc. 1997). The number of installed telefax machines in the model represents the competing electronic communication means. But this variable did not get any significant coefficient in time series analysis with quarterly data over the period 1976 to 1995. However, the ratio of average letter price to average telephone price became a statistically significant coefficient in the model, and even the effect on letter volume is relatively small. According to Nankervis et al., a ten percent deterioration in letter prices relative to the telephone was associated with a drop in mail volume of between 1 percent and 2 percent. In Finland a corresponding elasticity of cross prices has not existed during the last decades, but a ten percent increase in letter prices should lead to a much bigger drop in letter volumes than in the UK (see Models 5.2 and 5.3). No separate price variable for letter services was included in the UK model.

A distinct reason for different cross flexibility in prices between letter and telephone services in the UK and Finland is the absolutely different price development in the countries under consideration. The ratio of the UK average letter price to average telephone price has increased about 10 percent during the last 17 years. The same change has been about one hundred percent in Finland (see Figure 4.3). Telephone prices have dropped so dramatically that an elasticity of cross prices does not exist in

Finland any longer. As far as the real price of long distance calls is concerned the drop has been considerably more dramatic in Finland. The real prices in question have fallen to a tenth of what they were 20 years ago.

The use of quarterly data in the UK study will cause many problems: seasonal variation, reliability of data, correlation between different variables and autocorrelation. These elements are made much more difficult using part-yearly series than by yearly data and this phenomenon can also hide the substitution effect. Aggregating significantly quarterly data regarding the number of installed telefax machines for the period 1976-1995 is very difficult. This increases the possibility of the replacement effect being hidden in the model.

Using letter demand per household as the dependent variable the UK model represents letter traffic between business and households and between households but not between business. In 1994-1995 about 85 percent of mail originated from business senders and around 65 percent was received by households in the UK. According to Nankervis et al., these shares have also risen steadily over time. But the superior share of telefax machines is to be found in business organizations and therefore letter services substitution by telefax machines and also by other electronic communication means takes place first in inter-business traffic. Substitution in inter-business traffic could be the reason the share of letters received by households has risen steadily over time in the UK. The same has happened in Finland, too.

The reason the share of mail sent by businesses has also increased in the UK, may be the flourishing state of the British economy. This positive economic indicator has led businesses more than households to increase their use of letter services. The better financial status of private individuals has meant that households are now more often equipped with a telephone and the increased use of the telephone has thus substituted letter traffic. Telefax machines and other electronic communication means except the telephone are still quite rare in households and so letter substitution by new electronic communication by households will largely be left to the future.
In an earlier but very similar study about which reference was made above Nankervis and Rodriquez noted that communication by paper has a range of substitutes which compete on a number of criteria, not the least of which is price (Nankervis and Rodriquez 1995). This conclusion is very different from the results found out in this study, as well as in the German, Japanese and UPU studies (discussed below): transmission prices do not have any great significance in the choice of communication mode, rather speed of transmission, reliability of communication means and accessibility of service have an important role in the decision process (Azumi and Umemura 1995, Plum 1997, UPU 1997). The conclusion drawn in British research on the erosion of letter services is that it will not take place until also electronic communication means other than the telephone are sufficiently common in households, too.

The Canadian Case

Canada Post Corporation has made a study of substitution trends and development of communication services (Coopers&Lybrand 1998). One of the key findings in this research was that for the first time there is not only an erosion in the market share of letter mail, but absolute volumes are now also decreasing. According to these results mail volume will decrease about 3 percent in the next 2-3 years. Because total communication volume is expected to increase 12 percent simultaneously, the total substitution of letter mail by electronic communication will be much higher than 3 percent. Without further details of the Canadian study, it can be concluded that the researchers had increasing economic growth as a trend variable in their model, so without replacement the volume of letters should increase, too. Primarily this migration will concern telefax, eMail and Internet communication according to the Canadian study. This is the situation in Finland, also.

In the Canadian study the following properties were found to be the competitive strengths of letter mail: letter services are a good tool for promoting customer relations, it provides privacy, it is easy to use and the most ubiquitous form of targeted communication. These factors are very similar to those found in this study (see Chapter 6).

The Canadian researchers also found competitive weaknesses for letter mail: customers' low confidence that the letters will be delivered, relatively slow delivery, the time and effort required to prepare and send the letters and the transmission cost of letters. All except one of these competitive weaknesses are the same as in our studies - the Finnish senders of messages have more confidence in the delivery of letters than that of telefax, eMail and Internet (see Chapter 6). One reason for that could be the short delivery times of letters in Finland: more than 90 percent of 1st class letters are delivered in one business day and 2nd class letters within three days. In Canada the delivery standards are 2-4 business days. Canadian researchers recommend an improvement of delivery times "even an improvement of one day would contribute enormously to the competitive position of Letter mail".

The German Case

Very congruent conclusions with this research have been drawn in substitution research in Germany, although any quantitative results could not be carried out (Plum 1997). The research was more empirical. But also in Germany the senders of messages paid more attention to the reliability of communication means and accessibility of service than to the costs of communication. The same result has also been found in a study carried out in Japan and by the UPU (Azumi and Umemura 1995, UPU 1997). According to Plum telefax has also been the most important electronic communication means in the substitution effect of letter services by electronic communication in Germany. The same communication modes were under consideration in the Germany study as in Finnish research.

The favorable development of GDP or other income measures are determinant factors in many demand studies of postal services (Tolley 1989, Nankervis and Rodriguez 1995, Nikali 1992b and 1997a, Izutsu and Yamaura 1997, Azumi and Umemura 1995). According to Plum that may overlap substitution effects. That is quite right and therefore it is very important to separate the effects on the demand of postal services of the different factors. These types of factors in addition to GDP and other income measures are e.g. real prices of postal and telecommunication services, economic fluctuation and use of different electronic communication means. This problem has been catered for in this research either by using cross-sectional data and changing the economic factors in different parts of the country so that they can be compared (substitution models in Chapter 3) or by adding all the different factors in the same demand models (Chapter 5). The idea of this examination is to estimate the presumed demand for postal services without any replacement and compare this to actual demand. The difference between these two forms of examination gives the replacement effect.

Plum also mentions, *inter alia*, change from monthly to annual invoicing as a negative effect on letter mail restructuring of communication processes. This is clear, but the implementation of new electronic communication means will also change the same processes, and from my experience these process changes will have a much bigger impact on letter demand than the effects of function period changes.

Not all electronic communication is viable substitution for letter mail. New electronic communication media can often be used parallel to letter mail. According to Plum a good example of this is sending a document by telefax first, and then confirming it by post. In Japan similar results have been obtained (Izutsu and Yamaura 1997). Research in Chapter 4 has shown that this kind of effect has in fact existed in Finland, but not for the last two-three decades. Results of studies on the use of eMail have reviewed that only 6 percent of electronic communication replaces letter mail, while 65 percent is extrinsic and the remaining 29 percent represents substitutes for other communication means (Davey 1995). It is true that eMail competes intensively with other electronic communication means especially with the telephone and telefax, as can be seen from the results illustrated in Chapter 6. But concerning extrinsic communication and its possibilities for replacing letter mail the following three facts have to be kept in mind:

• According to the results carried out in Chapter 6 the most significant factor increasing the use of all targeted communication means is the internal correlation of the communication mode. By internal correlation is meant that it is easiest to answer the message using the same mode as that in which the message is received. This is a factor which will delay changeover from letter services to electronic communication modes

- In many cases eMail communication can be an alternative for both letter mail and other electronic communication, especially telefax and telephone.
- In many organizations eMail is only in intraorganization use. Before the replacement can effect in fact be realized the eMail mode must become interorganizational. This has happened to a great extend in Finland already. Share of external communication is 63 percent in Finland (see Chapter 6). In order to use eMail effectively the sender and recipient will have to be equally competent and only then can eMail compete equally with letter mail.

Plum writes that "electronic communication poses a viable threat for postal operators, if not today, then in the future". She mentions many point of views which the postal operators should take into account in their strategy:

- postal operators should monitor the development, also competition, of electronic communication;
- remove existing inefficiencies, which often originate from former or still existing monopolies;
- rate-restructuring such that rates reflect cost structure;
- diversification into new products for the purpose of competition e.g. development of hybrid letter services;
- concentration on core businesses;
- regulatory decisions should also take into account the effects of growing electronic competition;
- redefinition of universal service; and
- liberalization of postal services.

According to Plum the reserved services lead to a state of affairs in which the situation of the postal operators degenerates through competition with electronic communication. Further liberalization would also mean more freedom for postal operators. These principles are very similar to those above in Section 7.4 where the future of postal organizations is discussed.

The Japanese Case

In the study carried out in Japan the effect telecommunication has on postal services by input-output tables as well as micro-cross section and macro-time-series analysis has been examined (Izutsu and Yamaura 1997). Input-output analysis in this case means an examination in which the development of demand for letter and telecommunication services in Japan is studied concurrently.

In input-output analysis Izutsu and Yamaura have classified Japanese industry into three sectors: the services; mining, manufacturing and construction; and agriculture, forestry and fishery. They have compared how large the shares of inputs are which postal and telecommunication services have and how these shares have developed over the last decades. According to these results the share of postal services has been quite stable and it is much lower in comparison with the share of telecommunication services, whose significance is constantly increasing. However, the demand for both postal and telecommunication services has simultaneously grown in most sectors. In 66 percent of industries in Japan the demand trends for both postal and telecommunication services were upward. In 20 percent of cases both trends were downward and in only 8 percent of cases the demand for telecommunication services had increased and the demand for postal services decreased. The conclusion of these Japanese researchers is that only in a few industries have domestic telecommunication services contributed directly to the relative decline in demand for postal services. Rather postal and telecommunication services are currently involved in a synergetic upward trend.

In the case of households, the Japanese's relative consumption of postal and telecommunication services has not changed over the last ten years.

In Finland the demand for postal services has also increased up to recent years, but the growth would have been more rapid without the replacement effect of electronic communication on letter services.

In a micro-cross section analysis these Japanese industries were classified into 12 groups, and demand models for postal services for these groups were estimated. The models were calculated for total letter mail demand and separately for sealed letters as

well as for postcards. In all cases the number of telefax machines had a positive correlation, which means that ownership of a telefax machine increases the use of letter services in Japan. Although the coefficients were statistically significant, the explanatory degree of models was in most cases very low, less than 20 percent. Also the coefficients of telephone prices for all of the models were positive, which is difficult to comprehend: the rise in telephone prices should increase the use of letter services, too. The causality in question must be temporary, not correlative of telephone price changes. In addition to that the models did not include their own price variable, which is usually one of the most important factors in explaining the demand for postal services.

Corresponding results for households were very similar to those discussed above. According to the models the ownership of telefax machines will increase the use of letter services in Japanese households. Also in these models the coefficients of telephone prices are positive but very low. Ownership of a personal computer had a positive coefficient, too. All these coefficients were statistically significant, on the other hand for computer connection to the network there was no significant coefficient.

More than 90 percent of enterprises owned a telefax machine in Japan in 1996. This proportion is the same as for Finland. Ownership rate for households was 21 percent in Japan in 1996, this being about double that of Finland.

In the time series analysis Izutsu and Yamaura estimated demand models for four different letter mail categories: regular-delivery letters, 1st class standard-sized and non standard-sized letters, as well as 2nd class letters. All of the estimated formulas included the same independent variables: GDP as a trend variable, real price of letters as the price variable and the number of telefax machines as the competing electronic communication form. In all cases the coefficients of own real prices were negative and significant, whereas the coefficients for number of telefax machines were positive and according to the t-test significant, too. Only in the model for 2nd class letters was this variable not statistically significant. The numerical values for telefax variables' coefficients are low, but their significance for letter mail demand can not be assessed, because the form of these variables is exponential in an otherwise logarithmic model and so significance is dependent on the absolute number values of telefax machines. The number of telefax machines in Japan was not known by the author of this study. The Japanese researchers have not evaluated the importance of the number of telefax machines to the demand for letter services in Japan.

The formula for demand models in the Japanese time series analysis is identical to that presented above in this study in Chapter 5 (Formulas 5.2 and 5.3).

According to Izutsu and Yamaura another demand study of the effect of telefax machines on letter services was carried out in Japan earlier. In that study two different variables describing the use of electronic communication were used: the number of telefax messages and the transmission price of those messages. But the results were the same, the correlation between demand for letter services and number of telefax messages as well as transmission prices was positive.

The conclusion of the Japanese studies according Izutsu and Yamaura is that telecommunication services have had both a positive and negative effect on mail services, but the positive effect has exceeded the negative one. The result is the same as in the German case presented above (Plum 1997). In this respect the Japanese situation differs from the Finnish one, as there has been no noticeable generative effect in Finland for the last two or three decades.

In a demand study of mail services carried out in Japan earlier, the total mail volume was divided into settlement communication and dialog-type communication (Azumi 1995). The important factors of letter volume according to that study were GDP, amount of sales in Japan, the profit of financial institutions, the number of employees and of course the prices of preparing and transferring the messages. But including the above mentioned economic elements in the same demand model will cause a multicol-linearity problem. Very high levels of multicollinearity can lead to technical problems in estimating regression coefficients (Aiken and West 1991). Of course there are many regression techniques to avoid this problem e.g. centering of variables or using difference model technique, but to explain the phenomenon can, however, be difficult, if too many very similar factors are included in the same model (Neter etc. 1989).

According to Azumi the demand for letter mail increases about 6 percent when the number of checks increases 10 percent in Japan. The number of checks is dependent of the number of settlements and because the postal service is a financial service, postal items posted from a public enterprise or a credit card company are all related to settlements. According to Azumi the development of telecommunication plays a central role in streamlining logistics. When electronic communication encourages economic activities in Japan, the businesses can manage with electronic means but the settlement processes need letter services. So according to Azumi there still exists a generative effect on letter mail of telecommunication in Japan, or at the very least the demand for postal and electronic communication will develop concurrently with a positive correlation.

The Universal Postal Union Case

The Universal Postal Union (UPU) carried out a global study of the development of letter services in 1997 (UPU 1997). The aim of that study was to evaluate the future of letter services. The period under consideration was the years 1995-2005.

According to this study the demand for letter services is dependent on economic factors, postal factors, social and demographic factors and technological factors, listed in order of importance. By postal factors are meant elements which can be influenced by postal administrations. According to the study a 1 percent increase in economic growth worldwide generates an increase in volume of between 0.8 percent and 1 percent. Also the volume of letter services reacts very sensitively to the number of households.

The World Bank's forecast for annual worldwide economic growth is 3.5 percent a year for the period under consideration (World Bank 1996). The United Nations (UN) population forecast for the same period means an increase of 1 percent a year in the number of households in the developed countries and 2.4 percent increase in the least developed countries (UN 1996). In total, these factors should mean an increase of about 5 percent a year for letter mail volume worldwide, but the annual forecast increase for domestic letter mail volume in the study was only 2.5 percent a year world-

wide on average. This means that the replacement rate for letter mail will be about 2.5 percent a year for the period 1995-2005. This result is in accord with the replacement model presented in Chapter 3 and discussed in Section 7.1.

The UPU study found three effects important to the development of the communication market: growth generated by globalization and introduction of new communication means, complementary between various communication means and the substitution effect. By complementary is meant positive interaction, which means that the use of one communication means may stimulate the use of another. The above mentioned three effects except one are the same as those discussed in this study. The complementary effect (generative effect) discussed in this study in Chapter 4, has not existed in Finland for the last two or three decades. But previously an effect like that did really exist in Finland also.

3 Replacement of Letter Mail by Electronic Communication to the Year 2010⁵

3.1 Introduction

It has been assumed for a long time that electronic communication will eventually replace letter mail. In addition to the telephone, other electronic communication media have spread so rapidly in Finland in the 1980's that they are bound to have influenced the use of the traditional letter mail. It has been difficult to observe any actual shift from the one to the other, however, as the volume of letters also has increased remarkably at the same time because of the booming economy, the moderate pricing policy of postal services by the Finland Post, and the easy use of new technology to produce written messages, for instance by photocopying or laser printers.

The telecommunication network in Finland and its service quality has been among the best and least expensive in the world. Approximately 80 percent of the network were digitalised in 1993. This digitalization completed in 1996. There were a total of 54 telephone lines per 100 inhabitants in Finland in 1992, which was the fifth highest figure in the world, while the country occupied an even more prominent position in terms of mobile phones, of which there were currently approximately 10 per 100 inhabitants (Financial Times).

The cost of telephone calls have declined considerably during the last 15 years. The real prices of trunk calls within Finland has declined by 1993 to less than one sixth of those in 1977. The prices have further declined thereafter due to opening up of the trunk calls market at the beginning of 1994. Also the real prices of local, mobile and foreign calls have declined during the same time. Finland was the sixth cheapest country in the world for domestic business phone calls in 1992 and the second cheapest for international calls

5

This chapter is based on Nikali 1994a.

(OECD Tariff Comparison Model). Business use on telephone call costs in Finland approx. 30 - 40 percent less then the average for the other OECD countries.

Good communication connections are essential in Finland, a large country with a small population of 5 million. Japan has almost the same land area, but it has population of 120 million, i.e. 25-fold that of Finland. Finland can be regarded as one of the pioneers in liberalization of postal and telecommunication services which all are free for competition today. In fact, corresponding competition conditions and circumstances can be found only in Britain, New Zealand, Australia, Japan and Sweden. This liberalization and the possession of the most advanced and least expensive telecommunication services in the world create an almost unregulated framework within which the letter mail could be replaced by electronic communication means.

3.2 Problem Definition

The aim of this study is to figure out the extent to which the expansion in electronic communication has reduced the volume of letters and to evaluate by models this trend up to the year 2010.

The study is based on cross-sectional material, i.e. data on the demand for postal services in Finland by province, and attempts to explain these differences in demand by reference to regional patterns in the numbers of electronic communication devices. As the economic resources of companies tend to be different in different provinces and dependent on their size and number, the provincial demand data has been related to the total turnover of companies in the province per head of population. This implies that if there are only a few companies in a province, or if these are small relative to the number of inhabitants, low volume of business letters may not necessarily be caused by an abundance of electronic communication devices but equally well to the general lack of entrepreneurship in respect to population. The adjustment of the demand by reference to the turnover of companies ensures that all parts of the country occupy an equal position in the study. The current study focuses on the 1st and 2nd class domestic letter mail, excluding bulk mail. The letter mail is divided into four content categories on the basis of the types of electronic communication assumed to have been and to be replaced. The selection of the latter being based on the technical applicability of given means for replacing letters in a certain content category. The categories and their electronic alternatives are:

Bills, replaceable by data communication;

Notices, i.e., documents, orders, offers, advertisements sent by first or secondclass post, and receipts, replaceable mainly by telefax;

Messages, i.e., personal letters, cards and invitations, replaceable mainly by electronic mail; and

Magazines, books and goods sent by first or second-class letter post, which are not expected to be replaced by electronic communication means.

Information on the demand for letter mail services was obtained from material used in the study regarding the nature and contents of the letters made in 1993 (Nikali 1993b). The current material does not include the Åland Islands as they were not covered by the previous research.

The data on electronic communication means were calculated from material obtained in a study regarding the use of postal services and telecommunication by companies and the public sector in 1992 (Lyytikäinen 1992).

3.3 Methods

Equations have been estimated by least squares regression. The replaceability equations are of the form

$$q = \alpha + \beta * y, \tag{3.1}$$

where q = demand for letter mail by province;

y = numbers of tele services users instead of letters in respective province; and a and $\beta =$ parameters to be estimated.

Replaceabilities were calculated on the basis of the ranges of variation observed in the use of tele services between the provinces. The coefficients are mean values for these ranges. As tele services are expected to be more widespread in future than today, their effect on letter mail will not necessarily be as linear as can be concluded from these models.

The diffusion in tele services can be estimated using the following logistic curve:

$$q_t = \frac{Q}{1 + e^{\alpha + \beta t}},\tag{3.2}$$

where $q_t =$ number of users in the year t;

Q = saturation level;
a and β = parameters to be estimated; and
t = time.

The saturation level denotes the total number of users, which must be evaluated before applying the formula. Parameters a and β in the diffusion model can be estimated from

$$\ln \frac{\mathcal{Q} - q_t}{q_t} = \alpha + \beta t , \qquad (3.3)$$

The assumption in diffusion models is that new services will spread at a rate which complies with an S curve as a function of time so that each service has a saturation level of its own (Kangas 1991). Expansion is fairly slow in the beginning, but becomes rapid at its most active phase until it comes close to the saturation point, after which it declines again towards a saturation threshold, which will not be exceeded.

3.4 Replaceability Models

3.4.1 Classification of Letter Mail by Content

The numbers of 1st and 2nd class letters and their distribution by content in 1993 are given below. It should be noted, however, that the sum of the percentages is not 100, as more than 30 percent of the letters could be recorded in more than one content category, e.g. bills accompanied by notices. The sum of the percentage column indicates that each letter was classified into approximately 1.51 content categories.

Content category	Proportion	Number	
	percent	million items	
Bills	34.2	252	
Notices	73.1	538	
Messages	36.0	265	
Magazines, books, goods	7.7	57	
TOTAL	151.0	736	

The replacement of letters by electronic communication means is dependent on the economic resources available to potential senders and recipients to purchase the required equipment. These devices should be utilized to such an extent that the investments required for them are profitable. A further requirement from the sender's point of view is that the recipient should actually be contact able by this means. It is evident that written correspondence between organizations, i.e. companies, authorities, local councils and associations, is most likely to be the first to be affected by this.

Distribution of 1st and 2nd class letters by sender-recipient categories in 1993 was as follows:

Sender	Recipient	Proportion in 1993		
Organization -	Organization	43 %		
Organization -	Private person	44 %		
Private person -	Organization	4 %		
Private person -	Private person	9 %		
TOTAL		100 %		

Communication between organizations constitute more than 40 percent of the total volume of letters. Electronic communication devices have decreased so much in price in recent times and are now so easy to use that they are becoming increasingly common even in private households. This increases opportunities of senders to contact their recipients. At the moment letters sent by organizations either to other organizations or to households constitute almost 90 percent of the total letter mail, and the increased use of tele services in households was taken into account in the calculation of the replaceability models.

3.4.2 Replaceability Models

3.4.2.1 Replacement of Bills by Data Communication

Bills constitute 34 percent of all 1st and 2nd class letters in Finland, with fairly little variation between the provinces, only from 30 percent to 38 percent. These figures would vary considerably more, i.e. from 32 percent to 51 percent, if all the provinces possessed the same total company turnover relative to population. There were major differences between the provinces in the frequency of possession of data transfer facilities, the range of variation in 1992 being 7 - 38 percent. There was a high coefficient of correlation, -0.92 percent, between the use of data transfers and the proportion of bills relative to turnover/inhabitant.

