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TOPICS IN ELECTRONIC MONEY

A Thesis submitted to:

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LIST OF ABBREVIATIONS

APACS – Association for Payment Clearing Services

ATM - Automated Teller Machine

BIS - Bank for International Settlements

BOE - Bank of England

BOF - Bank of Finland

CHIPS - Clearing House Interbank Payment System

DTV - Digital Television

ECB - European Central Bank

EFTPOS - Electronic Fund Transfer Point of Sale

EMI - European Monetary Institute

E-money/E-Cash - electronic money/electronic cash

ESCB - European System of Central Banks

EU - European Union

FED - US Federal Reserve System

FSA - Financial Services Authority

GDP - Gross Domestic Product

GNP - Gross National Product

GOT - Group of Ten

IMF - International Monetary Fund

NatWest -National Westminster Bank

LETS - Local Exchange Trading Systems

PC - Personal Computer

PDA - Personal Digital Assistants

POS - Point of Sale

SWIFT - Society for World-wide Interbank Fund Transfers

UK - the United Kingdom

US - the United States of America

WAP - Wireless Application Protocols

WSCs – Windows for Smart Cards

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To my dearest Mother.

"Hasretinden Prangalar Eskittim", Canim Annecigim.

Abstract

There has been an increased interest on the electronification of payments systems in the last two decades in general and on electronic money (e-money) on particular in the last decade with increased computing power and decreased cost of communication. E-money did not only attract attention from the academicians but also from central bankers, financial supervisory authorities, treasuries, finance ministries and innovators and operators all around the world.

The purpose of this thesis is fourfold. Firstly, it seeks to define and critically assess e-money including the expected functions, necessary features, its potentials and major implications for different sides of financial system. Secondly, it tries to present empirical evidence on the current stage of e-money technology with two case studies, namely Mondex and Digicash. Thirdly, it investigates the perception of e-money innovators and operators with an assumption that they have the power and influence on the future shape of e-money. This section includes the analysis of two European surveys and one additional comparative survey conducted in Miami, the US. Lastly, it studies the free banking implications of e-money covering the impact on monetary policy framework and monetary policy instruments including whether e-money should be regulated or not.

The research finds that the current definitions given to the e-money phenomenon is incomplete and defines the necessary functions and features for the future success of e-money applications. It describes e-money trends in Europe and compares it to the US perception finding no serious differences although the FED and the ECB have different approaches to e-money. Another conclusion the thesis reached is that e-money may result in a new approach to central banking with a contestable framework through the synergies with free banking. Finally, e-money is not seen as a danger for the successful conduct of monetary policy and the thesis underlines that when it is 'representative', regulation is possible whereas 'independent' e-money issuance may manage to stay out of the coverage of conventional regulatory frameworks.

1. INTRODUCTION

This thesis investigates developments in electronic money (e-money) that have been emerging rapidly especially in the last decade. E-money has drawn increasing attention from almost all national central banks in the developed world and international organisations, such as the Bank for International Settlement (BIS). The latter has recently published a survey on e-money developments (BIS, 2000). The impact of e-money on financial regulation has already been felt with a European Union (EU) directive, which has been finalised in content and awaits published of the Official Gazette. Additionally, as the importance of payment systems and payment systems infrastructure has been recognised as been increasingly important for international financial integration, developing countries have been trying to establish the potential implications of e-money. There will be impacts on financial service provision and monetary policy frameworks, and policy instruments. As a result, e-money has emerged as a phenomenon that should not be ignored. It should be analysed carefully in order to understand its potential and its limits for the future of money and central banking.

This thesis first sets on the motivation for the research including the questions, aims and contributions and follows those with the research methods and data sources. Then, it gives a theoretical framework and literature review on e-money. This section looks at the definition of conventional money with its functions and features. It covers a wide range of definitions given to e-money in order to underline the general confusion about the current development, and critically tries to provide a new approach for a new definition that may cover independent issue of e-money as well. It then applies a systemic approach to e-money in order to describe a bridge between conventional money and its electronification and describe the necessary functions and features for e-money in order for successful implementation for its full potential. It later looks at the sources of demand for e-money and analyses the current problems surrounding its development and concludes with a short summary of the implications of e-money for central banking.

After the theoretical framework and literature review, the thesis looks at two major examples of e-money implementation. The first one is Mondex, which is the company that held the first e-money trials ever at Swindon in the UK in 1995 and still tries to develop an e-money version that is compatible all around the world with interoperable e-money equipment including smart cards and card readers. The section covers many interviews with Mondex

officials in the last two and a half years at different times and a field search that was conducted in the summer of 1998 at Exeter in order to observe the Mondex close-circuit trial at the University.