The following model was obtained for the replacement of bills with data communication:

$$q = 53.4 - 0.58*y,$$
 (3.4)
(28.0) (-7.1)
 $R^2 = 0.85,$

where q = proportion of bills among 1st and 2nd class letters in Finland; and

y = frequency of data transfer facilities in business and public administration offices.

The model based on cross-sectional material explains a high proportion of the variance, $R^2 = 85$ percent, and the coefficients are highly significant, as shown by the t values given in brackets below the parameters. The model is shown in Figure 3.1.



Frequency of data transfer facilities in business and public administration offices, percent

Figure 3.1 Proportion of the Bills in All 1st and 2nd class Letters in Accordance with the Frequency of Data Transfer Facilities and the Model Calculated Accordingly.

The replaceability model indicates that a 10 percent increase in data transfer facilities would reduce volume of bills in the letter post by 6 percent. In view of the fact that a total of 252 million bills were sent by post in 1993, a 10 percent increase in the possession of modems would reduce this number by approx. 15 million, i.e. each new data connection would reduce it by approximately 500 items a year. Conversely, a total of 130-140 million more bills would be sent by post if no data transfer facilities existed. This means that approx. one third of the bills sent by post have already been replaced by data transfer.

The use of data transfer facilities has expanded rapidly. Where only 8.3 percent of business and public administration offices had access to such facilities in 1987, the figure five years later was as much as 22.6 percent (Väyrynen 1988). There were a total of 280,000 data

modems in use in Finland in 1993, and the assumed saturation threshold of 1,000,000 is likely to be achieved only after 2010. The calculated diffusion model is the following:

$$q_t = \frac{1,000,000}{1 + e^{586.0 - 0.294*t}},$$
(3.5)

 $R^2 = 0.99$,

where q_t = number of data modems;

t = years 1971 - 2010; and

t values for the coefficients are 44.5 and -44.2^6 .

The model achieves a high explanation of variance, 99 percent, and the t values of the coefficients are also good.

The replaceability and diffusion models indicates that an average of 7.1 percent of bills will be replaced by other means of communication during the period 1994 - 2000. The annual change anticipated for the following decade being -2.7 percent, while the cumulative change will be -40 percent from 1993 to 2000 and -55 percent by the year 2010. As no allowance is made here for any overall increase in volume of bills, the decline in the volume of bills posted can be regarded entirely as a replacement effect caused by the spread of data communication.

3.4.2.2 Replacement of Notices by Telefax

Notices denote here letters, whose contents consist of documents, orders, offers, advertisements or receipts, as mentioned in Section 3.2.

Notices constitute 73 percent of all 1st and 2nd class letters in Finland, often accompanying bills, for example. As bills were regarded as the primary content in such cases, where they were also notice or message. For this reason the data, of which demand on notices was calculated by provinces, bills were excluded.

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The t values for a and β are in theory identical as can be shown.

The following model was obtained to indicate the replacement of notices by the use of telefax:

$$q = 88.6 - 0.56*y,$$
(3.6)
(31.7) (-7.5)

$$R^{2} = 0.86,$$

where q = proportion of notices among 1st and 2nd class letters; and

y = frequency of telefax facilities in business and public administration offices.

The model has a high R^2 value, i.e. 86 percent, and its coefficients according to the t test are highly significant. The correlation between the variables q and y is -0.93. The model is shown in Figure 3.2.



Frequency of telefax facilities in business and public administration offices, percent

Figure 3.2Proportion of Notices in All 1st and 2nd class Letters in According to the
Frequency of Telefax Facilities and the Model Calculated According.

The replaceability model indicates that a 10 percent increase in the number of telefax machines will reduce the number of notices sent by letter mail by 6 percent. There were approx. 180,000 telefax machines in Finland in 1993, and in view of the fact that 538 million notices were sent by post in the same year, a 10 percent increase in the frequency of such machines would reduce volume of notices by approx. 30 million, i.e. each new machine would bring an average reduction of approx. 1700 notices a year. Conversely, it should be noted that approx. 300 million notices a year more would be posted if no telefax machines were available. This means that telefax machines have already replaced approximately one third of all notices which would otherwise have been sent by post. The outcome is the same as the one obtained for the replacement of bills by data communication.

A total of 43 percent of all business and public administration offices in Finland currently have a telefax machine. The figure was five years earlier only 12 percent. The saturation threshold assumed in the model is 400,000 machines. There were 180,000 machines in the country in 1993. It is likely that number of the machines in use comes close to this threshold around the year 2005. The following diffusion model was calculated:

$$q_t = \frac{400,000}{1 + e^{961.5 - 0.482*t}},$$
(3.7)

$$R^2 = 0.99$$

where q_t = number of telefax machines;

t = y ears 1980 - 2010; and

t values for the coefficients are 31.0 and -30.9.

The replacement of notices by telefax messages will continue rapidly throughout this decade. It will reach its peak in the mid-1990's but declining rapidly before the turn of the century. Thus it can be roughly estimated that telefax machines will not remarkably reduce volume of letters any further in the following decade. Thus volume of notices sent by letter mail will have declined by 30 percent from the current level by the year 2000 but by less than 40 percent by the year 2010, assuming that no overall increase takes place in volume

of notices. The average change will be -5.2 percent per year over the period 1994 - 2000 and -1.0 percent in the following decade.

3.4.2.3 Replacement of Messages by Electronic Mail

Messages, denoting here letters containing personal messages, cards and invitations, constitute 36 percent of the 1st and 2nd class letters sent in Finland. As with notices, the replaceability model was calculated on the basis of data from which bills were excluded.

The following model indicating the replacement of messages by electronic mail was obtained

$$q = 55.6 - 0.49*y,$$
 (3.8)
(19.6) (-4.0)
 $R^2 = 0.64,$

where q = proportion of messages among 1st and 2nd class letters; and

y = frequency of electronic mail among business and public administration staff.

The model achieves a fairly high explanation of variance, 64 percent, and its coefficients according to the t test are highly significant. However, the inverse correlation between volume of messages and the occurrence of electronic mail is not as close as the one between bills and data transfer or notices and telefax. However, it should be noted that a sufficiently high correlation coefficient was obtained, -0.80. The model is shown in Figure 3.3.



Frequency of electronic mail among business and public administration staff, percent

Figure 3.3 Proportion of Messages in All 1st and 2nd class Letters According to the Frequency of Electronic Mail and the Model Calculated Accordingly.

The replaceability model indicates that a 10 percent increase in the frequency of electronic mail will reduce the number of messages posted by 5 percent. Since approx. 400,000 persons had access to electronic mail in Finland in 1993 and a total of 265 million letters in the message category were sent in the same year. 10 percent increase in the use of electronic mail would increase the number of users by 40,000 and reduce volume of messages sent by letter mail by 13 million. Each new user of electronic mail would reduce volume of letters by an average of approx. 300 a year. Alternatively, if electronic mail did not exist, approx. 130 million more messages would be sent by post than is the case today. A rough conclusion is that electronic mail has already replaced approx. one third of all messages sent by post. The outcome is the same as for the replacement of bills and notices by data transfer and telefax.

Of all types of telecommunication examined here, electronic mail has increased most rapidly in recent years, as it has only existed for a relatively short time. Only 2 percent of business and public administration staff in Finland had access to it in 1987. The figure was five years later as much as 27 percent. There are approx. 465,000 users of electronic mail in the country in 1994. It is likely that the assumed saturation threshold of 1.5 million users will be achieved by the year 2010. The idea behind this is that a person may belong to two user categories, one at home and one in the work. The following model was calculated for the diffusion of electronic mail:

$$q_t = \frac{1,500,000}{1 + e^{1571.1 - 0.789 * t}},$$
(3.9)

 $R^2 = 0.97,$

where q_t = number of users;

t = y ears 1983 - 2010; and

t values for the coefficients are 15.0 and -15.0.

Replacement will take place most rapidly at the beginning of this period, but will gradually slow down thereafter. The volume of messages sent by post will have declined by one third from the current level by the turn of the century and to one half by the year 2010. The average annual change will be -6.1 percent in 1994 - 2000 and -2.6 percent in 2001 - 2010.

3.5 Demand for Letter Mail to the Year 2010

The evaluations of the replaceability models in Section 3.4 does not take the trend in the overall volume of mail into consideration at all. According to the demand models trends in the 1st and 2nd class letter mail goes along with the volume of the gross domestic product (Nikali 1992b). Predicted trends for 1994 - 2010 are indicated in Table 3.1 with reference to three levels of average annual change in gross domestic product: 0 percent, +1.7 percent and +3.0 percent a year. It was assumed these to remain constant over the whole period. As the real price of the letter mail also influences demand, the figures for 1993 are used throughout in these calculations.

Evaluation of the drop in letters volumes occasioned by the spread of electronic communication means involves comparing the reduction in respect to the situation in 1993.

A vision was set out how the situation would be changed in the letter mail if electronic devices suddenly became far more popular than they are at present.

Table 3.1		Predicted Different 7	Volumes Frends in (of 1st an GDP.	nd 2nd cla	ass Letter	s in 1994	4 - 2010,	Given
Year	GDP	change 0.0) %/v	GDP	change +1	7 %/v	GDP	change +3	0%/v
- •••	Number	Change/y	Cumulat. changes	Number	Change/y	Cumulat. changes	Number	Change/y	Cumulat changes
	million		from 93	million		from 93	million		from 93
	items	%	%	items	%	%	items	%	%
1991	748			748			748		
1992	751	+0.4		751	+0.4		751	+0.4	
1993	736	-2.0		736	-2.0		736	-2.0	
1994	693	-5.8	-6	705	-4.2	-4	714	-3.0	-3
1995	644	-7.1	-12	666	-5.5	-9	683	-4.3	-7
1996	602	-6.6	-18	633	-5.0	-14	657	-3.8	-11
1997	569	-5.5	-23	608	-3.9	-17	640	-2.6	-13
1998	540	-5.1	-27	587	-3.5	-20	626	-2.2	-15
1999	515	-4.6	-30	570	-3.0	-23	615	-1.7	-16
2000	495	-3.9	-33	557	-2.3	-24	609	-1.1	-17
2001	481	-2.9	-35	550	-1.2	-25	609	0.0	-17
2002	468	-2.6	-36	545	-0.9	-26	611	+0.3	-17
2003	458	-2.3	-38	542	-0.6	-26	615	+0.7	-16
2004	448	-2.3	-39	540	-0.3	-27	621	+0.9	-16
2005	442	-2.0	-40	541	+0.1	-27	630	+1.4	-14
2006	435	-1.5	-41	542	+0.3	-26	639	+1.6	-13
2007	430	-1.4	-42	545	+0.5	-26	651	+1.8	-12
2008	426	-1.1	-42	549	+0.6	-25	664	+1.9	-10
2009	423	-1.0	-43	554	+1.0	-25	679	+2.3	-8
2010	422	-0.7	-43	562	+1.4	-24	679	+2.7	-5
Average a	nnual cha	nge							
1994-2000)	-5.5 %			-3.9 %			-2.7 %	
1994-2010)	-3.2 %			-1.6 %			-0.3 %	

The columns in which the GDP does not change represent a pure replacement effect. Replacement are expected to be rapid throughout the current decade, reaching its maximum in 1995 but declining steadily after that. One third of the volume of letters sent in 1993 will have been replaced by electronic communication by the year 2000, i.e. approx. 5.5 percent per year, and more than 40 percent by the year 2010.

As all the models indicate that electronic communication means have already replaced one third of the letters in each respective category, the same must also apply to the total volume of 1st and 2nd class letters sent in Finland. Since that part of the letter mail (magazines, books and goods) which is not replaceable by electronic communication, is only less than 8 percent of total volume of the mail. The Finland Post would have had 350 - 400 million more letters to deliver in 1993 if these had not been replaced earlier by electronic communication means.

Increase in the gross domestic product should be in an average of 5.5 - 6.0 percent a year in 1994 - 2000 in order to compensate for the loss of total letters volumes caused by this replacement effect. Even in this case the total letters volume would not increase but remain at the 1993 level. The corresponding average annual rise in GDP in the first decade of the next century would have to be 1.5 - 2.0 percent.

Since the beginning of the current decade, Finland has been undergoing the most severe depression of this century, which produced a 13 percent drop in its GDP over the period 1991 - 1993. A 2 percent increase is forecast for 1994. An annual rise of 5 - 6 percent may be achieved in the following few years, though this is not likely to be maintained throughout the rest of the current decade.

If the GDP rises by approx. 1.7 percent a year in 1994 - 2010, the letters volumes will be approx. 25 percent smaller in the year 2010 than today. Under these conditions no increase in volume would take place until the middle of the next decade.

If the average increase is 3.0 percent a year, however, the letters volumes will begin to increase at the turn of the century. In any case the total volume will remain some 5 percent below the figure recorded for 1993.

Trends in the letter volumes corresponding to the three GDP predictions (change 0 percent per year, +1.7 percent per year or +3.0 percent per year) are shown in Figure 3.4, which



indicates actual trends in the volumes of 1st and 2nd class letters in 1961 - 1993 and predictions up to the year 2010.

Figure 3.4 Actual Trends in the Volumes of 1st and 2nd class Letters in 1961 - 1993 and Anticipated Trends for 1994 - 2010 Corresponding to Three GDP Predictions.

The most detrimental electronic communication device with regard to the future of the letter mail seems to be the telefax machine, the influence of which is predicted to be almost as great as that of data communication and electronic mail together. The dangers posed by it are further compounded by the fact that will come close to its saturation threshold more rapidly than will electronic mail or the modem. Furthermore, that its replacement effect will be mainly focused on the current decade.

It must be borne in mind when applying the results, however, that they show only tendencies. The calculated models indicate largely simplified effects of electronic communication on the letter mail. For the models has been taken the influence of only one factor into consideration, whereas actual trends will be dependent many other factors as well.

The prospects for the traditional letter mail may not even be as favorable as figured out above. Furthermore, for further innovations in electronic communication are almost certain to be introduced and taken into use in the next decade which may change the prospects radically. Technology tends to adopt increasingly versatile, easy-to-use and inexpensive forms. The outcome of this study discussed here are based on figuring out of the replacement effects of those communication means which are already in widespread use.

A survey of the frequency of personal computers in households in Finland carried out by IDC Finland Ltd. and Finnish Gallup Market Research indicates that 23 percent of households currently have access to a computer and 7 percent to a modem (Aaltonen 1994). According to IDC evaluations, more than one out of every three households in Finland will have a computer by 1996 and the number of moderns will double. The conclusion which they reached was that "households create a basis for the development and supply of increasingly advanced applications and services", thanks to the extensive distribution of computers and high standards of user habits. Clearly, there is potential inherent in such applications for further erosion of letter mail volumes.

4 The Generative Effect on Letter Services of Electronic Communication⁷

4.1 Introduction

It has been predicted that by the year 2000, electronic forms of communication, will have reduced letter services in Finland by one third compared with the year 1993 (Nikali 1995a). And this is without taking into consideration the growth trend. Furthermore if there were no such substitution effect regarding electronic forms of communication, about one third more letters would be sent in Finland today. According to this substitution effect about 40 percent of the total number of letters for 1993 will be substituted by the year 2010. The same conclusion was drawn when organizations were asked their views on the development of letter services over the next five years (Nikali 1995b). Companies believe the number of domestic letters they send will fall by 20 percent over the five year period. This drop will be just as great for letters delivered by competitors of Finland Post. On the other hand the number of international letters, hybrid letters (ePost), parcels and electronic mail (eMail) is expected to grow considerably. The more letters a company send nowadays, the more pessimistic it is about the future of letter services.

The purpose of this study is to clarify whether electronic communication has had or still has a reversing effect. Forecasts made 20 years ago estimated that the volume of letter services would fall rapidly in the 1980's. This, however, has not taken place, rather the volume of letters has grown considerably. One reason for this is considered to be the simplification and cost reduction of copying techniques. The increasing effect on letter services of electronic communication is estimated from both long and short term perspectives in this study. It is useful to know how competitiveness and pricing have affected this development over long periods of time.

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This chapter is based on Nikali 1995c.

The Finnish postal service was established in the year 1638. In 1927 postal and telegraph services were combined to form the General Directorate of Posts and Telegraphs. It was strictly under government control, and was a department subject to the state budget. It carried out also some tasks of a public authority. Until 1990, when the Posts and Telecommunication became a state-owned business enterprise, the main postal rates were set by the Council of State. It was only the prices for some additional services that the Posts and Telecommunication of Finland could decide on independently.

During its period as a business enterprise between 1990 - 1992, only a few decisions on service charges were made by the Council of State. Two concerned postal services: the price of 1st class mail and the prices of newspapers and periodicals distributed in mail delivery. Those concerning telecommunication services were the prices for entry and annual fee of the telephone subscription, and charges for domestic long distance calls, over which Telecom Finland then had a monopoly. This decree was annulled in the autumn of 1992, after which the National Board of Post and Telecommunications has been able to decide for itself the prices it will charge for its services.

Since the beginning of 1994, Posts and Telecommunications of Finland has been a state-owned limited company, PT Finland Ltd, with its subsidiary companies Finland Post Ltd and Telecom Finland Ltd (Tele). Naturally, the Group is free to decide on its own pricing system.

Until 1990, Finland Post has had a monopoly for "the transportation of addressed letter items against payment." Nevertheless, in principle, competition was already free before that, because Finland Post took no measures to protect its monopoly. On 1 July 1991 the decree was repealed, which abolished constraints on competition between postal operators, so since that time postal operations have been completely liberalized in Finland. This freeing of competition has not so far affected the market situation: for a long time Finland Post has had a market share of 80 - 90 percent of letter services. The Act on Postal Services, which regulates postal services in Finland today, entered into force on 1 January 1994. For the management of local telephone services Finland had been divided into monopolies at the local level during the whole existence of such services. At the beginning of the 1900's there were 50 of these, reaching a peak of 800 in the 1930's while today there are 47 of them (Ministry of Transport 1994). Until 1993 they were only allowed to operate local services. Three quarters of this market was controlled by private companies and one quarter by Tele .

At the end of the 1980's telecommunication services began to be opened up to competition and completely free competition in domestic long distance services was achieved by the beginning of 1994. International services were opened up to competition on 1 July 1994 and now there are three operators offering international services. Tele's share of domestic long distance calls fell from 100 percent to about 40 percent in the course of one year.

4.2 Development of Communication Services in Finland

4.2.1 Volumes from the Year 1640

Income from different forms of communication in Finland can be studied from the middle of the 19th century onwards. Figure 4.1 shows real income for different forms of communication since the year 1640. Telecommunication incomes include turnovers from both Tele and private companies. Letter income from the establishment of Finland Post to the year 1850 has been estimated by logarithmic linear interpolation.

The income volume for letter services has, with only a few exceptions, grown throughout its 350-year history. After the war at the end of the second decade of this century, volume dropped substantially. With these few exceptions the trend towards growth of letter services did not slow down until the 1970's. Recently, of course, the severe economic recession of the 1990's has stunted growth.



Figure 4.1 Real Income for Different Forms of Communication in Finland in 1640 - 1995.

At the close of the 19th century, telegraph income approached the volume of letter services. Nevertheless the commencement of telephone services at the turn of the century caused a downturn in the telegraphic services curve. The income volume of the telephone services has, in fact, grown rapidly and continuously except for the end of the second decade of this century. Telex services will be a very short lived form of communication. The income volume of data services fails to give a complete picture of this form of service, since some of their income is registered under telephone services.

4.2.2 Different Communication Forms in the Communication Services Market

We can get a better idea of the competition between letter and electronic communication by comparing different forms of communication as a proportion of the communication services market. Relative proportions from the year 1640 onwards are shown in Figure 4.2.



Figure 4.2 The Shares of Different Communication Forms in Communication Market in Finland in 1640 - 1995.

The dominance of letters lasted until the end of the first quarter of the 20th century. Telegraphic services were at their height in the 1880's with a share of 20 percent of the market. Only when the telephone services developed in the 1930's did the share of letters in the communication services change radically. At the end of the 1940's, when the volume of letter services dropped and the telephone made a rapid ascent, the proportion of letter services in the market fell below 50 percent. Of the total volume of communication services, in the year 1995 the share of letters was 20 percent, telephone 70 percent.

In examining the above figures, the inescapable conclusion is that the explosive growth of electronic means of communication has had an effect on the growth potential of the letter services.

4.2.3 **Price Development of Communication Services**

The prices of communication services should be a potent factor in competition between postal and telecommunication services. In the earlier demand studies the

transmission price of competition means in proportion to the price of letter services was a very important factor for letter services demand (Teräsvirta 1966, Talvitie etc. 1973, Soininvaara 1974, Mäkinen-Nikali 1980 and Nikali 1986). Nevertheless, in the last study of demand no significant elasticity of cross prices has been detected between these services (Nikali 1992). The concept above that the growth of telecommunication services increases postal services, would lead, without crosswise flexibility in prices, to an interesting conclusion: The real prices of telecommunication services in Finland have been falling rapidly over the past few years and evidently will continue to do so with the tightening of competition and cheapening of technology. However, Finland Post does not need to lower its charges in the face of competition in the field of electronic communication, because there is no influence from the elasticity of cross pricing. Furthermore, lowering of telecommunication prices increases the demand for telecommunication services and through this the quantity of the postal services, too. In this way, Finland Post would gain a twofold advantage in the competition for telecommunication services: charges would not fall and demand would rise. What sort of pricing policy other providers of postal services would choose to follow, is though another matter.

Figure 4.3 shows the real price of letters since the year 1850 and the real price of Tele's telephone services since 1925. The real price of letters has fallen to a third in the course of 150 years. The fall has taken place only during the present century. Because of the economic recession after the war at the end of the second decade of this century, prices were not raised despite acute inflation. The real price dropped to a level at which it had never been before and has never been at since. The boom in 1930's raised the real price of both letter and telephone services, but since then the real price of a letter has generally fallen. The real prices of letters fell again considerably during the Second World War.



Figure 4.3 Real Tariff Index for Letters and Telephone Services in 1850 - 1995 and 1925 - 1995.

The prices of telephone services, especially long distance calls, were kept high at least until the 1980's, because it was a camouflaged form of state taxation. After all, the state's Tele was running a monopoly. Since that time the real prices of telephone calls have fallen dramatically, to a third in 25 years. It took a hundred years for this to happen to letters. As far as the real price of long distance calls is concerned, the drop has been considerably more dramatic. The real price in question has decreased to a tenth of what it was 20 years ago.

4.2.4 The Distribution of Electronic Communication Devices

96 percent of Finnish households have a telephone installed, about 5 percent telefax and under 8 percent a computer with a modem (Nikali 1994). Over the course of the next five years the number of telefax machines should to double and computers with a modem triple compared to the year 1994. At the present time the number of such devices in households is, and will be procured over the next five years (with the exception of telephones), as follows:

Device	Have in 1994	Intend to procure within the next 5 years		
	% of households	% of households		
• telephone	96.2			
• telefax	5.3	6.4		
• computer and modem	7.8	16.0		
• two above together	2.2	2.4		

In the table presented above, those households (2.2 percent) that have both telefax and a computer are also included in the households (5.3 percent and 7.8 percent) that have only one of the devices in question. In that proportion of households intending to procure either telefax or computer, only those are included that do not already have them, and for the 2.4 percent of households that have stated their intention of procuring both, only those who as yet have neither of the devices in question. 89 percent of households have neither telefax nor a computer with a modem. Of these, 74 percent have no intention of procuring these during the next five years. This means that five years from now there will still be about 65 percent of households that, according to their own plans, will not have any of the above mentioned electronic communication devices, with the exception of a telephone.

Telefax is to be found at 80 percent of places of employment in organizations (Nikali 1995b). This proportion has increased sharply, as two years ago the figure for telefax machines installed at places of employment was 47 percent and in 1987 only 12 percent. There are electronic mailing facilities at one fifth and data communication devices at a quarter of places of employment. In interviews concerning electronic mailing no separate classification was made between intra- and inter-organizational networks. Telephones were to be found at all places of employment in organizations. The devices in question exist at present, or it is intended to procure these during the next five years, as follows:

Device H	ave in1994	Intend to procure within the next 5 years		
%	of organizations	% of organizations		
• telephone	100.0			
• telefax	77.5	13.0		
• electronic mail	17.3	17.2		
• data communication	25.2	15.2		
• other electronic communicati	on 1.6	1.8		

In that proportion of places of employment intending to procure at least one of the above-mentioned devices, only those are included that do not have them at present.

With the exception of telephones, 20 percent of places of employment in organizations do not at the moment have any of the above-listed devices. Of these almost half do not intend to procure the devices in question during the coming five years. This means that in five years time there will be about 10 percent of places of employment that do not have any of these electronic communication devices, except telephones.

It is natural that electronic communication devices are most common in large organizations. This can be seen clearly from Table 4.1, where the existence of electronic communication devices other than telephones is considered in relation to the size of personnel. The distribution according to the number of employees of Finnish companies looks very lopsided. The proportion of places of employment with a staff of less than ten persons is 90 percent of the total, and the only device in the study that was common in small places of employment was telefax. There is a telefax at nearly every medium-sized and large work place. Electronic mailing and data communication have just started to become common also in small places of employment, whereas at large places of employment they are already quite common. About a quarter of the smaller places of employment have no other electronic communication device than a telephone.

Table 4.1The Prevalence of Electronic Communication Devices other than the
Telephone in Organizations According to Size of Personnel in 1994.

Number of employees	Telefax	eMail	Data	Other	None of
			communi-	electronic	these
			cation	communi-	
				cation	
	% share	% share	% share	% share	% share
Under 10 persons	74	14	22	1	24
10 - 50 persons	93	22	33	4	6
51 - 100 persons	95	40	53	4	3
101 - 200 persons	100	59	76	4	0
201 - 500 persons	96	86	86	4	4
Over 500 persons	100	72	72	22	0
TOTAL	77	17	25	2	21

4.3 Long Term Demand Model for Letter Services

The long term demand model is calculated from material which has been gathered at five year intervals between the years 1850 and 1994. In estimating the model, as is normally the case with recurring time period material, the problem was the high correlation between the independent variables. Because the trend coefficient was close to 1, it was shifted to the dependent variable on account of the autocorrelation, in other words the real volume of letter services divided by the volume of gross domestic product, q_t/T_t , became dependent variable. For the same reason, the independent variables, income volume of telecommunication services and the real tariff index of letter services were divided between themselves, Q_t/P_t . The term Q_t/Q_{t-1} represents the change in the volume of demand for telecommunication services over a five year period. After these changes the independent variables did not correlate between themselves so strongly. The long term demand model achieved was:

$$q_t / T_t = e^{2.49} * (Q_t / P_t)^{0.14} * (Q_t / Q_{t-1})^{0.22}, \qquad (4.1)$$

$$R^2 = 0.95$$

$$DW = 1.62$$
= 0.141S = 1850 - 1994 in five year intervals t t-values of coefficients 0.14 and 0.22 are 5.8 and 3.7, where = income volume of letter services for the year t; qt = the volume of gross domestic product for the year t; T_t = income volume of telecommunication services for the year t; Qt = real tariff index for letter services for the year t; Pf R^2 = explanatory degree of the model; DW = Durbin - Watson coefficient; S = standard division of the error term in the model; and t = year.

The explanatory degree of the model is very high (95 percent). There is no autocorrelation and the standard division of error term is moderate (14.1 percent). The coefficients are highly significant. A separate price variable P_t did not become a significant factor in the model..

Interpreting the model is somewhat problematic. Because the coefficient of the term Q_t/Q_{t-1} is positive, it has an effect on letter services of increasing their volume as the growth rate of demand for telecommunication services accelerates. Generally speaking this was the case until the 1970's. After that the speed of growth began slowing down. Since then, the effect of the term Q_t/Q_{t-1} on the demand for letter services has been falling. The effect of the income volume of telecommunication services Q_t (coefficient 0.14) on letter services has been to increase them as the volume of telecommunication services grows. This has happened during the whole of the period, with the exception of a short period at the end of the 1910's. Thus, until the 1970's, both factors increased the demand for letter services, but since the 1970's the effect of term Q_t has been to increase and term Q_t/Q_{t-1} to decrease the demand in question.

Since 1970, the volume of telecommunication services has grown on average of 4.7 percent per year. When the effect of terms Q_t and Q_t/Q_{t-1} is studied from the year 1970 on, the result for the complete model is a drop of less then one percent in volume of letter services for the whole period 1970 - 1994. So that, in examining a long period the growth of telecommunication services had an increasing effect on letter services since the 1970's, after which the effect of the volume of telecommunication services steadily fell and is now almost nonexistent.

The result obtained, however, does not mean that the substitution effect of letter services by electronic communication no longer exists. Substitution is calculated according to the present stage of development in electronic communication in Finland and according to how the procuring of electronic communication devices and the possibilities of using these affect the demand for letter services.

The absolute value of the price variable coefficient, 0.14, remains a little below the results of earlier studies on demand (Teräsvirta 1966, Talvitie etc. 1973, Soininvaara 1974 and Mäkinen - Nikali 1986). Nevertheless, it must be remembered that in this model it was the demand for 1st and 2nd class letters which was studied, and that the periods in previous studies concerning Finland's letter services only commenced in the year 1930 at the earliest. In demand models made in recent years no price flexibility for second class mail has been achieved at all (Nikali 1992b).

The dependent variable and the calculated demand model are shown in Figure 4.4. As can be seen, the model follows the dependent variable pretty closely, particularly from the year 1910 onwards. At the end of the 19th century, there is a 25-year period during which the error term was positive the whole time. Real income from telephone services entered the independent variable from the year 1905, after which the model is quite accurate, and not at all autocorrelated. Moreover, the explanatory degree of the model has clearly been better during this century than in the last.



Figure 4.4 Long Term (1850 - 1994) Demand Model for Letter Services.

The error term for the long term demand model is shown in Figure 4.5. This model shows clearly the previously mentioned autocorrelated stage at the end of the 19th century and the random error term period beginning at the end of the 1910's. The error term variation is also clearly smaller for the period after the 1910's than for that before. The rather large error term for the year 1950 results from the growth in demand for letter services during the Second World War and the fall in volume at the end of the 1940's. On the other hand, the demand for telecommunication services also grew in the last half of the 1940's, although considerably more slowly than in the first half of the decade in question. In the middle of the 1950's, a period of rapid economic growth in Finland, demand for telecommunication services started to grow again swiftly.



Figure 4.5 The Error Term for the Demand Model for Letter Services over the Long Term (1850 - 1994).

4.4 Short Term Demand Model for Letter Services

The short term demand model for letter services has been calculated for periods of years between 1961 and 1994. In constructing the model the same correlation problems were encountered as for the long term model. Because the trend coefficient was almost 1, this model was also estimated on the basis of material in which the dependent variable was of the type g_t/T_t , i.e. demand for letter services divided by the volume index of the gross domestic product. Not purposefully, but the other terms are also the same as in the long term model. By statistical tests, the following form was arrived at:

$$q_t / T_t = e^{-6.53} * (Q_t / P_t)^{0.15} * (Q_t / Q_{t-1})^{-0.16}, \qquad (4.2)$$

$$R^2 = 0.95$$

$$W = 1.68$$

$$s = 0.031$$

t = 1961 - 1994

t-values of coefficients 0.15 and -0.16 are 3.3 and -2.2,

where

 q_t = income volume of letter services for the year t;

 T_t = volume of gross domestic product for the year t;

- Q_t = income volume of telecommunication services for the year t; and
- P_t = real tariff index for letter services for the year t.

The model's explanatory degree is high (95 percent), it is not autocorrelated and the standard division of the error term (3.1 percent) is clearly smaller than in the long term demand model (14.1 percent). On the other hand, the t-values of the model's coefficients are not as good as those in the long term model, although they well satisfy the demands of the 5 percent reliance margin.

The coefficients for the short term model are otherwise the same as for the long term model, except that the coefficient of change term of the telecommunication services volume Q_t/Q_{t-1} is marked negatively in this model, -0.16. In the long term demand model it was positive, 0.22. A negative coefficient means that the effect of the term Q_t/Q_{t-1} is a drop in letter services demand when the demand growth for telecommunication services accelerates and vice versa, an increase in letter services falls. The effects of the terms Q_t/Q_{t-1} and Q_t on letter services demand are reversed when the growth rate of demand for telecommunication services accelerates and parallel when demand for telecommunication services grows but not at an accelerating pace. However this process begins to slow down as the years elapse. Indeed the coefficients are quite small, so that the changes in question must be of some size before they have any noticeable effect on the volume of mail.

The year by year effects of the terms Q_t and Q_t/Q_{t-1} of the short term model on the demand for letter services for the period under consideration, are presented in Table 4.2.

Table 4.2Year by Year Effects of the Terms Q_t and Q_t/Q_{t-1} of the Short TermModel on the Demand for Letter Services.

Year	Effect of	Effect of	Combined effect of
	Q _t term	Q_t/Q_{t-1} term	terms Q _t and Q _t /Q _{t-1}
1961			
1962	+0.2 %		
1963	+1.5 %	-1.3 %	+0.1 %
1964	+1.3 %	+0.2 %	+1.5 %
1965	+1.2 %	+0.1 %	+1.3 %
1966	+0.9 %	+0.3 %	+1.3 %
1967	+2.4 %	-1.5 %	+0.8 %
1968	+0.2 %	+2.3 %	+2.5 %
1969	+1.2 %	-1.1 %	+0.1 %
1970	+1.7 %	-0.4 %	+1.2 %
1971	+0.4 %	+1.3 %	+1.7 %
1972	+0.5 %	-0.2 %	+0.4 %
1973	+0.7 %	-0.1 %	+0.5 %
1974	+0.4 %	+0.3 %	+0.7 %
1975	+1.9 %	-1.6 %	+0.3 %
1976	+3.7 %	-1.8 %	+1.8 %
1977	+0.7 %	+3.2 %	+3.9 %
1978	+0.4 %	+0.3 %	+0.7 %
1979	+0.6 %	-0.2 %	+0.4 %
1980	+0.3 %	+0.3 %	+0.6 %
1981	-0.5 %	+0.8 %	+0.3 %
1982	+0.7 %	-1.2 %	-0.5 %
1983	+0.6 %	+0.1 %	+0.7 %
1984	+0.0 %	+0.6 %	+0.7 %
1985	+0.8 %	-0.8 %	-0.0 %
1986	+0.2 %	+0.6 %	+0.9 %
1987	+0.8 %	-0.6 %	+0.2 %
1988	+0.7 %	+0.1 %	+0.8 %
1989	+0.2 %	+0.5 %	+0.7 %
1990	+1.3 %	-1.2 %	+0.1 %
1991	-0.2 %	+1.6 %	+1.4 %
1992	+0.2 %	-0.4 %	-0.2 %
1993	+0.2 %	+0.0 %	+0.2 %
1994	+0.4 %	-0.3 %	+0.2 %

As can be seen from Table 4.2, the yearly effects of telecommunication services on the volume of letter services have been trivial, because the coefficients in the model (4.2) are small. In comparison with the substitution model for letter services, in which the regression coefficients were between 0.5 and 0.6 (Nikali 1995a), the differences of the coefficients are great. Nevertheless, the total effect of the terms Q_t and Q_t/Q_{t-1} since 1961 has been to cause an increase. In the decades 1960 and 1970 the total significance was about +10 percent for both decades, but for the 1980's it was only +4 percent and the effects of these factors are all the time decreasing.

These results do not conflict with the substitution model, because the cross-section material for the substitution study was taken from the years 1992 and 1993 when, according to the short term demand model for letter services, the volume of telecommunication services had no longer any noticeable effect on the volume of letter services. In addition to that, no contradiction with the long term demand model exists at present, rather the results have tended to be corresponding.

The short term demand model for letter services is shown in Figure 4.6 and the error term for the model in Figure 4.7. It can be seen from these figures that the calculated model complies well with the dependent variable. Even the downward trend during the recession of the 1970's has been succeed to estimate. In the same way the downturn in letter services demand in the 1990's that followed a long period of growth becomes apparent from the estimated model. It will be observed from the error term graph that the standard division of this term is indeed small; certainly it has been possible to explain with almost 100 percent accuracy the development of the 1980's. The model seems to work best during the periods of economic growth, because in the first half of the 1970's, at the end of the same decade and in the early years of the 1990's, when there was a downward trend in the Finnish economy, the absolute value of the error term is greater than on average.



Figure 4.6 Short Term (1961 - 1994) Demand Model for Letter Services.



Figure 4.7 The Error Term for the Demand Model for Letter Services over the Short Term (1961 - 1994).

4.5 Views of Households and Organizations on the Development of Communication

Households, who sent 13.8 percent of domestic 1st and 2nd class letters and postcards in 1995 (Nikali 1995c), predict that over the period of 1995-2000 the total amount of letters they send will grow by about 8 percent (Nikali 1994). The quantity of postcards, posted by households, which is just as great as letters, is however forecast to fall by a third. Households predict that during the coming five years the number of telefax messages they send will triple and electronic mail messages will be over twelve times that of the present number. In Finland households' share of telefax messages is about 4 percent and electronic mail messages also about 4 percent.

Table 4.3 shows the views of organizations regarding the development of the amount of domestic letters they expect to send over the years 1995-2000 classified in accordance with the number of letters they send now (Nikali 1995b).

Table 4.3	Organizations' Views of the Development of the Number of Domestic
	Letters They will Send in the Coming Years Classified According to
	Number of Letters Sent in 1994.

Number of domestic	Change/year	Change over 5 years
letters	%	%
Under 5,000 pc/pa	+11.0	+69.0
5,001 - 10,000 pc/pa	+19.4	+143.0
10,001 - 30,000 pc/pa	+0.6	+3.2
Over 30,000 pc/pa	-9.2	-38.0
TOTAL	-4.4	-20.0

Organizations that send a lot of letters forecast a drop in their numbers by nearly 40 percent of the present figure over the next five years. On the other hand, organizations that send few letters say their numbers will increase. Nevertheless it is the major customers that decisively affect letter services as a whole and so the total volume of letter services is expected to fall by one fifth over the next five years. Because during the interviews for the study on client expectations economic activity was believed to

be on the increase, this result is completely consistent with the results in the letter services substitution study.

Table 4.4 shows how organizations were classified according to the development they forecast for the number of messages they will send by different forms of electronic communication.

Table 4.4The Classification of Organizations According to Type of
Development They Predict for the Different Forms of Communication
Services They will be Using in the Coming Years 1995-2000.

	Development of total amount of services over next 5 years				
Type of communication	Will grow	Will remain as before	Will fall	TOTAL	
	% share	% share	% share	% share	
Domestic letters	56.0	11.7	32.4	100.0	
Letters abroad	32.3	60.6	7.1	100.0	
Hybrid letters	16.2	83.6	0.3	100.0	
Telefax- messages	68.1	20.4	11.5	100.0	
eMail-messages	40.2	58.2	1.6	100.0	

Almost a third of these organizations believe the amount of letters they send will fall over the next five years. Of all these forms of communication services, the share of those forms for which a fall is predicted is greatest for letters. Although over half of these organizations forecast that the number of letters they send will grow, the situation for letter services is problematic, because those very organizations predicting a growth in volume are those sending the fewest letters. Then again, those organizations that sent many letters forecast a drop. Of these forms of communication services, telefax-messages were most generally given a growth prediction. When it is recalled that almost 80 percent of organizations in Finland use telefax and in five years time their prevalence will be 90 percent, the growth forecast for telefax messages is significant. At the present moment it is estimated that in Finland the number of telefax messages is about 45 percent that of 1st and 2nd class letters. In five years time they will comprise practically the same amount as 1st and 2nd class letters. With regard to the development of letter services in Finland, those organizations sending over 30,000 letters per year, i.e. by Finnish standards big letter users, are in a key position. Of those organizations that send out over 30,000 letters per year, and which forecast a rise in the coming years in the number of letters they will send, 71 percent also forecast an increase in telefax-messages. On the other hand, of those organizations in question that predicted a drop in the number of telefax-messages only 45 percent expected a rise in the number of letters. Of those predicting a fall in letters, 55 percent nevertheless expected an increase in the amount of telefax-messages they send. Then again, of those organizations that are expecting a decrease in the number of letters they send will fall. These differences in the trend of development amongst key customers for letters.

When organizations were asked what factors in their opinion are most likely to increase letter services, the most general reasons stated were the economic development of both Finland and the EU countries and their own organization's readiness to act. The most common reason for a fall in letters as a form of communication was said by the organizations to be the development of electronic forms of communication and the linking of organizations to information networks.

4.6 Conclusions

In the study of substitution in letter services, it has been estimated that there will be a decrease of about one third in 1st and 2nd class mail by the year 2000 compared to the situation in 1993 on account of the generalization of electronic forms of communication (see Chapter 3). In this case the trend growth is not included in the prognosis. The object of this study was to clarify whether the volume of electronic communication has been and still is a generative force in letter services. If this kind of effect can be found, the demand model for letters will have to be adjusted in this respect. The matter was studied using long and short term econometric models, in

which the demand for letters is explained by e.g. the volume of telecommunication services. On the other hand, opinions of households and organizations on the quantities of letters and the development of electronic forms of communication, as well as on the link between these, have been studied by means of customer surveys.

In the study of the long term consequences, the outcome was that two factors influencing the demand for letter services were discovered: the income volume of telecommunication services and its rate of growth. Both coefficients are positive i.e. the total amount of letter services has grown along with the growth in telecommunication services, and the demand for letter services has grown when the volume of telecommunication services has been on an accelerating course. On the other hand, when the rate of growth of telecommunication services has fallen, it has had the effect of decreasing letter services. The total volume of telecommunication services has grown almost throughout the entire period during which telecommunication services have existed in Finland and until the 1970's the rate of growth has, in the main, been accelerating. Since the commencement of the period of electronic forms of communication, at least until the 1970's, the telecommunication services have had the effect of increasing letter services. It is true that the model's coefficients are not very big. Nevertheless they are statistically significant. From the 1970's onwards the rate of growth of telecommunication services has slowed down, so that the effects of the factors in question in the long term demand model have been reversed, also no generating effect on letter services by telecommunication services any longer can be observed.

The demand model achieved for the short term model was almost the same as the long term model. The only exception was the coefficient factor indicating the rate of growth, which was negative in the short term model. A negative coefficient means that the demand for letter services decreases, when the demand for telecommunication services grows at an accelerating pace and vice versa, when the rate of growth of the demand for telecommunication services falls, the demand for letter services grows. The volume of the demand for telecommunication services and the effects of the factor indicating the rate of growth on the demand for letter services are reversed when the growth of the demand for telecommunication services accelerates and they are parallel when, although the demand for telecommunication services grows, it does so at an ever retarding pace. The coefficients in this model also are quite small, so the changes in telecommunication volumes have to be substantial if they have any noticeable effect on letter quantities.

Even though the coefficients concerning the rate of growth of telecommunication services volume in the long term and short term demand models are contradictory, the effects of these on letter services are parallel. When the short term model was used to estimate the total effect of telecommunication services on letter services, the results showed that the total effect in the 1960s and 1970's had been to increase demand for letter services by about 10 percent over ten year periods. In the 1980's the effect was altogether less than 4 percent and this effect is continuing to diminish. On account of this, both models indicate the same outcome in relation to the future development of letter services: the development of the volume of telecommunication services is no longer having a generative effect on letter services.

These results do not conflict with the substitution studies of letter services mentioned previously, for two reasons:

- The replacement models were estimated using cross-sectional material, i.e. between Finnish counties at different stages of development in telecommunication services. The prevalence of technical preparedness for sending electronic messages was also examined, as well as its effect on letter volume. It is another matter though, as to how this preparedness, upon which the development of the volume of telecommunication services depends, is exploited. This examination concentrated on studying the effect of telecommunication services volume on the demand for letter services.
- The positive coefficients of the long term demand model mean that the generative effect on letter services of electronic communication really has existed. Its existence belonged to a time when electronic forms of communication were comparatively new and just beginning to find their significance in the field of communication, i.e. the first seven decades of telephone services from the start of the 1900's until the 1970's. In the substitution study there was no result showing that the telephone as a traditional form of spoken communication still has a substitution effect on letter services. This substitution took place already earlier.

On the other hand, the opinions of households and organizations regarding the number of letters they will be sending in the future and their attitudes towards electronic communication were studied. The result was a clear impression that the increase of electronic communication will cause a decrease in letter communication. The estimated drop in the number of letters, 20 percent in five years, coincides with the substitution study on letter services.

Because a generating effect on letter volume of telecommunication services can no longer be observed in demand models, there is no need to make any adjustments in substitution models.

5 Demand Models for Letter Mail and its Substitutes⁸

5.1 Introduction

The aim of demand models is an assessment of the factors affecting the demand of the most important product groups of postal service. This assessment includes a calculation of the price elasticity of the product group concerned, in consideration of the other essential factors that have an impact on demand, including the development of electronic communication.

This report presents demand models for the following product groups:

- 1st class domestic letters and
- 2nd class domestic letters.

The study material is composed of annual series. The demand of product groups is measured by the volume of postal items⁹. The models calculated are based on statistics from the years 1974 - 1995. The year 1974 was chosen as the initial year, because, with regard to the electronic media considered in the study (telefaxes, data modems and electronic mail), the earliest statistics for modems are from the year 1975. The use of Internet is still so new that it cannot be taken into consideration in the examination of the time series.

The electronic media considered in the present study have become popular in Finland quite rapidly, as indicated by Figure 5.1. It shows the number of telefax machines, data modems and electronic mail connections in Finland for the years 1975 - 1995. At present, Finland is estimated to have about 250,000 active users of Internet, which represents approximately 5 percent of the population (Talouselämä 1996). Furthermore, the number of occasional users is double that of the active ones.