The second case study concentrates on a network-based solution to e-money implementation with Digicash. The company has had an interesting story and seems to be the right choice in order to follow the developments on e-money business. It failed on its first business model and declared bankruptcy. Within a short time, all the intellectual property was bought by eCash Technologies and the project is still alive with adjustments to the new conditions and further development of the network-based e-money. These two case studies will investigate in details these two particular e-money proposals but the coverage of the thesis includes other proposals such as electronic gold (e-gold), Beenz, and the like when seem appropriate.

Chapter 6 is on three surveys that have been conducted in two different continents. Two of the surveys were from England during "Smar99cards" and "Smartcard2000", and the third survey was held in Miami, the US during "CTST2000". The first survey aimed to look at the innovators' and operators' perceptions of e-money; and the second survey was an extension of the first. The third survey in the US compared the findings to the European surveys in order to find out whether the differences between the European Central Bank (ECB) and the Federal Reserve (FED) are shared by e-money innovators and operators or not.

Chapter 7 considers the possibility of e-money developing like free banking. It develops the concept of contestable central banking after describing the relevance of e-money to free banking, and the synergy between free banking and e-money. Second part of this chapter notes the impact of e-money on monetary policy. It first looks at the current developments on money and the payment system technologies, then it investigates the money multiplier, and monetary base velocity implications of e-money. Finally, the latest developments with the current monetary policy framework is analysed from an e-money point of view, and official reaction of the Bank of England (BOE) to e-money is reflected with the help of a questionnaire.

The last section before the conclusion discusses the regulation of e-money. The chapter first investigates the regulation of banks and financial services in general and considers the new financial service regulation framework in the UK –the Financial Services Authority (FSA). After noting the current trends in the regulation of e-money, the FSA approach is analysed with a help of a questionnaire and interview notes. The chapter concludes with the discusion whether e-money could be regulated.

The final section of the thesis concludes with some indications for further directions for the research.

1.1. MOTIVATION FOR THE RESEARCH

The important role of money in an economy is generally accepted with few exceptions. Schwartz (1987), for example, pointed out the evidence that the quantity of money has a significant influence on the level of economic activity in the UK economy. As e-money emerges around the world, central banks have been publishing research papers about issues raised by this phenomenon and trying to understand the implications of it (BIS, 1996, 1997, 1998 and 2000; EMI, 1994; ECB, 1998; Robson, 1996; Good 1997, 1998a and 1998b; Issing 1999 and Greenspan, 1997 and 1998). Further than that, the US House of Representatives had hearings on the future of money in 1995 and the US Treasury sponsored a conference on the role of government in an e-money environment in 1996. The US Department of the Treasury (1996) argued that e-money and electronic payment systems for retail transactions are on the top-ten list of issues for those with significant interest in financial services. Recently, BIS published a survey of 68 central banks around the world, including the ECB and the FED, on e-money developments in order to ensure that 'central banks have adequate information to monitor the growth of e-money and to assess its possible consequences' (BIS 2000, Foreword). The World Bank also joined the discussion with a recent conference on the Future of Monetary Policy and Banking, which aimed to look ahead to the next twenty-five years and invited academicians and central bankers discussed the impact of e-money on the future of central banking. The International Monetary Fund (the IMF) was among the organisers.

This attention from the academicians, practitioners, central bankers and other governmental and private institutions to e-money may be suggested as evidence for the importance of e-money developments for central banks and consequently for the whole economy. Additionally, e-money schemes have begun trials around the world in Swindon, a small UK town, in 1995 and it is not surprising to have new announcements for a new trial from time to time -like e-gold. Thießen (1999) looked at most of the proposals ranging from Millicent to Cybercash and tried to find out why most of them failed. But since then new versions have been developed such as Paypal. Digicash is an example of the failed versions but there are serious projects such as Geldkarte in Germany, which has distributed more than 50 million smart cards capable of holding monetary value to be used for transactions. All of the trials, failed or still alive, have resulted in increased public interest, thanks to digital economy

discussions, which seems to be getting even more popular every year. As new projects and trials are announced, the myth surrounding e-money has substantially increased, creating a need for more analysis, which is the aim of this thesis. There also seems to be a need to define e-money in the first place as the confusion persists because some argue that e-money covers every electronic payment instrument from debit cards to cheques (Boeschoten and Hebbink, 1996) whereas some make a clear distinction between electronic payment instruments and e-money (ECB, 1998). However, none of them differentiates between representative and independent issuance. The thesis intends to fill this gap as well.

1.2. RESEARCH QUESTIONS

The main questions to be addressed in this thesis may be grouped within five basic headings for exploring and explaining e-money.