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This chapter is based on Nikali 1997a.



Figure 5.1 The Number of Telefax Machines, Data Modems and Electronic Mail Connections in Finland in 1975 - 1995.

The figure quite clearly shows that growth in the use of electronic communication devices follows the S-curve. Last year, the number of telefax machines was about 320,000, data modems numbered approximately 380,000 and about 600,000 employees had access to electronic mail. It would seem that we are at the most rapid rate of growth in the frequency of telefax machines and that, within the next five years, the number of telefax machines is likely to achieve the saturation point. The replacement effect of the telephone on letter mail had already taken place at the time that the telephone became very common in Finland (Nikali 1993a). Altogether, as analyzed in Chapter 3 electronic communication devices have been estimated to have replaced about one-third of letter mail so far, about half of which is due to telefaxes.

5.2 Demand Models

5.2.1 The Form of the Demand Models

The demand models for 1st and 2nd class letters are of the following form:

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In the analysis, changes over time in the internal structure of a product group (e.g. a change over to lighter items as a result of a raise in tariffs) are not taken into account.

$$q_{it} = \alpha_{i} * Q_{t}^{\beta_{i}} * P_{t}^{\chi_{i}} * K_{t}^{\delta_{i}} * S_{t}^{\phi_{i}} * e^{\varphi_{i} * T_{t}} * e^{\xi_{i} * D_{t}} * \varepsilon_{it}, \qquad (5.1)$$

where for i = 1,2

- qit⁼ Volumes of ordinary domestic 1st- or 2nd class letters subject to a charge;
- P_t = Real tariff index of domestic 1st class letters;
- K_t = Real tariff index of domestic 2nd class letters;
- Q_t = Domestic demand at 1990 prices;
- S_t = Economic fluctuation variable, number of building permits granted;
- T_t = Number of telefax machines, 1000;
- D_t = Dummy variable, by which the changes in the volumes of 1st and 2nd class letters in 1984 has been corrected; and
- ε_{it} = Residual errors of the models.

5.2.2 The Variables of the Demand Models

The dependent variable in the demand model of 1st class letters was domestic 1st class letters and in the model of 2nd class letters domestic 2nd class letters. The series does not include registered or insured letters. The distributions of senders of domestic 1st and 2nd class letters are the followings (Nikali 1995c):

Sender	1st class letters	2nd class letters
Business enterprise	56 %	61 %
Private person	22 %	6 %
Authority or municipality	9 %	16 %
Association	10 %	12 %
Other	3 %	5 %
Total	100 %	100 %

Because organizations send the majority of 1st and 2nd class letters, general economic activity has a significant effect on the volume of letters sent. On the large scale, this is best described by the gross domestic product (GDP) or domestic demand. The difference between the GDP and domestic demand is that the GDP includes exports, but not imports, while the reverse holds true in the case of domestic demand. However, the actual difference between these variables is not substantial.

Figure 5.2 contains the curves representing the volumes of the GDP and domestic demand as well as the economic fluctuation variable used in the models.



Figure 5.2 Volumes of the GDP and Domestic Demand as well as the Economic Fluctuation Variable in 1971 - 1995.

The figure also indicates the difference between domestic demand and the economic fluctuation variable used, even though the volume of domestic demand is clearly influenced by economic cycle characteristics. A separate economic fluctuation variable reacts much more strongly to changes in the economy.

The time series of 1st and 2nd class letter volumes for the years 1970 - 1995 are given in Figure 5.3



Figure 5.3 Volumes of 1st and 2nd class Letters in 1970 - 1995.

A clear drop in the volume of 1st class letters and a shift upwards in 2nd class letters took place in 1984, when the old division into letters, printed items and postcards was replaced by the present division into 1st and 2nd class letters¹⁰. In the models, this was taken into account by means of a dummy variable, which makes a level correction in 1984 in the models being calculated. The volume of 1st class letters follows domestic demand quite well. However, after the year 1993 domestic demand clearly experienced an increase, but the volume of 1st class letters did not follow at the same rate. In the demand model this is explained by the economic fluctuation variable, which, in spite of all advance expectations, started to decline last year. After a sharp fall, the upward cycle remained very short. It is likely that it was caused by fluctuations in both domestic and foreign markets, one example of which is the slow decrease in unemployment.

The real prices of 1st and 2nd class letters have developed in different directions (Figure 5.4). During the period under study, the real price of 1st class letters slowly but steadily decreased. In 1995, the real price was almost the same as it was 15 years earlier. However, the real price of 2nd class letters has been increased a rate similar to the decline in real prices of 1st class letters.

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This was a classification change in letter-mail items, here referred to as the KILU Reform.



Figure 5.4 The Real Prices of 1st and 2nd class Letters in 1970 - 1995.

The competing data transfer mode used in the model of 1st class letters was the price of 2nd class letters. In the case of the electronic communication media, the modes used were the price of domestic trunk calls and the number of telefax machines and data modems in conjunction with a variable describing the frequency of electronic mail in organizations. Earlier, a cross elasticity had been observed between the prices of trunk calls and 1st class letters, although, according to different studies, its effect steadily decreased as the study approached the 1980s (Teräsvirta 1966, Talvitie etc. 1973, Soininvaara 1974 and Mäkinen - Nikali 1986). It was not until the second half of the 1980s that the number of new electronic communication media started to be big enough to have any measurable effect on the demand of letter-mail services. Since the KILU Reform in 1984, 2nd class letters have become a factor of competition for 1st class letters when letters are sent in volumes big enough that the minimum number of 2nd class letters per dispatch (20 items) does not prevent the choice. This is also evident in the share of these letter types in the different groups of senders (Nikali 1995c):

Sender	Type of item				
	1st class letter	2nd class letter	TOTAL		
	% share	% share	% share		
Business enterprise	45.4	54.6	100.0		
Private person	77.2	22.8	100.0		
Authority or municipality	33.8	66.2	100.0		
Association	44.2	55.8	100.0		
Other	36.8	63.2	100.0		
TOTAL	47.8	52.2	100.0		

Table 5.1Shares of 1st and 2nd class Letters in the Different Sender Groups in
1995.

Only in households is there no actual competition between these items. In the other groups, the volume of 2nd class letters has surpassed that of 1st class letters in the 1990s. The total share of letters delivered by other delivery organizations and the business enterprises themselves is about 15 percent of all letter mail (Nikali 1995b). However, there is so little information available on the annual development of the volumes and prices of letters carried by the competitors of Finland Post Ltd. that their effect could not be taken into account in the time series consideration.

The competitive data transfer forms used in the model of 2nd class letters were the price of 1st class letters and addressed bulk letters. The forms used in the model of the electronic communication media were the price of domestic trunk calls, the number of telefax machines and data modems and a variable describing the frequency of electronic mail in organizations. Earlier studies had indicated no cross elasticity with respect the price of telephone calls. After the KILU Reform, a situation of competition within 1st class letters is theoretically possible. However, information on the volumes and pricing of letters delivered by other delivery enterprises and companies themselves is so scanty that their effect on the model could not be taken in consideration.

5.2.3 The Results

The results of the estimations are presented in Table 5.2.

Variable	1st class	s letters	2nd class	letters
	Coefficient	t-value	Coefficient	t-value
α	-8.02	-2.84	-21.13	-4.49
Qt	1.28	6.78	2.3	7.57
Pt	-0.78	-4.80	-0.28	-0.80
К _t	0.51	4.64	0.15	0.60
St	-0.21	-2.81	-0.63	-4.38
Τ _t	-0.00061	-2.97	-0.00046	-1.13
D _t	-0.12	-4.23	0.16	2.69
Parameter	Val	ue	Value	
t	1974 -	1995	1974 - 1995	
R ²	0.99		0.99	
S	0.025		0.055	
DW	1.7	'9	2.00	

Table 5.2The Results of Demand Models for 1st and 2nd class Letters.

In the diagram, t indicates the years included in the models, R^2 is the explanatory degree of the models and s is the standard deviation of the residual errors. The Durbin-Watson (DW) test quantity measures the possible autocorrelation of the residual error of the. If the value of the DW test quantity is between 1.7 and 2.3 with the observation and variable amounts of the model used, then the autocorrelation is not significant (Koutsoyiannis 1977).

On the other hand, no significant coefficient could be found for the price of trunk calls. The prices of trunk calls decreased so much in the 1980s that any changes in this area are no longer significantly reflected in the demand model of letters. Likewise, no significant coefficients were obtained for the number of data modems or the variable describing the frequency of electronic mail devices.

Var./Var.	Qt	Pt	Kt	St	T _t
Qt	1.00				
P _t	-0.85	1.00			
K _t	0.72	-0.57	1.00		
St	0.02	0.01	-0.42	1.00	
T _t	0.27	0.07	0.65	-0.36	1.00

The correlation among explanatory variables are:

Another factor resulting in erroneous results is a heavy correlation between the variables. As the coefficient describing domestic demand for 1st class letters is close to one, this variable could be moved to the other side of the equation. For the same reason, in the demand model for 1st class letters the real-price indexes of 1st and 2nd class letters were divided by each other. This was possible, because the absolute values of the coefficients were close to one another, but had different signs. These adjustments lead to the following demand model for 1st class letters:

$$\frac{q_{1t}}{Q_t} = e^{-6.53} * \left(\frac{P_t}{K_t}\right)^{-0.52} * S_t^{-0.14} * e^{-0.00055 * T_t} * e^{-0.067 * D_t} * \mathcal{E}_{1t}.$$
(5.2)

Variable	Coefficient	t-value		
Constant	-6.53	-25.03		
P _t /K _t	-0.52	-6.73		
s _t	-0.14	-2.20		
T _t	-0.00055	-2.56		
D _t	-0.067	-2.31		
Parameter	Va	lue		
t	1974 - 1995			
R ²	0.88			
S	0.033			
DW	1.84			

Because the variable representing the number of telefax machines is in exponential form, the factor directly indicates the extent to which the total number of telefax machines has, by the time in question, replaced 1st class letters by telefax messages. Because of the exponential form of this factor, it is also important to know that in the estimation of model (5.2), the quantity of the time series of telefaxes is thousands of machines. As the rate of increase in the number of telefax machines slows down, i.e., we approach their saturation point, the additional replacement of 1st class letters by these devices will also slow down.

According to the Student t test, all the coefficients are significant. The dependent variable and the model describing it are shown in Figure 5.5. It shows that the model calculated follows the dependent variable quite well, even though the dependent variable represent the volume of 1st class letters in relation to the volume of domestic demand. This is also indicated by the quite high explanatory degree, 88 percent, of the model. Also the standard deviation of the residual error, 0.033, is small enough and there is no autocorrelation in the model.



Log

Figure 5.5 Demand Model for 1st class Letters.

In comparison with earlier studies, the price elasticity of 1st class letters has become considerably closer to the situation that prevailed in the demand models calculated on the basis of material from the 1930s to the 1960s, although the present reasons for the price elasticity are different. At that time, letter mail services competed strongly with the traditional telephone. Also, the density of telephones increased strongly in Finland. However, during the last ten years, 1st class letters have been competing with 2nd class letters and the quickly spreading new electronic communication devices. Competition with 2nd class letters is, indeed, quite natural, because a competitive situation between these dispatch forms was purposely created in the KILU Reform in 1984. The competition also seems to work. With the exception of households, the other sender groups now make greater use of the 2nd and not the 1st delivery rate, as indicated by Table 5.1. As late as the end of the 1980s, the reverse of this situation held true.

Perhaps the most interesting detail of model (5.2) is the seemingly low coefficient of the number of telefax machines. However, it is not irrelevant, when we remember the form of this factor in the model. As mentioned earlier, the factor describing the number of telefax machines in exponential form tells us the total annual substitution of 1st class letters by the electronic communication devices in question. In 1995, the number of telefax machines in Finland was about 320,000. According to model (5.2), this means that without telefax machines, the volume of 1st class letters last year would have been 16 percent more than it actually was. No statistically significant coefficients were obtained for the variables describing the greater frequency of the electronic communication devices. Market penetration of data modems and electronic mail has not yet reached a level that would allow the measurement of their effects in a time series analysis. Compared to the other electronic communication devices, telefax machines have reached a point of relative market maturity in their life cycle. The substitution of 1st class letters by telefax machines in accordance with this model is presented in Figure 5.6.



Figure 5.6 Actual Volume of 1st class Letters and Its Substitution by Telefax Machines in 1970 -1995.

According to the substitution model of letter mail (Nikali 1995a), telefax machines, data modems and electronic mail had replaced about one-third of 1st and 2nd class letters by the year 1993, and the proportion of this replacement attributed to telefax machines was about 50 percent. With regard to telefax machines, the model calculated is very much the same: so far, telefax machines have replaced 16 percent of 1st class letters.

Because the coefficients of tariff indexes in the demand model (Table 5.2) for 2nd class letters are not statistically significant and their signs are incorrect, we reestimated the model without prices, obtaining the following demand model for 2nd class letters:

$$q_{2t} = e^{-25.22} * Q_t^{2.59} * S_t^{-0.75} * e^{-0.00079 * T_t} * e^{0.19 * D_t} * \mathcal{E}_{2t}.$$
(5.3)

Variable	Coefficient	t-value			
Constant	-25.22	-28.45			
Qt	2.59	29.12			
St	-0.75	-8.92			
T _t	-0.00079	-2.77			
D _t	0.19	4.27			
Parameter	Va	llue			
t	1974 - 1995				
R ²	0.99				
S	0.045				
DW	2.19				

The explanatory degree of the model, 99percent, is very good. Also the standard deviation of the residual error, 0.045, is small enough and the coefficients are significant according to the t test. The DW statistic shows that there is no autocorrelation in the model.

The dependent variable and the model describing it are shown in Figure 5.7.



Figure 5.7 Demand Model for 2nd class Letters.

In regard to earlier studies, the results are very similar. Already in models calculated on the basis of material from the 1960s to the 1980s, no significant coefficient was obtained for the price of 2nd class letters themselves (Nikali 1986 and 1992b). The fact that the demand of 2nd class letters did not vary in accordance with the price of these letters, 1st class letters or the relationship between these prices to the extent indicated by the model depends on the fact that the competition situation between 1st and 2nd class letters is only unilateral. There is no other alternative for a 2nd class letter other than not sending the letter or using some other communication media altogether. The pricing policy has not been one which would have caused this alternative to have an effect big enough to be indicated in the model.

The fact that the demand for 2nd class letters is not flexible in relation to the price of these letters explains the greater dependence on economic trends for 2nd class letters than in the case of 1st class letters. It is almost always possible to move from the 1st class to a cheaper and slower delivery of the letter. In the 2nd class this alternative does not exist.

The unilateral competition between the 1st and the 2nd class has been influenced by the fact that the real prices of 1st class letters have not been changed much since 1984, whereas the real price of 2nd class letters was raised in the years 1982-1987 and 1991-1995. This caused a considerable change in the price relation of these items. In 1984 the difference of the average price was about 50 pennies, or, 41percent. After that the price varied until it attained its highest value, which occurred in 1991, when the price difference was almost 80 pennies, a difference of 45percent. A difference significant to the user of this service cannot but affect decisions on the service level or communication medium chosen by the customers. By 1995, the price difference had decreased by 10 pennies, to 36percent, which has represented a correct pricing policy during the recession.

One factor restricting the use of 2nd class letters is the minimum number of 20 items per dispatch, which. However, this should be of major significance only for private persons. In the earlier studies it has not been in need of separate economic fluctuation variable. But the last then years in Finland have been economically very exceptional. At the end of the 1980s it was a strong boom and at the begin of the 1990s a deep recession. However the demand of 2nd class letters hasn't followed this development purely. The volume has increased in spite of recession. When the coefficient of the trend, the volume of domestic demand, is fairly big in the model (5.3) and the sign of coefficient of the economic fluctuation variable is negative, they act as factors leveling each other. The difference between domestic demand and the economic fluctuation variable has been described after the Figure 5.2 on page 89 and it is no correlation between those variables, as can see on the correlation table on page 94.

As in model (5.2) for 1st class letters, a significant coefficient was obtained between the demand of 2nd class letters and the number of telefax machines. In model (5.3) the dependence is relatively even greater than in 1st class letters. On the other hand, no statistically reliable dependence was obtained between demand and modems and the frequency of electronic mail in this model, which corresponds to the result on 1st class letters. The number of telefax machines in both equations is taken into account in the same, exponential form, so that the number directly indicates the extent to which telefax machines have replaced the letters in question by the year under review. The telefax coefficient, -0.00079, of telefaxes in the demand equation of 2nd class letters means that so far telefaxes have resulted in 22 percent of 2nd class letters to be transmitted electronically. Thus, without the influence of telefaxes, the volume of these letters would at present be more than 20 percent greater.

With regard to telefaxes, the result obtained is harmonious with the replacement model of letter-mail services (Nikali 1995a). Because telefaxes have replaced 16 percent of 1st class letters according to model (5.2) and 22 percent of 2nd class letters according to model (5.3), the substitution in all letter mail traffic by the end of 1995 is 19 percent for telefax machines. According to the substitution model, the use telefaxes results in a shift from letter mail to electronic communication, which equals the total replacement by data modems and electronic mail. That may be the reason why no reliable dependence was obtained in this study in the consideration of time series between modems

and electronic mail and between the demand of 1st and 2nd class letters. These results mean that the electronic communication media being studied had replaced as much as 38 percent of 1st and 2nd class letters by the end of 1995. The substitution of 2nd class letters caused by telefax machines is shown in Figure 5.8.



Figure 5.8 The Actual Volume of 2nd class Letters and Its Substitution by Telefaxes in 1970 - 1995.

5.3 Conclusions

There is a long tradition in Finland in estimating demand models for postal services. The earliest models were created as early as the 1950s. For the first time, the time series examination now includes factors other than a notable example such as the cross elasticity of prices, which estimate the substitution effect of letter mail by electronic communication media. Of the electronic media, only those with a long history behind them can be included in this kind of study. By means of cross-sectional material from 1993, it has been estimated that, by that time, the telefax, electronic mail and data modems had replaced about one-third of 1st and 2nd class letters. According to the model in question, the substitution effect of telefax machines equaled the aggregate total of electronic mail and data transfer. Because the frequency of electronic means of communication follow the S-curve, i.e., their rates of increase follow their life cycles, a time series examination can take into account the replacement effect relating to the

various time periods better than cross-sectional material can. The replacement effect of the telephone as a traditional voice communication medium took place when its expansion was greatest, prior to the review period of this study, which involves the years 1974 - 1995. In addition to organizations, almost all Finnish households also have a telephone.

Nearly all organizations in Finland have a telefax machine, but fewer than one in ten household has one. Despite that, within the next few years the number of telefaxes will most likely have reached its saturation point. They are steadily being replaced by computers with modems. Already, almost 30 percent of Finnish households have computers, and one-third of which are equipped with modems. This makes it possible to acquire a telefax function for the computer as well as an electronic mail connection, which in turn provides access to the Internet.

In earlier studies, addressed bulk letters have been the only item for which a separate economic cycle variable has been obtained in addition to the business cycle variable included in the trend. The strong economic fluctuations of the last few years have resulted in a need for a separate economic cycle variable in the models. Because the coefficient of the economic cycle factor is negative in all the models, it affects the demand model by equalizing the effect of the trend factor.

With respect to the substitution effect of electronic modes of communication, statistically significant coefficients were obtained between telefax machines and the demand of 1st and 2nd class letters. The substitutions estimated by means of the time series are very similar to the results obtained earlier by means of replacement models calculated from cross-sectional material. If we presume that the frequency of telefax machines, data modems and electronic mail will increase in the next five years at an annual rate of ten percent, a careful estimate, the total substitution, according to the present models, of 1st class letters by telefaxes will rise from the present 16 percent to 24 percent, that of 2nd class letters, from 22 percent to 30 percent.

6 Selection Criteria of Communication Modes¹¹

6.1 Introduction

In order to estimate the factors affecting the transfer of messages, 400 representatives of organizations were interviewed. They do not represent all the organization stock in Finland, 90 percent of which consists of small organizations with fewer than 10 people. In these interviews, the main emphasis was on middle-sized organizations, because middle-sized and large enterprises and public administration organizations have several different communication media at their disposal, and the aim was to examine factors affecting the choice of these media. Of the electronic media, the study was comprised of telefax machines, electronic mail, EDI and Internet. Written messages refer to 1st and 2nd class letters. The ePost letter represents a combination of an electronic and a written message. Telephone traffic in the form of the traditional telephone falls outside the scope of this study, and the impact of the telephone is only taken into account in certain background factors. Electronic mass media also fall outside the scope of the study. This chapter presents the factors affecting the use of letter mail, telefax machines, electronic mail, EDI and Internet.

6.2 Criteria used

In order to estimate the criteria affecting the choice of communication modes, interviews were conducted with nearly 400 organizations representing three different categories: public administration, retail trade (with the exception of grocery stores) and the metal industry. Public administration and the retail trade are included in the study because they avail themselves of extensive contact networks using both written and elec-

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This chapter is based on Nikali 1997a, except the subchapters 5.6 and 5.7 are based on Nikali 1996b.

tronic communication. The metal industry represents a field with numerous international contacts.

Within the organizations interviewed, communication can be divided into internal and external communication as follows:

- Share of internal communication: 37 percent
- Share of external communication: 63 percent

The communication of the organizations interviewed is divided into domestic and international communication as follows:

- Share of domestic communication: 85 percent
- Share of international communication: 15 percent

The distributions of the organizations studied between the different modes of communication are presented in Table 6.1. The shares of the communication modes in the total communication of the organizations interviewed are presented at the bottom of the table¹².

¹² The shares correspond very well to the communication situation of all the organizations in the country. In 1994, a large sample was used to study the shares of ordinary letters, ePost letters, telefaxes and electronic mail in messages sent by organizations. The shares were: letters 60 %, ePost letters 2 %, telefaxes 24 % and electric mail 14 %. Only the relation between telefaxes and electronic mail deviates from the results now presented. EDI and Internet were not included in the study. Source: Nikali (1995a).

Share of the communication		Mode of communication					
of the organiza-	Ordinary	ePost/	Telefax	Electronic	EDI	Internet	
tion	letter	hybrid		mail			
		letter					
	% share	% share of	% share	% share	% share	% share	
	of enter-	enterprises	of enter-	of enter-	of enter-	of enter-	
	prises		prises	prises	prises	prises	
0 %	0.7	89.6	2.4	67.3	81.1	82.8	
1 - 10%	6.7	6.7	22.2	20.9	13.8	16.8	
11 - 20 %	8.8	0.7	19.5	6.1	3.4	0.0	
21 - 30 %	9.1	0.7	16.2	2.7	0.3	0.3	
31 - 40 %	8.8	0.3	7.7	1.3	0.7	0.0	
41 - 50 %	12.5	0.3	8.1	1.0	0.3	0.0	
51 - 60 %	9.8	1.3	5.7	0.0	0.3	0.0	
61 - 70 %	15.2	0.0	7.4	0.7	0.0	0.0	
71 - 80 %	12.1	0.3	6.7	0.0	0.0	0.0	
81 - 90 %	9.4	0.0	2.7	0.0	0.0	0.0	
91 - 100 %	7.1	0.0	1.3	0.0	0.0	0.0	
TOTAL	100	100	100	100	100	100	
						· · · · · · · · · · · · · · · · · · ·	
Total share	56 %	2 %	35 %	4 %	2 %	1 %	

Table 6.1The Distribution of Organizations by the Use of Different Communi-
cation Modes.

Ordinary letters and telefaxes are used by almost all organizations, whereas the use of the ePost letter, electronic mail, EDI and Internet is still limited to a fairly small percentage. They are common only in large organizations.

The factors affecting the choice of communication modes will be examined separately from the point of view of factors relating to the sender and recipient of the message and the operator transmitting the message. Factors relating to communication technology are included in the selection criteria studied from the point of view of the sender, because the sender has to assess these factors mainly from his own starting point. The selection with regard to all the factors is made by the sender of the message.

Table 6.2 contains the selection criteria in the order of importance from the point of view of the sender. The total significance of each factor is the unweighted arithmetic

average of the weights given to the different factors by those interviewed using the scale "of decisive importance" = 5, ..., "non-existent" = 1. The greater the total value of the selection criteria, the more significant it is to the senders of the messages. The percentage distributions of the levels of importance obtained for each criterion are also included in the table.

							· · · · · · · · · · · · · · · · · · ·
Selection criteria			Significanc	e of the select	ion criteria		
	Total sig-	decisive	important	reasonable	small	non-	TOTAL
	nificance	(=5)	(=4)	(=3)	(=2)	existent	
						(=1)	
		Percentage	Percentage	Percentage	Percentage	Percentage	Percentage
		share	share	share	share	share	share
Reliability of	4.4	51	42	6	0	1	100
communication							
Contents of the	4.2	40	42	15	2	1	100
message							
Speed of the	4.1	31	51	16	2	-	100
communication							
Data security of	3.7	17	47	25	9	2	100
communication							
Personal nature	3.7	16	45	30	7	2	100
of the message							
Possibility for	3.6	11	50	31	7	1	100
further utiliza-							
tion of the mes-							
sage							
Ability to use	3.6	18	46	20	10	6	100
different media							
Legal capacity	3.5	18	33	29	17	3	100
of the message							
Image of mode	3.3	11	35	31	19	4	100
of communica-							
tion							
Cost of forming	3.2	6	39	33	18	4	100
the message ¹³							
Costs of com-	3.1	5	38	33	17	7	100
munication							
Personal	3.0	6	26	41	20	7	100
preferences of							
the mode				i			

Table 6.2Significance of the Different Selection Criteria from the Point-of -
View of the Sender of the Message in the Selection of Communica-
tion Mode.

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Cost of forming the message refers to the trouble caused to the sender in collecting the message as well as external costs incurred there before the sending of the message.

The most important factor is the reliability of communication. The result is the same as in a study on the choice of competing operators in small-goods transport (Nikali 1996a). The reliability of transports, the punctuality and speed preceded the other selection criteria, whereas the price of the service only occupied a middle position among the criteria. In this study, the costs incurred by the sender from the communication were among the least significant selection criteria.

Table 6.3 examines the factors affecting the choice of communication mode the pointof-view of the recipient. As in the assessment of the costs incurred from the formation of the messages above, one of the factors included in Table 6.3 is the costs incurred by the reception of the message, which, analogously to that above, refers not only to monetary costs but also to the trouble it has caused.

Table 6.3	Significance of the Different Selection Criteria from the Point of view
	of the Recipient of the Message in the Selection of Communication
	Mode.

Selection criteria		Significance of the selection criteria					
	Total sig-	decisive	important	reasonable	small	non-	TOTAL
	nificance	(=5)	(=4)	(=3)	(=2)	existent	
						(=1)	
		Percentage	Percentage	Percentage	Percentage	Percentage	Percentage
		share	share	share	share	share	share
Contents of the	4.2	34	54	10	2	-	100
message							
Possibility for	3.9	20	57	20	3	-	
further utiliza-							
tion of the mes-				:			
sage							
Recipient's abil-	3.9	19	51	26	3	1	100
ity to use differ-							
ent media							
Personal nature	3.8	19	51	24	5	1	100
of the message							
Recipient's per-	3.4	7	32	41	17	3	100
sonal preference							
of the mode							
Costs of recep-	3.4	8	43	33	11	5	100
tion							
When considering the selection criteria from the point of view of the recipient, the most important criteria are the contents of the message and the possibility for its further utilization. Also, costs are now the least significant factor.

Selection criteria related to the operator are examined in Table 6.4. Like in the above examination of the selection criteria from the point of view of the sender, the reliability and the skill of the operator are the most important factors affecting the choice of operator. Data protection is also an important factor. As will be seen later on, the differences between the choice of written and electronic communication are significant. The price charged by the operator is in the middle in the order of importance of the selection criteria.

Selection criteria		Significance of the selection criteria					
	Total sig-	decisive	important	reasonable	small	non-exis-	TOTAL
	nificance	(=5)	(=5) $(=4)$ $(=3)$ $(=2)$ tent $(=1)$		tent (=1)		
		Percentage	Percentage	Percentage	Percentage	Percentage	Percentage
		share	share	share	share	share	share
Reliability of	4.4	51	42	6	1	0	100
operator							
Ability of opera-	4.3	39	52	8	0	1	100
tor to transmit the							
message							
Data security in	4.1	40	39	15	5	1	100
the transmission							
of the operator							
Speed of trans-	4.0	25	53	19	2	1	100
mission of the							
operator							
Contents of the	3.8	25	41	22	9	3	100
message							
Cost of message	3.7	14	52	24	8	2	100
transmission							
Possibilities for	3.6	14	48	27	10	1	100
further utilization							
of the message			4.7				
Personal nature of	3.6	17	41	28	11	3	100
the message							
Image of the	3.2	6	33	41	17	3	100
operator							
Personal	3.0	4	22	47	21	6	100
preterences for the							
operator							

Table 6.4Significance of the Different Selection Criteria in Choice of Opera-
tor.

6.3 Factors Affecting the Use of Letter Mail

The most significant factors **increasing** the use of letter mail that were found in the study were the number of letters received by those interviewed as a share of total messages received by them and the increase in domestic traffic in the total communication of the organization. In the study, the first factor will be referred to as the internal correlation of the communication mode. The correlation are strong. It would thus seem that a move from letter mail received to electronic communication is not easy. The mode of communication is a tradition mutually accepted by the sender and the recipient, and it cannot be changed in a moment. Electronic means are available, because almost all organizations already have telefax machines. Also, domestic traffic seems to favor letter mail. The most important factors increasing the use of letter mail and their respective correlation with the share of letter mail in the total communication of the organization were:

Factor	Correlation
Volume of letters received by sender	0.59
Share of domestic traffic in the total communication of the organization	0.41
Emphasis on the contents of the message in the choice of operator	0.24
Emphasis on the personal nature of the message in the choice of opera-	0.22
tor	

The last two factors above tell us that when the sender of the message feels that his message is very personal (which also emphasizes the significance of the contents), he prefers written form to electronic form. It may also involve a question of distrust in the data security of electronic communication.

As the inverse phenomenon, the factors **decreasing** the use of letter mail represent an increase both in the share of international communication in the total communication of the organization and in the number of telefax and electronic mail messages received by those interviewed from the organizations. The most important factors decreasing the use of letter mail and their correlation with the volume of letter mail are:

Factor	Correlation
Share of international traffic in the total communication of the organi-	-0.40
zation	
Number of electronic mail messages received by sender	-0.37
Number of telefax messages received by sender	-0.37
Satisfaction with electronic mail in the internal communication of the	-0.27
organization	
Satisfaction with electronic mail in the external communication of the	-0.26
organization	
Belief in increased communication cost savings through a good com-	-0.25
munication strategy	
Satisfaction with Internet in the external communication of the organi-	-0.24
zation	
Satisfaction with Internet in the internal communication of the organi-	-0.24
zation	
Decreased use of the telephone as the frequency of other communica-	-0.23
tion media increases	

The table also contains several factors describing the substitution of letter mail by electronic communication media: the greater the satisfaction with electronic mail and Internet is in the internal and external communication of the organization, the smaller is the use of letter mail. The results also reveal an interesting dependence between letter mail and costs in savings through a communication strategy. A belief in increased cost savings through a good strategy results in a decrease in the share of letter mail in the total communication of the organization. Note that the correlation shown is between the factor in question and the share of letter mail. Thus the results shown do not necessarily imply a decrease in total communication: rather, they imply a significant move to electronic communication.

If we examine the criteria affecting the selection of the mode of communication in Tables 6.2 - 6.4, those criteria most significant to letter mail are presented in Table 6.5. As in the previous examples, the criteria have been divided with regard to the sender, recipient and selection of operator. The averages for the importance attributed to the different factors have been calculated separately for organizations where the share of letter mail in total communication is low, below 20 percent, and high, over 50 percent. Both groups include about one-third of the organizations interviewed. The table also contains the correlation between each factor and the volume of letter mail.

Table 6.5	Significance of the Different Selection Criteria in the Use of Letter
	Mail in the Organization.

Selection criterion	Share of letter mai	l communication in	Correlation with the	
	Share of fetter-filar	Correlation with the		
	total communication	share of letter mail		
	Below 20 %	Over 50 %		
	Total significance	Total significance		
Selection criteria fron	n the point of view o	f the sender	<u> 14 Vanaan (</u>	
Legal capacity of the	3.2	3.8	0.21	
message				
Cost of communica-	2.8	3.3	0.18	
tion				
Data security of	3.5	3.8	0.14	
communication				
Cots of forming the	3.0	3.3	0.12	
message				
Selection criteria fron	n the point of view o	f the recipient		
No significant effects				
Selection criteria in th	ne selection of the op	erator		
Contents of the mes-	3.4	4.0	0.24	
sage				
Personal nature of the	3.1	3.8	0.22	
message				
Personal preferences	2.7	3.0	0.11	
for the operator				

When examining the selection criteria from the point of view of the recipient, no significant dependence upon letter mail was found. What is also surprising in the above results is that all the significant factors affecting the share of letter mail increase this share. Thus, the correlation are positive. There are also inverse dependencies, but the correlation are so small that they lack statistical significance and, therefore, they are not presented here.

An emphasis on the legal capacity of the message, data security and the personal nature of the message and the contents of the message increases the position of letter mail. In this respect, there is not yet sufficient trust in electronic communication. Interpretation of the cost factors in Table 6.5 is problematic. It was stated before that, of the people interviewed, a desire for savings in communication' costs through a good communication strategy decreases the share of letter mail in the total communication of the organization. However, in Table 6.5 the correlation between the significance of costs and the share of written communication is positive. We interpret this as meaning that the sender uses a lot of written communication, which are comparatively inexpensive. Because the significance of costs is high, or because the cost of written communication is high and the sender uses a lot of these services, the significance of costs in the choice of the communication mode is also high. The former interpretation is contradictory to the cost effects of communication strategy presented earlier.

When explaining the share of letter mail in the total communication of the sender by a regression analysis, an explanatory degree of about 40 percent is attained. The equation is:

$$q = -1.9 + 0.6* LR + 0.3* D + 0.2* S + 0.2* O, \qquad (N=361, R^2=0,38)$$
(6.1)
(-5.1) (10.6) (3.8) (2.6) (2.7)

where t values are in parentheses and

- q = Share of letter services in the total communication sent by sender;
- LR = Share of letter services in the total communication received by sender;
- D = Share of domestic communication in total communication of the organization;
- S = Significance of legal capacity of message in the choice of communication mode; and
- O = Significance of the contents of the message in choice of operator.

N is the numbers of observations and in brackets are the t-values of coefficients. The model only includes the factors for which a statistically significant coefficient was obtained. Some of the factors in Table 6.5 increasing the share of letter services were not included due to their internal correlation.

6.4 Factors Affecting the Use of Telefax Machines

As with letters, the number of telefax messages received by those interviewed had a strong effect on the share of messages which they also send by telefax. This so-called internal correlation is strong in all the communication modes considered in this study; outgoing and incoming communication takes place largely in the same communication media. It is apparently not easy to move from written messages to electronic ones. The same applies to transfers between electronic communication media. All the significant factors **increasing** the use of telefax communication and their correlation with the share of telefaxes in the total communication of organizations are:

Factor	Correlation
Number of telefax messages received by sender	0.61
Share of international traffic in the total communication of the organi- zation	0.33
Belief in an increase in the importance of telefax traffic in communi- cation between the organization and its corporate customers in the next few years	0.29
Unfamiliarity with the possibilities to utilize electronic mail	0.24

International traffic increases the use of telefaxes, which is contrary to the use of letters, whose share is increased by domestic traffic. The telefax is still largely considered to be a communication medium between organizations and their corporate customers. This is quite natural, because nearly all organizations already had a telefax machine in 1996, whereas they were present in only about 7 percent of households (Gallup and IDC Finland 1996). Electronic mail has clearly challenged telefaxes, but general unfamiliarity with the possibilities of using it favors the use of telefaxes.

The attitude towards electronic mail emerges as the most important factor **decreasing** telefax communication. It appears in three forms: satisfaction with electronic mail in the internal communication of the organization, satisfaction with electronic mail in the external communication of the organization and in the number of electronic mail messages received by those interviewed. The number of letters received by the sender is also included in the picture, but its significance is below that of electronic mail. The

significant	factors	which	were	found	to	decrease	the	use	of the	e telefax	and	their	corre-
lation are:													

Factor	Correlation
Satisfaction with electronic mail in external communication of the or-	-0.34
ganization	
Share of domestic communication in the total communication of the	-0.33
organization	
Number of letters received by sender	-0.33
Satisfaction with electronic mail in internal communication of the or-	-0.29
ganization	
Number of electronic mail messages received by sender	-0.29
Size of the organization	-0.26
Satisfaction with Internet in external communication of the organiza-	-0.25
tion	
Satisfaction with Internet in internal communication of the organization	-0.24
Belief in an increase in the significance of the ePost letter in communi-	-0.23
cation between the organization and households in the next few years	
Emphasis on being able to reach several people at the same time	-0.21

An increase in the share of domestic traffic increases letter services, but decreases the share of telefax communication. Internet, which is strongly tied to electronic mail, also competes with telefaxes and especially because of its international nature. If the sender of the message has to reach several people at the same time, the telefax machine is not the best device for that. As will be seen later on, in this capacity it is not able to compete with electronic mail. It is surprising that on the basis of the present material an increase in the size of the organization decreases the share of telefax communication in its total communication. This is also explained by the competition between electronic mail and Internet for communication shares. As the size of the organization grows, the shares of electronic mail and Internet in its communication increase, particularly at the expense of telefax communication. We must, however, remember that the material of this study is collected mainly from middle-sized and large Finnish organizations. Small organizations (under ten people) are clearly under-represented.

The most significant selection factors affecting telefax communication have been collected in Table 6.6. As above, the criteria have again been divided from the point of view of the sender, recipient and choice of operator. The operator refer the longdistance service provider. As in the case of letters, the averages of the significance values attributed to the different factors have been calculated separately for organizations in which the share of telefax communication in total communication is low, below 20 percent, and high, over 50 percent. The group making small use of the telefax includes about 40 percent of the organizations interviewed. The group using the telefax frequently consist of approximately 25 percent of those interviewed. The table also includes the correlation of each factor with the respective number of telefax communication.

Selection criterion	Share of telefax m	Correlation with the	
	communication of the organization		share of telefax
		communication	
	Below 20 %	Over 50 %	
	Total significance	Total significance	
Selection criteria from	n the point of view o	f the sender	
Data security of the	3.8	3.6	-0.12
communication mode			
Selection criteria from	1 the point of view of	f the recipient	
Ability of recipient to	3.9	3.6	-0.15
use different media			
Selection criteria in se	election of operator		
Price of message	3.8	3.5	-0.14
transfer			
Ability of operator to	4.4	4.2	-0.12
transmit the message			
Speed of operator's	4.1	3.8	-0.11
transmission		i	
Reliability of opera-	4.5	4.3	-0.11
tor's transmission			
Data protection in the	4.2	4.0	-0.10
operator's transmis-			
sion			

Table 6.6Significance of the Different Selection Criteria in the Use of the Tele-
fax in the Organization.

When examining the selection criteria from the point of view of the sender, data security was the only factor for which a statistically significant effect on the share of telefax communication in the total communication of an organization was obtained. An emphasis on data security in the selection situation tends to discriminate against telefax machines as a means of communication. In that case, the selection favors written communication (cf. Table 6.5), the data security of which is trusted much better than that of electronic communication media. From respect to the recipient, his or her ability to use different communication devices increases the user's willingness to employ those devices, which, in turn, decreases the use of telefax machines.

Contrary to the situation with letters, most of the significant selection criteria with regard to telefax communication concern the operator. As shown in Table 6.6, the most significant factor was the operator's price. However, this is not the most important factor, because the average calculated for its significance is clearly below the reliability of communication transfer and the skill of the operator to transmit messages. In the case of letters, all the significant correlation were positive. Thus, an emphasis of the significance of the criteria in question increases the share of written communication. In the case of telefaxes, the opposite is true: all the correlation are negative. This situation is special: the portion of those interviewed who use a lot of telefax messages put less emphasis on the reliability of the operator's skills in transmitting messages, speed and price. The behavior of senders who emphasize the transmission skills and speed of the operator increases the use of electronic mail, while those senders who emphasize reliability and data security tend to use written communication. The interpretation of the emphasis on price in the selection of the operator is problematic, as it was in the case of letters. However, it would seem likely that, in the opinion of those using telefax machines, the prices of telecommunication operators have decreased so much during the last ten years that, in the comparison of different operators, price is not a decisive factor.

When explaining the share of telefax messages in the total communication of the senders, the explanatory degree of the regression model was 40 percent. The equation is:

$$q = 1.4 + 0.7 * TR + 0.2 * I - 0.2 * O,$$
(N=328, R²=0,40) (6.2)

(4.8) (12.6) (2.5) (-2.1)

where t values are in parentheses and

- q = Share of telefax communication in the total communication sent by sender;
- TR = Share of telefax communication in the total communication received by sender;
- I = Share of international communication in the total communication of the organization; and
- O = Significance of price in the selection of operator.

Of the selection criteria used (Tables 6.2 - 6.4), a statistically significant coefficient in the explanation of the share of telefax communication was obtained only for the significance of price in the selection of the operator. The other relevant factors in model (6.2) are the number of telefax messages received by the sender and the share of international communication in the total communication of the organization.

6.5 Factors Affecting the Use of Electronic Mail

When examining the share of electronic mail in the total communication of organizations it seems that electronic mail is competing more with telefaxes than with written communication, as already noted in the previous chapter. Of the communication modes studied, the share of electronic mail in the number of messages sent had the highest correlation with the number of electronic mail messages going to the sender. Only Internet achieves a comparable internal correlation. This is natural considering the ease of responding to these messages. Also, satisfaction with electronic mail has a greater effect in increasing its popularity than in the case of the other communication modes studied. The most important factors in the study which were found to **increase** the use of electronic mail and their correlation with the share of electronic mail communication were:

Factor	Correlation
The number of electronic mail messages received by sender	0.80
Satisfaction with electronic mail in the external communication of the	0.65
organization	
Satisfaction with electronic mail in the internal communication of the	0.55
organization	
Belief in an increased significance of electronic mail in communication	0.36
between the organization and its corporate customers in the next few	
years	
Satisfaction with Internet in the external communication of the organi-	0.36
zation	
Decreased use of the telephone in connection with an increased fre-	0.35
quency of other electronic communication	
Emphasis on being able to reach several people at the same time	0.33
Size of the organization	0.31
Share of internal communication in the total communication of the or-	0.29
ganization	
Satisfaction with Internet in the internal communication of the organi-	0.29
zation	

As I have already discussed, both the need to reach several people at the same time and the size of the organization increase the popularity of electronic mail. Thus far, electronic mail is primarily a communication mode within organizations. For example, only 9 percent of households have computers equipped with modems (Gallup and IDC Finland 1996). The table also contains an interesting factor which connects the popularity of electronic mail with a decrease in the use of the telephone. The same dependency did not occur in the other electronic communication media studied.

The two most important factors **decreasing** the popularity of electronic mail relate to the communication medium itself, a lack of knowledge of the possibilities of utilizing electronic mail and uncertainty as to whether the message actually reaches the recipient. Another notable element is the competition factors caused by the other modes of communication. The most significant correlation are:

Factor	Correlation
Unfamiliarity with the possibilities to utilize electronic mail	-0.43
Uncertainty as to whether an electronic mail message reaches the right	-0.31
recipient	
Belief in an increased significance of telefax communication between	-0.30
the organization and its corporate customers in the next few years	
The number of letters received by sender	-0.30
Share of international communication in the total communication of the	-0.29
organization	

An increase in international communication naturally decreases the share of electronic mail, because it is handled by Internet. If we compare the effect of letters received by the sender on the shares of telefax communication and electronic mail in the total communication of the organization, the difference in the correlation is only minor. For telefaxes, the correlation is -0.33, for electronic mail, -0.30. No corresponding statistically significant correlation was obtained for the other modes of electronic communication.

When examining the selection criteria, the results for electronic communication are opposite to those for letters. While emphasis on legal capacity, contents and the personal nature of the message increase the share of letter-mail communication, it decreases the share of electronic communication in an organization's total communication. The most significant factors are presented in Table 6.7. Because about one-third of those interviewed were using electronic mail, the significance of the different selection criteria were divided in the study into those using electronic mail and those not using it.

In spite of its modern nature, electronic mail is not considered a status factor, because both an emphasis on the image of the communication mode and a favorable attitude towards a certain operator decrease the share of electronic mail communication in total communication. When studied from the point of view of the recipient, no statistically significant dependencies were found for the selection criteria. In Table 6.7, all the correlation (with the exception of the ability of the operator to transmit the message) are negative. The emphasis on the ability of the operator to transmit the message decreased the use of the telefaxes, while in the case of electronic mail, the reverse holds true.

Table 6.7	Significance of the Different Selection Criteria in the Use of Elec-
	tronic Mail Communication.

Selection criterion	Use of electronic m in total communica zat	Correlation with the share of electronic mail communication					
	Not in use	In use					
	Total significance	Total significance					
Selection criteria from	n the point of view o	f sender					
Legal capacity of the message	3.6	3.2	-0.20				
Image of the commu- nication mode	3.4 3.1		-0.13				
Selection criteria from	Selection criteria from the point of view of recipient						
No significant effects							
Selection criteria in th	e selection of operation	tor					
Contents of the mes- sage	3.9	3.4	-0.27				
Personal nature of the message	3.7	3.2	-0.26				
Operator's ability to transmit the message	4.2	4.4	0.16				
Personal preferences for the operator	3.1	2.8	-0.12				

When explaining the share of electronic mail communication in the total communication of the senders by means of a regression model, the explanatory degree is quite high, 67 percent. The equation is:

$$q = 0.2 + 1.0 * ER + 0.1 * I - 0.1 * O1 - 0.1 * O2 + 0.2 * O3, \text{ (N=362, R2=0,67) (6.3)}$$

(0.6) (22.6) (4.5) (-2.7) (-2.2) (2.7)

where t values are in parentheses and

q = Share of electronic mail communication in the total communication sent by sender;

- ER = Share of electronic mail communication in the total communication received by sender;
- I = Share of internal communication in the total communication of the organization;
- O1 = Significance of the contents of the message in the selection of operator;
- O2 = Significance of the further utilization of the message in the selection of operator; and
- O3 = Significance of the ability of the operator to transmit the message in the selection of operator.

The coefficient for the electronic mail messages received by the sender 1.0 describes the situation in which it is easiest to reply to an electronic mail message by using the same medium. Of the selection criteria in Tables 6.2 - 6.4, statistically significant coefficients were obtained only in reference to the selection of the operator.

6.6 Factors Affecting the Use of EDI

With regard to the examination of factors affecting its use, EDI differs from the other communication modes studied. But then its nature is also different: the use of the communication mode is not only left to the selection of the sender. In practice, EDI solutions are of a standard that makes it unnecessary even to consider other alternatives. Unlike in the case of the other communication modes, a factor increasing the use of EDI communication is not the number of messages of the same type received, but satisfaction with EDI communication. Internal correlation is only the second most important factor. The use of EDI is also in many ways affected by the importance of a communication strategy of the organization. It seems that only organization that make extensive use of EDI have a communication strategy. The most important factors increasing the use of EDI and their correlation with the share of the total communication of the organization are presented in the following table.

Factor	Correlation
Satisfaction with EDI communication	0.49
Number of EDI messages received by sender	0.32
Pressures to create a communication strategy for the organization	0.18
caused by shortness of money	
Belief in the increased importance of EDI in communication between	0.16
the organization and its corporate customers in the next few years	
Pressures to create a communication strategy for the organization	0.14
caused by customer	
Pressures to create a communication strategy for the organization	0.14
caused by tightening competition in the own field	
Emphasis on recipient's ability to use different media	0.12

The last line of the table shows that EDI requires that also the recipient has versatile skills in the use of communication media.

When examining factors decreasing the use of EDI communication we can see that EDI competes on the same level with telefaxes, letters, electronic mail and even the telephone. EDI clearly requires that the organization has at least some level of strategy and its central implementation. The most important factors **decreasing** the use of EDI and their correlation are:

Factor	Correlation			
Belief in the increased importance of telephone in communication be-	-0.17			
tween the organization and its corporate customers in the next few years				
Satisfaction with telefax communication in the external communication	-0.17			
of the organization				
Belief in the increased importance of telephone in communication be-	-0.15			
tween the organization and households in the next few years				
Belief in the increased importance of letter mail in communication be-	-0.15			
tween the organization and its corporate customers in the next few years				
Deficiencies in the EDI strategy of the organization	-0.14			
Lack of planning in the EDI strategy of the organization	-0.13			
Belief in the increased importance of telefax in communication between	-0.13			
the organization and its corporate customers in the next few years				
Belief in the increased importance of electronic mail in communication	-0.13			
between the organization and households in the next few years				
Belief in the increased importance of telefax in communication between				
the organization and households in the next few years				

Only few statistically significant selection criteria affecting the EDI mode of communication were found in the material studied. EDI messages were not ranked high with regard to legal capacity or personal nature. Instead, as already noted, the selection of EDI required that the recipient also had the skill to use different media. Like in the case of electronic mail, the selection criteria of EDI communication possibilities are examined on the basis of whether the sender had access to an EDI communication mode or not. 10 percent of those interviewed had access to it, 90 percent did not. The most significant factors and their correlation are in Table 6.8.

Table 6.8.Significance of the Different Selection Criteria in the Use of EDI
Communication.

Selection criterion	Use of EDI comm communication o	Correlation with the share of EDI com- munication				
	Not in use	In use				
	Total significance					
Selection criteria from	f sender					
Legal capacity of the	3.5 3.1		-0.08			
message						
Selection criteria from	n the point of view o	f recipient				
Recipient's ability to use different media	3.9	3.9	0.12			
Personal nature of the	3.9	3.5	-0.11			
message						
Selection criteria in the selection of operator						
No significant effects						

A regression model is not presented on the share of EDI communication in the total communication of the senders, because of the low level of the explanatory degree. Although there is a strong correlation between the EDI messages sent and received by the same person, the number of messages received can, however, not reliably explain the numbers of EDI messages sent. This may be due to the fact that evidently EDI communication are very unilateral. One organization maintains a data base, which is used by others. This does not require equal two-way traffic in the traffic volumes.

6.7 Factors Affecting the Use of Internet

The use of Internet is increased by almost the same factors as electronic mail. Also the correlation are of the same magnitude, i.e., the internal correlation is specially high. Internet is, in fact, used very much as an international channel of electronic mail, so that an increase in the share of domestic traffic decreases the share of Internet in the total communication of organizations. In addition to this, almost the only difference with regard to electronic mail is that the most important factors increasing the use of Internet also include the assertion that a good communication strategy results in savings in communication costs. These most important factors increasing the use of Internet are:

Factor	Correlation
Number of Internet messages received by the recipient	0.79
Satisfaction with Internet communication in the external communica-	0.51
tion of the organization	
Belief in increased communication cost savings through a good com-	0.45
munication strategy	
Satisfaction with electronic mail communication in the internal com-	0.33
munication of the organization	
Belief in the increased importance of Internet in communication be-	0.30
tween the organization and its corporate customers in the next few	
years	
Share of internal traffic in the total communication of the organization	0.26
Satisfaction with electronic mail communication in the external com-	0.24
munication of the organization	
Size of organization	0.22

The strong connection between Internet and electronic communication also tells us that the above table contains a factor under which the share of internal communication in the organization would increase the use of Internet. This seemingly contradictory result is due to the fact that the access to the use of Internet is often created through electronic mail and that electronic mail is strongly connected with the internal communication of the organization.

Also the factors **decreasing** the share of Internet in the total communication of organizations are almost the same as in the case of electronic mail, only Internet-specific. This means that the possibilities of using Internet and electronic mail are not known well enough and that the users are uncertain of whether an electronic mail message actually reaches the recipient. The only differences with regard to electronic mail were the decreasing effect of domestic traffic on the use of Internet and the lack of competing communication modes in the table. The factors significant for the use of Internet were:

Factor	Correlation
Unfamiliarity with the possibilities to utilize Internet	-0.29
Unfamiliarity with the possibilities to utilize electronic mail	-0.28
Share of domestic traffic in the total communication of the organization	-0.24
Uncertainty as to whether an electronic mail message reaches the right	-0.21
recipient	

Also the selection criteria for Internet were almost the same as for electronic mail. In Internet communication, the legal capacity of the message, its contents or personal nature are not emphasized, just like in the case of electronic mail messages. However, the use of Internet is quite expensive, because its users emphasize the costs of communication clearly less than others. No significant selection criteria were found relating to recipients. The most significant selection criteria for the share of Internet communication in the total communication of the senders appear in Table 6.9. They will be examined on the basis of whether the sender of the message has access to Internet or not. The share of users with access to Internet among those interviewed was about 20 percent.

Table 6.9	Significance of the Different Selection Criteria in the Use of Internet
	Communication.

Selection criterion	Use of Internet com communication o	Correlation with the share of Internet communication					
	Not in use	In use					
	Total significance	Total significance					
Selection criteria fron	1 the point of view o	f sender					
Costs of communica-	3.2 2.9		-0.15				
tion							
Legal capacity of the	3.6 3.1		-0.13				
message							
Selection criteria from the point of view of recipient							
No significant effects							
Selection criteria in the selection of operator							
Contents of the mes-	3.9	3.3	-0.15				
sage							
Personal nature of the	3.6 3.2		-0.11				
message							

When explaining the share of Internet communication in the total communication of the senders by means of a regression model, the explanatory degree is quite high, 50 percent. The equation was:

$$q = 0.2 + 1.2 * IR - 0.04 * S$$
, (N=370, R²=0,50) (6.4)
(2.7) (19.1) (-1.8)

where t values are in parentheses and

- q = Share of Internet messages in total communication sent by the sender;
- IR = Share in Internet messages in total communication received by the sender; and
- S = Importance of communication costs in the selection of the mode of communication.

In the model, the coefficient of the so-called main factor, the number of Internet messages received by the sender, 1.6, is even higher than in the corresponding model for electronic mail. On the other hand, the coefficient of costs affecting the selection of the mode of communication is fairly low, even though it is statistically fairly significant. Of the selection criteria in Tables 6.2 - 6.4, this is the only one remaining in the equation.

6.8 Conclusions

The modeling of the selection criteria of the various communication modes supports the replacement phenomenon descussed above. We can conclude from the cross effects of the selection criteria that also the competition between the electronic modes of communication is fierce. In particular, electronic mail has challenged telefaxes. This is the basis for the assertion that the telefax machine is beginning to reach the peak of its life cycle. Electronic mail, which mainly serves the internal communication of organizations, will be accompanied by Internet which specializes in traffic between organizations and international traffic. The selection criteria for the use of these two modes of communication are very similar.

The strong points of letter mail are its data security, personal nature and legal capacity. In the case of electronic messages, there is distrust in whether they reach the recipient and fear that people for whom the message is not intended will have access to it. Lack of legal capacity, such as a lack of an electronic signature, hinders an increase in the use of electronic communication devices.

An examination of the selection criteria reveals that electronic mail and the telefax compete equally strongly with letter mail. In the competition between the telefax and electronic mail, the use of the telefax seems to react much more strongly to the use of electronic mail and the attitude of the users toward electronic mail than does electronic mail to the telefax. Being able to reach several people at the same time also seems to favor electronic mail. The use of electronic mail is, on the other hand, most strongly restricted by unfamiliarity with the possibilities it offers. In the case of Internet, the situation is likely to be similar to that of electronic mail, though it is still too early to make any definitive conclusions with respect to Internet.

7 Implications of the Study

7.1 The Importance of the Substitution Effect and the Realization of the Substitution Model

The first substitution model was estimated in 1994 and is presented in this study in Chapter 3. In that model gross sectional material from the years 1992 and 1993 was used. According to the model telefax machines, eMail and data communication had replaced about one third of 1st and 2nd class letters by the year 1993. In that study I also made a forecast up to the year 2010. This estimate is presented in Figure 7.1. In the same figure the actual demand for 1st and 2nd class letters up to 1997 has also been drawn. In the forecast for the years 1994-1997 the realized GDP has been used, for 1998-1999 the GDP forecast is +3 percent a year and for 2000-2010 +2 percent a year on average.



Figure 7.1 Actual Trends in the Volume of 1st and 2nd class Letters in 1961-1997 and Anticipated Trend for 1994-2010 according to the Substitution Model in 1993.

Although actual development has differed considerably from the forecast itself, it has not made the estimated replacement model unreliable. Just that the forecast based on that model has not yet been realized so rapidly. They are many reasons why the replacement has not been in accordance with the forecast during the years 1994-1997:

• In the years 1990-1993 Finland underwent the deepest economic depression in the course of a period of a hundred years. In three years the volume of GDP dropped 12 percent and domestic demand 18 percent. If we compare the increase of demand for letter services from the year 1960 after the economic depressions, we find interesting changes. During the last 35 years there have been three veritable economic depression periods in Finland, the years 1966-1968, 1976-1978 and 1991-1993. In the middle of the 1980's there was also a short economic depression, its duration being only one year, 1986. The four years increases in GDP volume after those depression periods were on average (1969-1972) 6.7 percent/year, (1979-1982) 4.3 percent/year, (1987-1990) 3.6 percent/year and (1994-1997) 4.3 percent/year. The average yearly increases of letter volume for those corresponding periods were 4.5 percent/year, 6.3 percent/year, 3.7 percent/year and 1.3 percent/year. If we compare the average letter volume increases with the GDP changes for those after-economic-depression periods we get the following proportions: (1969-1971) 0.7, (1979-1981) 1.5, (1987-1989) 1.0 and (1994-1996) 0.3.

Two of those proportions are one or more, and two less than one. In the 1960's the substitution of letter services by telephone was the highest, as penetration of the telephone was the most rapid (Nikali 1993a). At the end of the 1970's this replacement effect had already become realized and any replaceable electronic communication means other than the telephone did not exist. At the end of the 1980's replaceable electronic communication means (telefax, eMail and data communication) were still fairly rare and the substitution factor did not have the same effect as it does today (see Figures 4.6, 4.8).

The price changes for letter services have been very stable during the whole period under consideration and thus this does not explain the development. Instead of that the prices of telephone services have decreased very quickly since the year 1976 and thus it has supported the change. In 1997 the demand for letters was at a zero-increase level, despite the fact that GDP growth was 5 percent and the real prices of letters decreased about 3 percent. Owing to this letter volume should have increased to about 6 percent last year instead of remaining at zero. And we must remember that during economic depression periods other than at the begin of 1990's the volume of GDP did not decrease, rather growth became slower. The reaction after a deep depression should be stronger than after a small depression.

- The forecast for the years 1994-2010 is a so-called passive forecast and the object is that it should not be realized, it has been carried out as a warning to the postal services. The postal operator must be very careful about competition between written and electronic communication: the price politics for letter services have to be moderate, the service quality high and the needs of different customer groups well-known. Finland Post has taken these points of view into consideration in its activities.
- Finally, it is too early to draw any conclusions about the reliability of the substitution model. In addition to that according to the demand models 4.2 and 4.3 the replacement loss for 1st and 2nd class letters during the period 1994-1997 by telefax communication has totaled about 6 percent. Those demand models could only take into the consideration the replacement effect of telefax machines. Today the effect of eMail is not less than that of telefax machines. By looking at Figure 7.1 and comparing the actual growth of letter volume before and after the deep depression of the 1990's a big difference can not be overlooked.

The replacement rate for the substitution model presented in Chapter 3 was without a trend factor from 1995 to 2005 on average 3.7 percent a year, and with a GDP change of 1.7 percent a year 2.1 percent a year (Table 3.1). A corresponding estimate of the replacement rate of the European Union (EU) is on average from 1.7 percent to 3.4 percent a year in Europe (Coopers&Lybrand 1996). In that study the total substitution rate up to 2005 varies from 5-15 percent in the household-to-household sector to 20-35 percent in the business-to-business sector. The estimates presented in Chapter 3 are very congruent with the study of the EU.

About 40 percent of workers in all organizations in Finland had an eMail connection at their disposal in 1997. In Figure 7.2 the content distributions for 1st and 2nd class letters received by eMail- and without-eMail-organizations in 1997 are presented (Nikali 1997b). The share of money-affair letters is much higher in organizations which do not have eMail at their disposal than in eMail-organizations. The relative difference is still bigger in terms of messages. Because the sum of the shares in both groups are one hundred percent, the share of documents will, on the other hand, be stressed in eMail-organizations. By *money-affairs* I mean bills, receipts and other letters concerning money transactions, by *messages* I mean personal letters, cards and invitations and by *documents* official documents, orders and offers. Compared to the substitution models presented in Chapter 3 the bills will be replaced mainly by data communication, the documents by telefax and the messages by

eMail. The Figure shows very clearly the influence of eMail. Because the same organizations which have at their disposal eMail also have EDI-connections, the Figure describes the substitution of bills by data communication, too.



Figure 7.2 Distribution of Letter Contents Received by Organizations According to whether they had eMail or not in 1997.

8 percent of households in Finland had an eMail-connection in 1997. Figure 7.3 shows the content frequencies of 1st and 2nd class letters received by eMail- and withouteMail-households (Nikali 1997b). The sample for that study was so big, 26,000 letters, that the figures for distribution of letters received by eMail-households can be considered reliable, too. The number of observations in that category was about 1,300.



Figure 7.3 Distribution of Letter Contents Received by Households According to whether they had eMail or not in 1997.

Here the big difference is for messages, the share of that category being much less for eMail-households. And it is just messages that should be being replaced by eMail according to the substitution models presented in Chapter 3. Because in this case also the sum of the shares in both groups is one hundred percent, the share of documents and advertisements will on the one hand be stressed in the eMail-households. On the other hand the existence of an eMail-connection does not have any influence on the number of money-affair letters received by households.

7.2 The Usability of the Different Communication Means

Why the telephone is so superior in the communication market, is a very interesting question. In Table 7.1 the superiority of the studied communication means has been compared and two subindexes (technical index and service index) and a total index for usability of different communication means have been calculated. Indexes, one for messages sent between organizations, one for messages sent between organizations and households and one for messages sent between households, have been calculated.

The technical index measures communication means' technical ability to its user. In a technical sense the different communication means are the same for all user groups and so are the technical indexes, too. The technical index includes four different factors.

The service index measures communication means' standard of service to the sender and receiver of messages. It has fife different factors.

The formula used for the indexes is as follows:

$$X_k = \frac{\sum_i \delta_i x_i}{\sum_i \delta_i},\tag{7.1}$$

k = Technical index or service index

The properties in the technical index are:

x₁= Message Types of communication means measure what kind of message forms can be transferred, as presented in Figure 1.7, using a scale of 1 to 4.

- x_2 = *Interaction* refers to one- or two-way traffic. The corresponding values are 1 and 2.
- x_3 = Speed of Transmission measures how soon the message is at the addressee. If transmission happens simultaneously, the transmission time in the formula is 1 (that is the case for all electronic communication modes) and for letters the average transmission time is 3 (=1+2). There is a one day delivery time for 1st class letters and 3 days for 2nd class letters. Because the numbers of those letters are about equal the mean delivery time is 2 days, which is the difference with electronic communication.
- x₄= Further Utilization of message describes how easy and diversely the receiver can reuse the message. The values of this factor are based on results of organization interviews presented in Chapter 6 and the values are between 1 and 5.

The properties in the service index are:

- x₅= *Price of Transmission* is calculated as average transmission cost of message.
- x_{6} = *Penetration* measures the reaching of recipients in organizations and households by different communication means (as ten percents shares). This factor takes into consideration that both sender and receiver must have these communication means. The values of this factor are between 0 and 10. For example, if 40 percent of organizations have the communication means under consideration, the factor in inter-organization communication will have a value of $(40/100)^2=0.16$, and if 8 percent of households have the same means connection, the factor for organization-household communication will be $(40/100)^*(8/100)=0.032$.
- x7= Choosing the Time for Recipient depends on whether the recipient can or can not him/herself choose the time, when (s)he is ready to receive the information. The value is 1 if the recipient can not him/herself choose the time. That is the case only with the telephone, in other cases the value of the factor is 2.
- xg= Cost of Forming the Message is not in itself monetary expenditure, but this factor measures the effort taken in forming the message ready for transmission. The values for this factor have been compared to the unit effort of writing a letter. The effort of preparing a telefax or Internet message are estimated to be the same as for letters. ePost and also eMail as well as EDI messages often come from computer files, so the effort of getting these messages ready for transmission is smaller than for writing letters. I have estimated these efforts as a half of that for letters. For telephone messages the effort is estimated as one fifth of that for letters.
- x9= *Data Security* of communication measures how safe the sender and receiver consider the communication means. The values are also based on results of organization interviews presented in Chapter 6 and they are between 1 and 5.

Inter-Organization Communication								
Factor	Weight			Means	of Commun	ication		
		Letter	ePost	Telephone	Telefax	eMail	EDI	Internet
		_						
Type of message	3,8	1,0	0,5	0,8	0,5	1,0	0,8	1,0
Interaction	4,4	0,5	0,5	1,0	0,5	0,5	0,5	0,5
Speed of transmission	4,0	0,3	0,3	1,0	1,0	1,0	1,0	1,0
Further utilisation	3,6	0,4	0,3	0,2	0,4	1,0	0,8	0,9
Technical Index	15,8	0,56	0,41	0,76	0,60	0,86	0,76	0,84
Price of transmission	3,1	0,3	0,3	0,9	1,0	0,6	0,7	0,7
Penetration	5,0	1,0	1,0	1,0	0,9	0,2	0,1	0,1
Choosing time for receiving	3,4	1,0	1,0	0,5	1,0	1,0	1,0	1,0
Cost of forming the message	3,2	0,2	0,4	1,0	0,2	0,4	0,4	0,2
Data security	3,7	1,0	0,9	0,7	0,8	0,9	0,9	0,4
Service Index	18,4	0,74	0,75	0,82	0,79	0,57	0,57	0,45
TOTAL INDEX		0,66	0,59	0,79	0,70	0,71	0,65	0,63
Organization-Househo	old Com	munica	tion					
organization nousen		maniou						
Technical Index	45.0	0.50	0.44	0.70	0.00	0.00		0.04
l'echnical index	15,8	0,56	0,41	0,76	0,60	0,80	-	0,84
Dries of transmission	24	0.2	0.2		1.0	0.0		0.7
Price of transmission	5,1	0,3	0,3	0,9	1,0	0,6	-	0,7
	5,0	1,0	1,0	1,0	0,1	0,05	-	0,03
	3,4	1,0	1,0	0,5	1,0	1,0	-	1,0
Cost of forming the message	3,2	0,2	0,4	1,0	0,2	0,4	-	0,2
	3,7	1,0	0,9	0,7	0,8	0,9	-	0,4
Comrise Index	10.4	0.74	0.75	0.94	0.67	0.54		0.44
Service index	18,4	0,74	0,75	0,81	0,57	0,54	-	0,44
TOTAL INDEX		0.00	0.50	0.70	0.50	0.00		0.00
		0,00	0,59	0,79	0,59	0,69	-	0,62
	L							
Inter-Household Com	nunicat	ion						
Technical Index	15,8	0,56	0,41	0,76	0,60	0,86	-	0,84
Price of transmission	3,1	0,3	0,3	0,9	1,0	0,6	-	0,7
Penetration	5,0	1,0	1,0	0,9	0,01	0,01	-	0,01
Choosing time for receiving	3,4	1,0	1,0	0,5	1,0	1,0	-	1,0
Cost of forming the message	3,2	0,2	0,4	1,0	0,2	0,4	-	0,2
Data security	3,7	1,0	0,9	0,7	0,8	0,9	-	0,4
			_					
Service Index	18,4	0,74	0,75	0,80	0,55	0,54	-	0,43
TOTAL INDEX		0,66	0,59	0,78	0,57	0,69	-	0,62

Table 7.1The Usability of Different Communication Means in Organizations
and Households.

The final values of each factor are between zero and one and they have been calculated by giving to the best practices in each factor a value of one and the others become values of their own in proportion to the best practices. Thus, the higher the index value the better the communication means in question. The weights δ_i were asked the representatives of 400 organizations about all the factors (Nikali 1996c). The total index is the arithmetic weighted mean of the subindexes. The weights for the total index are the sums of the subindexes' weights.

As we can see from the table above the total index values are highest in the case of the telephone. That means that the telephone is still the best communication means. In all communication sectors eMail will get the second best total index value. The third best communication form is, for inter-organization communication, telefax but for other sectors it is the ordinary letter. For inter-organization communication the ordinary letter is in the middle of all communication means. The hybrid letter is not ranked very high in this comparison. In organization-household communication the index values are very similar to the values for inter-household communication and the ranking of the means are the same.

The different communication means have been placed according to service-technical superiority in Figure 7.4. There are two service quality values for telefax, one for household communication and the other for organizations.



Figure 7.4 The Placement of Different Communication Means in a Service-Technical Quality Matrix.

As can be seen from the figure above the telephone is placed highest in both dimensions. Two separate groupings of communication means can be seen in the illustration. The communication means of one group (eMail, Internet and EDI) are technically high-grade but their standard of service is mediocre. The other group (telefax for organization communication, ordinary letter and ePost) includes communication means with a high-grade standard of service but technologically they are not very good. Telefax machines for household communication is the worst mode among the communication means under consideration and therefore the forecast for telefax machines is downward, as discussed earlier in this study.

The communication means of both groupings in the above figure consist of similar features. Until now telefax has been the leading competitor to letter services. Competition has taken place between communication means with very similar properties, but now the situation is changing fast. eMail is challenging both telefax and letters and in the future it will compete with different technical and service properties. The telephone is still so superior that its position is not in any danger yet.

The comparison between different studied communication means is presented in Figure 7.5 from a technical perspective. The communication means are presented in order of superiority. The best communication means is eMail. The Internet is quite close, but the telephone lags behind considerably. The reason for this is that further utilization of messages transferred by the telephone is much less than for eMail in the technical mean. On the other hand the telephone is at present the only communication means by which two-way communication is possible. The ordinary letter is considerably behind the telephone in the technical mean and the ePost gets the lowest value in that mean.



Figure 7.5 Technical Quality and its Factors for Different Communication Means.

The order for different communication means in relation to the standard of service is quite different if viewed from a technical point of view. The comparison is presented in Figure 7.6.



Service Quality

Figure 7.6 Service Quality and its Factors for Different Communication Means.

Quality values for telefax in a service sense vary for different communication sectors. For household communication (Telefax H) it has a much lower value than for organization communication (Telefax O). This distinction is caused by penetration differences in organizations and households.

Market shares for different communication means appear more to follow relationships between standard of service than technical quality. The reason for this is that the procuring prices for different communication means are so low that very little investment is required. And some means like the ordinary letter do not need any investment at all. It is also much more difficult to improve the technical than the service quality of communication means. Costs are not the most important factors in selection between different communication means, but the ability to use the means and the capacity of the means to transmit messages, as discussed in Chapter 6. More discussion on market shares is presented later in Section 7.3.

Through comparison between the standard of service of different communication means can be estimated that the eMail will exceed the total index value for telephone when its penetration in organizations is 85 percent at the minimum, assuming that relationships between the other factors are the same. That will take five-to-ten years in Finland. Today penetration is about 40 percent (Nikali 1997b). When the generality of eMail becomes the same as of the telephone, in other words all organizations have eMail at their disposal, eMail will be ranked a much better communication mode than the telephone. However, although eMail would reach a 100 percent penetration, even then its standard of service will be inferior to the telephone. The low costs of preparing and sending messages by telephone explain this situation. Changing the forming costs is not easy but transmission costs by eMail will probably decrease as eMail becomes more common in households, too.

If development is as fast as it has been in this decade, almost all employees in organizations will have an eMail connection in Finland within ten years. But even in five years the vast majority of employees (about 85 percent) will be in that position. And up to that point most of the eMail-systems will have been changed from intraorganizational to inter-organizational. The fact that eMail-systems today are to a great extent intraorganizational decreases the significance of eMail in competition between different communication means. The significance of the communication means will increase explosively as penetration exceeds a certain limit. What that limit is, is very difficult to say, but for eMail it will be higher than 40 percent i.e. the penetration today. Plum (1997) used the term critical mass in diffusion function and according to her the critical mass by eMail has not yet been reached in Germany. The penetration level of eMail is lower in Germany than in Finland.

The penetration of the telephone in households is today 97 percent in Finland and of eMail 12 percent. The service quality for eMail will be the same as for the telephone, when the penetration in households is 80 percent or better. However, that will still be a low value compared to telephone and letters. It will take more than 10 but less than 15 years to reach the 80 percent limit, but it will take even more time before penetration for eMail in households is able to compete with telephone and letters. The Internet will play a remarkable role in this development. The Internet will also change attitudes towards letters and generally the whole of targeted communication. The increasing frequency of electronic shopping and making payments by electronic network will have direct influence on the frequency of physically transported letters and as a result of that development it could be that the posts will change into parcels transportation firms to a large extent.

Because penetration of most communication means is much lower in households than in organizations, the increasing frequency of those means by households will determine the importance of those means for household-organization communication. Communication with new electronic means can not become very extensive before these new means are common enough in households, also. And people must also learn to communicate with those means, which will require time after they have procured the means. Thus the use of new electronic communication means between organizations and households will become more common only when inter-household communication becomes general.

The more the personal nature or the importance of the contents of messages are emphasized the more the senders will use letters exchange in electronic communication modes. Confidence in letter mail is still strong, although the delivery process depends on manpower to a large extent. The same conclusion was drawn when security of electronic communication means was studied (Ollikainen 1997). There must be many changes before electronic communication forms have the same reliability in the minds of message senders.

In Finland today 40 percent of employees have eMail at their place of work and one fifth of them say they use eMail more than the telephone for communication at work (Nurmela 1997). That means, that 8 percent of employees use eMail more than the telephone in their work today. In addition to that one-tenth of the respondents use it as frequently as the phone. When eMail also becomes general in households, it will compete with the telephone for the highest status among different means of targeted communication.

7.3 Development of Targeted Communication Market in Finland 1995-2005

7.3.1 The Total Market

Even if the ordinary letter is the oldest means of targeted communication, the importance of the telephone is much greater today. In Figure 7.7 the market shares for different communication modes in Finland for 1995 and a forecast for 2005 are presented. Volumes are measured in numbers of messages. Of course comparison of different messages is problematic, it is not so easy to say whether one letter corresponds to one telephone call. It can always be said that one telephone call is the equivalent of many letters, because communication by the telephone is two-way. In this approach the point of interest is the communication events rather than the volume of information in different messages. However, this figure gives an idea of the importance of different communication means. The number of telephone calls is estimated separately for local and long distance calls on the basis of the average duration of one call and the total calling time (Ministry of Transport 1996). The figures for telefax, eMail, EDI and Internet messages are based on interviews with organizations and households (Nikali 1994 and 1995b), and the numbers of ordinary and hybrid letters are based on Finland Post's statistics and its market shares of letter services.



Figure 7.7 Breakdown of Domestic Communication Market by Means of Communication, for 1995 and 2005. Total Market.

The number of telephone calls in 1995 was four times greater than the volume of ordinary letters, but the number of telefax messages was at the same time about a half that of letters and the number of eMail massages only about one-fifth of the letter volume. Although ten years later the changes in Figure 7.7 do not seem so radical, the relationships between the different communication means have changed very much. This forecast is based on the following average yearly increases: ordinary letter -1.4 percent, telefax 6 percent, telephone 8 percent, eMail 21 percent and hybrid letter 13 percent.

The breakdown of the communication market in Finland for 1995 and 2005 presented above is very similar to a worldwide study carried out by the Universal Postal Union (UPU 1997). The only noteworthy differences are in the shares of ordinary letters and telefax. The share of ordinary letters is bigger worldwide (19 percent) than in Finland (17 percent), and the forecast of that service is not as pessimistic as that in this study; 15 percent for the UPU and 9 percent for Finland in 2005. The situation concerning the role of telefax is inverse: the share of telefax messages was lower worldwide (6 percent) than in Finland (8 percent) in 1995, and this share is forecast to decrease faster than in Finland (UPU 4 percent, Finland 7 percent). The number of messages in the domestic communication market according to means of communication in 1995 - 2005 are presented in Figure 7.8. The total amount of communication will increase 7 percent a year which means that the number of messages should double during the period under consideration. The forecast for total communication has already been presented above in Chapter 2 (Table 2.1).



Figure 7.8 Number of Messages in the Domestic Communication Market by Means of Communication in 1995 - 2005.

The volume of telephone calls in 2005 will be nine time greater than the number of ordinary letters (four time greater in 1995) and the volume of eMail messages will then also be much greater than the number of letters (one-fifth in 1995). In my view telefax will reach the top of its life cycle during the next five years, and the volume of telefax messages will remain lower than the number of ordinary letters. The penetration of telefax machines will reach its peak in a couple of years in Finland, but the volume of messages will then start to decrease only a few years later. Even if the demand for hybrid letters increases rapidly, its share of total communication will remain very small. Its share of all letters was about 3 percent in 1995, but it will be much more significant, about 10 percent, in ten years time, even though competition between electronic communication means will become very intense, especially between telephone and

eMail as well as telefax. However, the dominant position of the telephone will be under no threat in the near future.

If we study the distribution of communication volume for different sender-recipient segments, we learn that the changes in total communication will not be so great in ten years time. The number of messages and shares of segments in 1995 and 2005 appear in Table 7.2. The business-to-business segment is the most important today and will be so even after the next ten years, the shares are about 40 percent at both moments in time. The business-to-household segment is much more important in the letter market (ordinary and hybrid) than in the total communication market. About 60 percent of the all messages are sent by business and 40 percent by households.

Sender-Recipient Seg- ment	The Amount of Total Communication					
	Year 199	95	Year 2005			
	Number of Mes- sages (in mil- lions)	Market Share	Number of Mes- sages (in mil- lions)	Market Share		
Business to Business	2100	41%	4300	42%		
Business to Households	900	18%	1600	16%		
Households to Business	1000	20%	2100	20%		
Households to House- holds	1100	21%	2300	22%		
Total	5100	100%	10300	100%		

Table 7.2Breakdown of the Domestic Total Communication Market by Sender-
Recipient Segments in 1995 and 2005.

Even though the sender-recipient segment changes in the total communication market will be very small during the next ten years, the changes in the same segments for different communication means will be significant (Table 7.3). The reason for that is that new means of communication will come into more general use in households, too.
Sender-Recipient Seg- ment	Means of Communication									
	Ordinary letter Market Share		Telefax Market Share		Telephone Market Share		Electronic mail Market Share		Hybrid letter Market Share	
	1995	2005	1995	2005	1995	2005	1995	2005	1995	2005
Business to Business	45%	31%	98%	93%	30%	30%	99%	81%	6%	20%
Business to Households	43%	53%	0%	3%	14%	14%	0%	9%	94%	80%
Households to Business	3%	5%	1%	1%	28%	28%	0%	3%	0%	0%
Households to House- holds	9%	11%	1%	3%	28%	28%	1%	7%	0%	0%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 7.3Breakdown of Domestic Markets by Communication Means according
to Sender-Recipient Segments in 1995 and 2005.

Because even today the telephone is found in almost all households, changes in telephone distribution will be slight. The business-to-business segment of ordinary letters will decrease considerably during the next ten years, which will mean letter substitution by electronic communication, especially by telefax and eMail. The replacement effect will take place first in that segment. Another reason for this is that the organizations will use more and more hybrid letters in inter-organization communication. The position of the telephone will remain stable in inter-business communication. But we must remember that the demand for eMail messages will increase much more than the demand for the telephone in business-to-business communication, too. As can be seen from Table 7.3 use of eMail will be much more general than telefax in households. As has been said before the telefax machine will never be very common in households.

7.3.2 The Business Market

The distribution of the communication market according to different communication means is very different in the business-to-business segment than in the total market. The distributions in inter-business and business-to-household communication in 1995 and 2005 are presented in Figure 7.9.

The share of the telephone in the business-to-business segment is noticeably smaller than in the total market. The reasons for this are above all the commonness of telefax machines in the business sector and the use of eMail. More than 95 percent of organizations have a telefax machine and about 40 percent of workers in all organizations have eMail at their disposal. The property of those communication means allowing the addressees of messages to decide for themselves the time they wish to read the messages is very important in business-to-business communication. The telephone does not have this property.





Business to Household Segment



Figure 7.9 Breakdown of Domestic Communication Market by Means of Communication, for 1995 and 2005. Business to Business and Business to Household Segments.

In communication in households it is much more important than for the business world that they can communicate two-way, and this is possible by telephone. The ordinary letter is for business communication equally important today as for households communication. But the change of demand for ordinary letter services during the next ten years will be more dramatic for the business-to-business communication segment than for the others.

Because most of the hybrid letters include bills, this communication mode is not so general in business communication as in the business-to-household segment. The telephone will still keep its position in the near future, but the situation between telefax machines and eMail will change very much. In the next ten years most of the organizations will have at their disposal an eMail system just as they today have telefax machines and so more messages will be sent by eMail than by telefax. Today most of the eMail systems are for intra-organization communication but as the eMail becomes much more general, most of the systems will be for inter-organization communication and also for global communication. Hybrid letters will not have any significant role in business-to-business communication, even in the future.

Both ordinary and hybrid letters have today and will have even in the next ten years a most important role of their own in the business-to-household segment. The reasons the share of the telephone will still increase in the business-to-household segment are the following:

- The significance of eMail will not have time to increase to any great extent before the year 2005, even though the relative increase for eMail will be the biggest among all communication means in all segments.
- The digitalised telephone network will make it possible much more than up to the present to use automatic telephone services for simple orders and inquiries.
- As has been said before, telefax machines will never be very common in households.

Although the growth rate for hybrid letter volume was the second highest among all the studied modes in the period under consideration, its significance did exceed the 5 percent marginal in the business-to-household communication.

7.3.3 The Household Market

The distribution of communication means for households is quite different when compared to that for organizations. Distributions in household-to-business and householdto-household communication for 1995 and 2005 are presented in Figure 7.10.



Figure 7.10 Breakdown of Domestic Communication Market by Means of Communication, for1995 and 2005. Household to Business and Household to Household Segments.

The position of the telephone is superior. The reason for that is that nearly all households have a telephone, but only 10 percent of them have a telefax machine and 12 percent of households can send eMail messages today by their computers. The share of ordinary letters has remained low, because the real prices of telephone calls have dropped dramatically during the last two decades and simultaneously the real prices of letters have remained stable. However, the number of ordinary letters sent by households during the last 15 years has increased, but slowly compared to total letter volume (Nikali 1997b). Hybrid letters are not in common use in households, because most hybrid letters include an invoice and households send only few bills.

The changes over the next ten years will be very small, because eMail does not have enough time to become such a significant factor in household-to-business communication. The share of ordinary letters will also decrease further.

The share of the telephone is not so high in inter-household communication as in the household-to-business segment. Much more ordinary letters than eMail messages are being sent today between households, but the situation will be changed in 2005. An eMail connection will be so general in households after ten years that the number of eMail messages is about the same as the number of ordinary letters. Instead, telefax machines and hybrid letters will not be important for inter-household communication.

7.4 The Future of Postal Organizations

7.4.1 The Liberalization of Postal Services in Finland

Finland Post was founded in 1638. In 1927, the Post and Telegraph were united into the General Directorate of Posts and Telegraphs. It was an office strictly controlled by the State and subordinated to the State budget, and it also had some duties as public authority. At the beginning of 1990 Posts and Telecommunication became a state-owned business enterprise, after which it did not have any authoritative duties and in practice it operated in competitive environment. At the beginning of 1994, the Posts and Telecommunication of Finland became a limited company fully owned by the Finnish State, PT Finland Ltd, and one of its subsidiaries is Finland Post Ltd.

Until 1990, Finland Post had a monopoly on "the transportation of addressed letter items against payment." In practice, however, there had been open competition earlier because Post did not protect its monopoly in any way. The constraints on competition between

postal operators were abolished on 1 July 1991 when the Decree on Postal Operations (1980) was repealed. This Decree defined the operations of business enterprises like Finland Post in a competitive environment in which also private courier companies operated (Leskinen 1997). Since then postal services have been completely liberalized in Finland. The period from the beginning of 1990 to 1 July 1991 was in this regard ambiguous.

The present Act on Postal Services, which regulates postal services in Finland today, entered into force on 1 January 1994. The aim of the Act is to ensure that postal items can be sent and received under equal conditions in the whole country. All postal operators must have operating licenses granted by the Council of State.

The situation regarding 1st and 2nd class letters and addressed advertising mail is just that presented above, but the delivery of unaddressed advertising mail has been absolutely open to competition as long as the category has existed. Addressed advertising mail has been an item category in the Post since 1956 and unaddressed advertising mail since 1959.

The reason Finland was the first country in the world to liberalize its postal services was that Finland wand to demonstrate a liberal legislative policy. In Finland we strongly believe in the competition in a market economy. Although Finland is located on the fringes of Europe between the East and the West, it had a great desire to open its doors to Europe even before the membership of the EU. The promotion of competition, itself also supported by legislation, is a measure of this development.

Another reason for this development was the fact that Finland Post had already long been prepared for free competition. Finland Post has already made profitable returns for 14 years. This has been obtained by:

- keeping expenses in check, actually decreasing;
- the good volume development of the 1980's, based on good economic progress and the decrease of the real prices of postal services; and
- continuously raising the standard of service.

Because the Post's result has been positive, it has had no need to protect its monopoly and demand its retention in the 1980's. The Post has itself participated in developing of legislation and in the deregulation of competition.

Also in the future, the Post will be willing to respond to competition with a moderate pricing policy and a good standard of service, which today includes increasing contacts with customers and listening to their service demands. A new factor that has not yet been fully exploited is the Post's transport, delivery and service network that covers the whole of the country. The interface with customers at the start and finishing points must move closer to customers, and total logistics services have to be provided instead of partial services.

The reasons Finland Post's position has been and still is strong in letter traffic and in addressed advertising mail has also been the fact that Finland Post has had no competitor of Sweden's City Mail type and it is also due to Finland's surface area. For example those of Germany and Finland are almost equally large, but Germany has 16 times more inhabitants than Finland and the number of inhabitants in Helsinki, is less than half of that in Stockholm.

7.4.2 Managing Letter Services in Finland

Until 1990, when Posts and Telecommunication became a state-owned business enterprise, the main postal rates were set by the Council of State. It was only the prices for some additional services that Posts and Telecommunication of Finland could decide on independently. During the years 1990-1992 of the business enterprise, the Council of State only decided on the prices of a few basic services. In the Post, there were two of them: the price for a 1st class letter and transportation charges for newspapers and periodicals distributed with the mail. This statute was abolished at the beginning of September 1992, after which Posts and Telecommunication has freely decided on the pricing of its services. Naturally this right of independent decision as regards pricing continued when Posts and Telecommunication of Finland became a limited company of the Finnish State at the beginning of 1994.

Finland Post's pricing principles for letters today are weight, size and manageability of items. No major changes in this respect have occurred during the last few decades.

The weight is taken into account in pricing in two ways:

- each weight category has its own price and
- each item category has its own maximum weight.

The size is taken into account so that each item category has its minimum and maximum size. The manageability of items is also taken into account in two ways:

- a so-called surcharge for bulky items is collected for an item that exceeds the maximum size in some respect and
- a minimum of 20 2nd class letters, 1000 addressed advertising mail items and 500 unaddressed advertising mail items per mailing can also be considered to belong to this category.

In Finland, all rates for letters and advertising mail are nation wide, irrespective of distance, with the exception of one rate. This exception is unaddressed advertising mail that has its own rate for locally distributed items. Their delivery times are fixed for three weekdays. There is no corresponding non-local service. Instead, there is the so-called fixed date delivery where the unit price is 20 percent more expensive than local delivery, and the socalled calendar week delivery that is some 20 percent cheaper than local delivery, both deliveries covering the whole country.

The discount principles at the Post are based on the Post's dominant market position. The national and international competitive regulations require equal treatment of all customers, so that the compensation principles have to be the same for all. Discount may be allowed on the following grounds:

- the size of the consignment is big enough; and
- a big consignment recurs often enough; and/or
- the customer's annual volume is big enough.

For a discount to be given on account of the size of the consignment, the consignment must be packed in boxes and sorted into postal code order. The maximum discount is 6 percent for a big consignment and for sufficiently frequent mailings. In addition, a customer with a large annual volume may get a discount of 2 percent at the most. Contract pricing can also be used for consignments of unaddressed advertising mail that are really big by Finnish standards.

When competitive conditions and the price of postal services are compared, interest becomes centered on the antithesis of monopoly/non-monopoly services and services with a large/small market share. If price is used as a means of competition, real prices could rise in monopoly services and in services where the market share is big, whereas the real prices should fall in non-monopoly services where the market share is small. This is not the case in Finland, however. The real tariffs for the Post's letter services have all been mainly falling for the last 20 years, irrespective of whether it is a question of monopoly service or not or whether the market share is big or small (Figure 7.11).

Although the Post's monopoly on letter transport in the 1960's and 1970's was substantial, the real tariffs for 1st class letters during the whole period of observation and the real tariffs for 2nd class letters since the middle of the 1970's have been going down. The fact that the real tariffs for 2nd class letters rose in the 1960's and at the beginning of the 1970's was not due to competition but to the objective of bringing the prices of 1st and 2nd class letters closer to each other. At the beginning of the 1960's, the price of a 1st class letter was almost threefold compared with the price of a 2nd class letter. In the middle of the 1970's, the relation was only 1,6-fold. After that, both real tariffs have developed step in step with each other. The difference is only 40 percent today.



Figure 7.11 The Real Prices of Domestic Letter Traffic in 1961-1996.

The prices of addressed advertising mail, where the Post's market position is strong, and those of unaddressed advertising mail, where the Post's market position is weak, have run parallel during the whole period of observation. The same applies to the price development of heavily competed items (advertising mail) and weakly competed items (letters), especially over the last 20 years.

Raising the tariffs for unaddressed advertising mail at the beginning of the 1970's led to the founding of private companies in major cities that specialized in the delivery of such items, after which the Post's market share which had been almost 100 percent fell very quickly. However, Finland Post was reluctant to use pricing as a means of competition very intensely.

Before Posts and Telecommunication became a business enterprise in 1990, prices were decided on by the Council of State. Pricing decisions on postal services were made on political grounds, and the politicians did not want to annoy consumers by making big increases in prices. The competitive regulations have also had some effect on the moderate pricing policy of recent years. The Post is not allowed to misuse its dominant market position. It is not allowed to restrain new competitors by dumping prices. Actually, the Post's policy has been to follow customer expectations actively and maintain a high standard of service.

It must be remembered, however, that the above practices have been possible because the Post has been in a position to afford it. The Post's returns have been profitable for the last 14 years, last year was the 14th consecutive period of profit (Figure 7.12). The satisfactory direction of cost development has provided a strong basis for this. Since 1981, except for one year, income volume has developed better than cost volume or, as cost volume has grown, income volume has grown more, and when cost volume has fallen, income volume has fallen less. This positive development brought about a profitable result in 1984. Before that, the Post's activity was unprofitable, and at the beginning of the 1970's, even very unprofitable.



Figure 7.12 Annual Change in the Post's Income, Cost Volumes and Operating Profit in 1981-1996.

Profitable development has made it possible for the Post's tariff policy to actually follow cost development (Figure 7.13). When cost development has been moderate, so has tariff development. In reality, both of these have been falling. Some nominal tariffs have even dropped in this decade. This has been possible because the cost level has stayed unchanged and inflation has remained low in Finland. Declining letter volume has also increased pressure in this direction.



Figure 7.13 Annual Change in Post's Cost and Tariff Levels and Operating Profit in 1981-1996.

The pricing strategy for postal services in Finland has been very similar to that used in the USA. Tolley and Bernstein (1997) mention four important goals for pricing strategy in the U.S Postal Services over the past twenty years:

- decreases in the real price of postage;
- increases in mail volume;
- increases in mail per employee; and
- elimination of taxpayer financing of the Postal Service.

With one exception all these goals have been completely realized in Finland also. Until this decade, mail volume was continually on the increase, but the deep recession and replacement by electronic communication caused a downturn. Although there has been a boom in Finland for four years now, mail volume has only shown a slight increase. However, the number of letters per employee has continually increased, because the number of employees has dropped in Finland Post from 32,000 in 1990 to 23,000 in 1996. That is the important reason, because the other goals mentioned above have been realized in Finland in spite of the recession in this decade.

7.4.3 Scenarios for the Future

The Post has been in Finland 360 years. Since that time there has been written communication, first between the king of Sweden and his officials, then from business to business and today most of the letters go from business to households. When electronic communication means become quite general in households, too, the life curve of letters will be stark descending, as can be seen from Figure 7.14.

The period from the beginning of letter services in Finland to the latter part of the last century is the development stage. This represents the time when no electronic communication means existed.

The growth stage is characterized by a rapid increase in sales. At the same time electronic communication means became more common, too, especially the telephone. However, during the growth stage, from the start of this century until the 1970's there was a generative effect on letter services of electronic communication, which means that electronic communication caused an increase in letter volume, as discussed in Chapter 4.



Volume, million FIM

Figure 7.14 The Life Cycle of Letters.

The saturation/maturity stage, in which we are now living, will extend to the second decade of the next millennium. This period represents a time when many different electronic communication means will have entered the communication market. One reason for the saturation of letter services is the large supply of different electronic communication means and the rapidly decreasing prices of those means, and another reason is that the volume development of telecommunication services is no longer having a generative effect on letter services (see Chapter 4).

The decline of mature products is caused by changes in consumer preferences, product technology, competitive activities, and other environmental factors. The volume of letter services at the end of the next century according to Figure 7.14 will be at the same level as in the middle of the 20th century and the volume will have decreased to a fifth from its peak, in the 1990's.

The duration of the development stage was more than 200 years, the growth stage took less than 100 years and the saturation stage will be only about 50 years.

From the above figures it can be concluded that the role of the posts is steadily declining in the communication market. If the worst comes to the worst the posts will in the near future, after 30-40 years, only be a marginal operator in the field.

The growing competition between companies that provide transport and delivery services has not had any direct effect on the pricing of Finland Post's services. Instead, it has had a considerable effect on the cost consciousness of the Post. This has made the Post ready for competition, which in turn has made possible the moderate pricing policy that has been practiced over the last 20 years. As Finland Post has also long had a high standard of service and today has an ever growing desire to listen to its customers, the threat coming from the new enterprises now emerging in the market have been somewhat alleviated. At the same time, it has become more difficult to cross the threshold of the delivery market.

The Post's biggest threats are not, indeed, from other carriers, but the opportunities offered by electronic communication forms. According to a study, already about 40 percent of 1st and 2nd class letters in Finland have been replaced by electronic communication: the traditional telephone, telefax, electronic mail and data communication. By 2010, this will still affect 30 percent of the present 1st and 2nd class letters, if attention is not paid to the trend of growth. Of the above-mentioned electronic communication forms that are already largely in use, telefax has been the most significant for letter traffic. Its compensating effect has been as great as that of eMail and data communication together. The compensating effect for the traditional telephone had already in the main taken place earlier. However, the most important replacement role is change over from telefax to eMail, because in a technical sense eMail is much better than telefax and the standard of service by eMail will improve rapidly as it becomes more common. Plum (1997) believes that substitution in the coming years will still be concentrated on fax communication by eMail has not yet been exceeded. eMail is much less common in Germany than in Finland. Even the good economic development and moderate pricing policy of the postal services will not permanently raise the number of letters above the level of the culmination period. Such future development is also independent of the competitive regulations on the postal services. The Post should try to find new forms of activity to slow this process down and without prejudice develop postal business activity of a kind which would also be based on electronic communication. I believe that a similar development will be realized in all the developed countries of Europe during the next few decades.

If we consider the development of postal organizations in the developing countries, then those will be dependent on the progress of the telecommunication services in the countries in question. They do not have the financial resources to build up telecommunication networks based on cables. Even a mobile communication network is too expensive to construct, and therefore these countries will not develop telecommunication networks based on existing technology and they will change over to satellite technology in telecommunication directly. That means postal organizations in those countries will never develop to a modern technological level, and this will affect all the postal services of the developed countries in the world.

For postal organizations I see three different possibilities for the future policy, especially as they apply in the new conditions for competition: I call these Drifting, Alliance and Withdrawal Scenarios. I could also label them the most probable, the most desirable and the most dangerous scenarios, too.

a. Drifting Scenario

The national posts are seen as social organizations for which it is very difficult to react fast enough to new competition. This scenario, called the Drifting Scenario means that the postal organizations do not have an active policy of their own suitable for this new situation.

Basing their views on their splendid past the postal services consider the new conditions from too narrow a point of view. They only see how physical competition is

growing more intense and at the same time they do not understand how competition with electronic communication is changing things. Although the new Postal Services Act which liberalized the market in Finland irreversibly has been in force since 1st January 1994, the first private license application for delivering 2nd class and addressed advertising letters in the Helsinki metropolis was under consideration by the Finnish government for two years. This debate concentrated on the question of how it might be brought about that all postal items can be sent and received under equal competitive conditions throughout country, if there is one nation-wide operator (Finland Post Ltd) and one regional private postal operator and what the license payment for the regional operator would have to be. There was very little discussion about competition between letter and electronic communication services. I think this is the case also in other countries and in EU legislation, too. Information concerning competition between letter and electronic communication services is so scant that the influence of this is not known, and so it is easier to talk about the conditions, legislation and regulation of competition separately by the postal and tele services. However, the more the traditional postal services are reserved for one operator, the more liberalized the market in communication will become due to competition between physically transmitted and electronic communication. So in that scenario the legislation recognizes only competition in the telecommunication and postal services but not the competition between

If the posts are not able to find any new solutions for their traditional letter services and simply allow the market to determine competition, this will not have a positive influence on the posts. The posts will be faced with keener competition from physical transportation operators, too. The real prices of postal services are increasing and not decreasing, but the real prices of electronic communication services are even decreasing at this very moment as more new electronic communication markets appear. The result of that development will be that the posts will have to be satisfied with a partial market that decreases all the time and the possibilities for the posts to compete in the logistics market will decrease, too. To be competitive in the logistics market the posts will need to make considerable investments for which they do not have the fi-

these services

nancial resources. All this will further increase pressure to raise the prices of postal services.

The posts should be able to find cooperation partners even from among operators working in the electronic communication market, but making alliances with them will not be easy, because the posts are no longer strong enough partners. In the new market situation it will be very important to be one part of a network, yet for the posts this is going to be difficult. In such circumstances they will have to find new markets from other countries and in that way increase competition in the postal services as they compete among themselves.

As the change from physical communication to electronics gains momentum it will be very difficult to reverse this trend. And with communication modes reverting to the previous means it will take a very long time and it will be difficult maybe almost impossible to accomplish this.

When will this happen? The best indicator is the frequency of different communication means in households. Households are in a decisive position in this regard. For example, the frequency of eMail in households today is 12 percent in Finland and not until the penetration exceeds 70 percent will the influence of substitution be really significant for household communication. It is not easy to say when frequencies will be high enough for changes to take place fast, but in Finland anyway this will take from 10 to 20 years.

b. Alliance Scenario

In the Alliance Scenario the most essential matter is the function of communication itself. All operators should understand what kind communication services the customers need and the operators should have the ability and willingness to serve them together. This attitude is especially important for the posts and they should be able to offer electronic communication services, too. This they can do alone or in cooperation with operators offering electronic communication modes. Besides that, the defining boundaries between letter and electronic communication modes is becoming more indistinct, although this is not so important. The important matter is that the communication functions properly. For senders and recipients of messages the essential things are the reliability of the operator, data security in the transmission, speed and price of transmission, not what the transmission modes are. This is a good reason for operators to work together.

One problem in this development could be that in most countries the posts are state owned companies strongly regulated by their owners, but the tele companies are ready for listing on the stock exchanges. So even in the near future the basis of ownership could be different for those firms and thus operation practices different, too. One possibility would be to split the posts into two separate companies, one for communication services and the other for logistics services. This could be to the advantage of the posts as far as letter competition and goods transport services are concerned and it could make it easier for the posts to find business partners. When electronic shopping is in widespread use the posts will have an important role in that respect. Alliances with other communication operators and networks will be key factors then, too. It will be especially important for all postal organizations to have uniform regulations for all communication forms, both physical transportation and electronic communication. Both regulations and standards should be uniform.

The posts might be able to find new hybrid solutions for letter services. One alternative could be to provide an eMail address for everybody. If the addressee does not have a computer equipped with an eMail connection at home, the messages could be printed at the local post office and delivered to the recipient by post. For example, this would be a good practice in invoicing. Finland Post transports about half of the newspapers and 90 percent of the periodicals and most of the newspapers are delivered early in the morning (so-called pre-delivery). There should, though, be only one delivery in which all postal items are delivered together.

The timetable is the same for this scenario as for the previous Drifting Scenario. In ten years the new electronic communication modes have become so common even in households that these new alliance relationships should already be discernible. If the posts are not able to this, electronic communication operators will do it alone or they will look for partners among delivery operators other than the posts. This type of activity would provide the posts with a possibility of being successful in competition between different communication modes. Although the volume of ordinary letters will decrease even using this development alternative, the posts would be able to find new services for their product assortment and could prove successful in the goods transportation market, too.

c. Withdrawal Scenario

The Withdrawal Scenario is the most pessimistic of all for the posts. According to this alternative the posts will play an active role in yielding the way for competition with electronic communication. The posts would offer the customers letter services as long as they need this means of communication, but the trend in volume would be continually on the decrease. And the posts would accept this development without fighting against it. At the same time the posts would more and more become goods transportation firms, but competition would increase very much even in that area.

There would not be much competition in letter services, but the prices of letter services could not rise, because competition with electronic communication would be so intense. The only possibility of balancing the posts' economy would be by decreasing the number of employees. Investments would be negligible making the posts' position ever more uncomfortable in goods transportation competition. However, it would take some decades before the situation of the posts became really difficult. But the atrophying of the posts would be fastest in this scenario.

8 Conclusions

This chapter presents the main results of the study, estimation of the changes that will take place in communication markets during the next few decades based on the results obtained, and suggestions for subjects of further study.

8.1 Summary of Findings

The initial interest was in the future of the letter, prepared in written form and delivered physically from a sender to a recipient, in a world where the electronic communication means proliferate very fast. However, the regularities of the competition between physically and electronically transmitted communication also affect on competition between the original and the hybrid letter and between the various electronic communication means. Therefore, the focus of this study extends to the whole field of targeted communication and its prevailing volumes and devices, excluding only mass communication.

Competition between different targeted communication means have been examined in the study from several different perspectives. The quantitative effects of competition have been measured by econometric models using both cross-sectional material and time series analysis. Factors that are important today in the selection of different communication means have been examined through a survey of users.

The study produced the following main results:

- Letter mail volume in Finland would be about 40 percent higher today without the substitution effect.
- The increasing prevalence of electronic communication means has also had a generative effect on letter services. However, this has not occurred to any large extent for the last two or three decades.
- Telefax has been the most important replacement for letters. eMail has now taken its place and the life curve of telefax will be relatively short.

- Transmission costs do not play any important role in competition between different communication means. The reliability of delivery, the legal capacity and data security are considered to be better for letters than for other targeted communication means. The advantage of electronic communication means is their speed of transmission, whereas the telephone also provides the possibility of two-way communication.
- The whole of targeted communication will experience a great turning point soon as the boundary line between targeted and mass communication will blur with the use of hybrid networks and digital transmission.

During the last twenty years telefax has been the most important mode in the replacement of letters by electronic communication, counting for as much as eMail and data communication put together. The replacement effect of the telephone as a traditional voice communication medium took place earlier during the expansion years. At the same time, electronic communication means also had a generating impact on letter mail volume.

The prices of telecommunication services, especially those of long-distance calls in Finland have decreased during the last twenty years to the extent that the price of letter services also has been constrained to be quite moderate. This can be the reason why transmission costs for messages no longer play any important role in competition between different communication means.

Competition in targeted communication occurs not only between physically delivered letters and electronic data transmission, but also between different electronic communication means. eMail especially has challenged not only letters, but also telefax and the telephone. The destiny of telefax will be similar to the telegram and telex earlier with a relatively short life cycle of only a few decades. The telefax will reach the peak in its life curve already at the begin of the next decade, after which its growth will start to decline and its use start to decrease quickly.

The original letter service has also reached the peak of its life cycle, but the saturation stage will continue for least ten years, after which its use in its present form will decrease rapidly. The whole of targeted communication will experience a great turning point soon, however, the dominance of the telephone will not be shaken before 2005. After that, the boundary line between targeted and mass communication will blur and

the integrated use of different communication networks will become common. The whole field of communication will be restructured using hybrid networks and digital transmission.

The Posts can not slow down this development nor would it pay off. If they are not capable of adapting themselves to the new situation and allying themselves with the electronic communication giants, in a few decades, the Posts will become mere operators specializing in the transportation of parcels. In telecommunication, large multinational mergers and alliances have already taken place. In the same way, large companies and media houses specializing in automatic data processing are taking over the global market and penetrating into markets which used to belong to the targeted communication operators. The transmission of telephone calls through the Internet network is a good example of this.

Limiting and preventing competition in the postal services does not protect the postal organizations which are part of society's infrastructure. On the contrary, it adds and contributes to competition between physically and electronically transmitted communication, which only further weakens the position of the postal services.

Legislation and regulation should also take into account competition between physical and electronic transmission of messages. The present legislation only recognizes them as separate elements, and regulations also operate in a decentralized way. This has resulted in a completely deregulated market and free competition between these communication forms, so that development in fact proceeds all the time to greater extent on the conditions of the electronic communication. This is not only a Finnish phenomenon, but the same happens in every developed country. The sharpening of competition between postal and telecommunication services takes place irrespective of whether those responsible for postal services wish it or not.

8.2 The Future of Targeted Communication

Competition between different targeted communication means and the change of the whole targeted communication market can be now studied explicitly by measuring the use of different communication means and comparing the factors which have an impact on their use. In addition, we have estimated the technical quality and the standard of service of different communication means from the users' point of view. The results show that the period in which we now live is still a transitional phase before the really radical changes in the field of targeted communication will take place.

The vision of one network using a totally integrated technology cannot regarded a realistic option. Instead, the different digital network solutions simultaneously use, socalled hybrid network, will be the prevailing trend. Then it will be ever more difficult to distinguish on which communication channel the messages have been transmitted. Although the technology necessary for this development exists already, it will take some 10 to 15 years to implement this change. The change requires large national investments and international agreements on the introduction of common standards and rules. The current years will be significant for both the starting of digitalised communication services and decisions on common international standards and rules. In Finland, decisions have already been made on large investments in this connection, and the European telecommunication administrations have already agreed on the rules for overground digitalised transmission services. A decision has just been reached on a common European next generation mobile phone technology.

In the age of hybrid networks, communication will take place from one terminal to another, and a computer will be able to function as a television at the same time or, if desired, as a channel of mass communication. A message may contain, besides a voice, a moving image, in which the sender states what (s)he has to say, but the sender may also insert a text for transmission on the same screen.

The recipient will be able to turn on the communication channel in real time or later if that is more convenient. On the screen, the recipient may easily select a channel to the sender and then the communication would also be simultaneously two-way. In this way, both sender and recipient will be able discuss together and work on the text transmitted along with the message. The whole communication process with its additional messages would be saved and forwarded to other recipients.

This development will also cause changes in the definition of targeted communication and considerably obscure the boundary between targeted and mass communication. A sender of a message, a recipient, the message itself, and a channel for transmitting the communication were essential elements in our previous definition of communication. But in the future the concept of a channel will be blurred, it will turn into a network and communication will become real only when the recipient has become acquainted with the message. There are so much communication on offer that only messages which are offered in an interesting way will reach their recipients. One-to-one messages will be also so easily copied and forwarded in a manner reminiscent of mass communication that the clarity will become blurred.

As to the development of future targeted communication, the following observations can be presented. These are not a presentation of technical possibilities but mainly a presentation of the prevailing reality after a few decades:

- •. Electronic communication means have been marginal in the sense that their capacity to transmit messages has been limited. This will not be the case in the future.
- The sending of messages has been dependent on the channels available. Due to hybrid networks, this will not be the case in the future.
- Essential to the measurement of the communication expansion has up till now been its volume (number of messages or transmission costs). In the future, targeted communication will be followed, besides by the proper message, by so much "background information" that the relevant amount of information will be marginal as compared to the total amount of information transferred.
- The transmission costs of communication have been based on a charge for number of messages per channel or duration of communication per channel, and the transmission costs have mainly been paid by the sender of the message. In the future, the charge will be based on a mere channel fee or, more correctly, on the network fee which does not depend on the volume of use. A charge may also be collected from the recipient of the message, because it will be the recipient who in the future can decide on the method of receiving the message.

• Up till now, it has been important to get the messages transferred from the sender to the recipient. In the future, it will be important to arouse the interest of the recipients or the agents who represent them and control the communication they are as a focus. In other words, the communication has to go through filters which limit acceptance, so that only messages relevant to the recipient will reach the communication targets.

The conveying of information from the information provider to its consumer in digital form concurrently takes place using several different data transmission networks. However, the possibility of using physical delivery services of the present type will in the future also be a part of society's messaging infrastructure. Equality of citizens requires that messages are also delivered to those recipients who in the future will not even possess the terminal equipment necessary for interactive data transmission, or who do not want to use them. Those cases will be served by the logistics services of goods deliveries. Deciding on this will, however, require political intervention, and implementation of those services could be given to organizations like the posts.

The increase of interaction in communication, especially in mass communication in residential use will be mainly realized through terminal equipment similar to television sets, in the working environment through computers connected to hybrid networks and, where people are on the move, by using mobile technology. Due to the limitation of interaction, the transmission of a message from the information provider to the recipient before the hybrid networks existed was largely based on the push model. In the future the transmission of communication will be based on a pull model, the information user will be an active force who can immediately exploit the properties of interaction. The vanishing of interdependence between the sender's and the recipient's terminal equipment will be essential in the coming communication environment; communication is not dependent on time or place; both the sender and the recipient can decide on whether the communication will be one-way or two-way; and there is always the possibility of recording and thus large possibilities for further utilization of messages.

The changes in information technology will also create new structures in industry. The borders between regionality, nationality and globalization will diminish. When society has its global communication networks, then both small and medium-sized enterprises will have better possibilities than today for selling their products and looking for partners worldwide. Thus, global data transmission and technology of the Internet type will have considerable economic implications, too.

8.3 Suggestions for Future Research

This thesis has pointed out that the perspective for future research should be communication based on hybrid networks, the effects of new technology on operation processes in companies as well as communication behavior and needs of households. The changes will be so extensive that a social and legislative perspective has to be included in the research, in addition to technical and economic considerations, as well as the questions of social equality and equal opportunities for different communication services. As worldwide information networks are a template of globalization, the research into the impact of social and technical solutions must take place in an international perspective.

As a summary, many subjects for future research can be proposed:

- Effects of new communication technology on the operation processes in companies and communication behavior in households.
- The variability of selection criteria of communication modes in different communication situations and consumer groups.
- Cost structure and service charge system of new communication technology.
- The role of the traditional letter and the status of service institutions like the postal organizations, which will belong to society's infrastructure in the age of hybrid networks.
- Effects of total deregulation of communication services.

The construction of digital communication networks requires enormous investment. When these decisions are made, the effects of this reform have to be known, so that the new terminal equipment and communication services will correspond to the expectations of companies and households concerning new technology.

Postal services have traditionally had a universal service obligation, which in a competitive environment leads to cream-skimming by competitors (Crew and Kleindorfer 1992). Joint production has also led to a difficult situation: cross-subsidy is not allowed, especially when a monopoly service subsidizes a service under competition. Numerous studies have been made in support of a right and fair pricing system for postal services (Crew and Kleindorfer 1992, Crew and Kleindorfer 1994, Bradley and Colvin 1994, Cremer etc. 1997, Haldi and Merewitz 1997, Stumpf 1997, Gallet and Toledano 1997). However, no unambiguous solution has been found that would define real costs and fair service charges, due to joint production and the regional and structural differences in costs. The hybrid services will complicate the pricing problem further. One alternative would be a mere network charge or, in addition to that or alternatively, a service charge could be collected also partly from both the senders and recipients of messages. It is also possible that all costs would be collected from the consumers indirectly, without separate service charges, or the communication would be so strongly seen as part of the infrastructure that the costs would be covered by tax revenue.

As communication through its interaction reaches completely new dimensions, it will cause great changes in the operation processes in companies and in the power structures of society. The push model has given extra power to information providers, as it has been able to decide on the distribution of information almost independently. In the pull model, active information users can always, if necessary, demand additional information from the information provider. This of course also includes great economic possibilities, as all products will have equal marketing and ordering channels at their disposal.

Postal organizations have as a matter of priority to create new strategies for their communication services. They can no longer rely on their traditional letter mail service. In a world of hybrid services, the posts which operate alone will have a walk-on part. The posts must look for cooperation partners, just as already happens in the world of automated data processing and among telecommunication operators. The posts may ally themselves with each other or with the above-mentioned communication service

providers as well. Whether the posts wish it or not, the liberalization of communication is advancing continuously, so hanging onto the old postal reserved services will only make the posts' position more difficult. This is also an essential reason why research of all the effects caused by the liberalization of communication services will be vital before the great changes take place.

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