1. *What is electronic money*? A definition will be the starting point of the analysis. As e-money is an emerging phenomenon, recent definitions given seem to be confusing and contradictory, as they do not clearly indicate a full and complete definition because of the incomplete nature of different proposals for e-money. The intention is to single out the best definition that explains all the aspects of e-money. More than that, complexities on the current definitions will be discussed, as well.

2. *What are the current trends in the development of e-money*? This question will be answered through case studies on two different types of e-money. One type is the card-based solutions, addressed by Mondex and the other type is network-based solutions addressed by Digicash. The analysis will keep in mind that differences are getting closer and closer after the discoveries on the multi-functionalities of smart cards that allow card-based solutions to address network payments and network-based solutions to address conventional payments.

3. *What are the opinions and perceptions of innovators (as technology discoverers and providers) and operators (as solution finders and applicators) on the issues surrounding e-money? Do they have parallel views on either side of the Atlantic?* The first part of question will be answered by two surveys conducted in England during Smart99cards and Smartcard2000 Exhibitions. The second part of the question will be answered by the survey conducted in Miami, the US, by comparing the similarities and differences among European and American innovators and operators.

4. *What are the implications of e-money on monetary policy and policy instrument*? The main weight in this section will be given to free banking possibilities of e-money, which might

force central banks to a contestable framework for their future existence. Assuming e-money is a reality, potential changes in the conduct of monetary policy will be investigated and any necessary adjustment for the conduct of monetary policy will be examined as well. The Bank of England and Bank of Finland are the sources of data used in this section as part of the analysis in order to provide real examples to the analysis.

5. *Should e-money be regulated*? Although e-money is at the emerging stage, regulators (ECB, 1998 and EU, 1998) have already proposed different approaches to the regulation of e-money assuming that it needs to be regulated without waiting for a proven business case. Regulatory implications of e-money, due to its importance, will be discussed in order to investigate this question as the EU directive is finalised in the content and awaits publication in the Official Gazette. The official views of the UK's financial services authority will be investigated through a questionnaire supported by interviews in order to establish their approach to the regulation of e-money.

1.3. THE AIMS OF THE RESEARCH:

The main aims of the research are, first of all, to explain and define e-money and to evaluate critically the issues and problems raised by its emergence. The second aim is to seek out the current state of e-money trials with their success and failures including the technologies such as operating systems. The third aim is to find out innovators' and operators' opinions on the development of e-money and compare their views with central banks' approaches on both sides of the Atlantic in order to see whether they differ. The fourth aim is to investigate the implications of e-money especially for free banking alternatives to central banking and try to describe the impact of those implications on the current monetary policy framework arrangements. Finally, the last aim is to investigate whether financial authorities should intervene in e-money or not; extending the coverage to whether it can be regulated or not.

1.4. MAIN FINDINGS

The thesis, first of all, observed that the controversies with regard e-money starts with its definition. The hype surrounding the e-money phenomenon created contradictory proposals for a definition, and even the European Monetary Institute (the EMI) failed to give an acceptable or comprehensive definition as EMI (1994) ignored the network-based solutions and covered only card-based e-money schemes.

The second finding of the thesis is that e-money is still in an emerging stage and any decision made on the basis of the current pace of its development may be misleading. Almost every month, there seems to be a new announcement for a new solution to electronic representation of purchasing power. Private entrepreneurs have been investing a lot of money to come out with the most reliable business model ranging from simple Local Exchange Trading Systems (LETS) representing different items from time to bread, to complicated proposals such as distribution of gold as a medium of exchange in digital form. Not all the proposals manage to survive. Most of the earlier models designed three to five years ago have failed. But, the enthusiasm on the future of e-money seems still alive as more and more alternatives are developed, which has resulted in a situation where more e-money proposals appeared on the agenda than failed. The technology has had a strong impact on this fast moving agenda. In the beginning, e-money was almost all about smart cards but later Internet or networks gained increased priority. Recently, mobile phones, especially with wireless application protocols (WAP) gained popularity but the prospects for Personal Digital Assistants (PDAs) and digital TV (DTV) seems also very strong. If the current trend is extrapolated forward, it may be expected that the future may bring further alternative devices for e-money circulation such as game consoles, smart-card-powered electronic kitchen equipment such as refrigerators etc.

These observations led the thesis to assume that the main drivers of e-money could most probably be the innovators as the real discoverers of necessary technologies to sustain lower fixed and operating cost of e-money business and operators as the service developers to enrich the technology to reach to the end user. After this assumption, three surveys have been conducted.

In the first two surveys, the innovators and operators confirmed the potential of e-money to replace central bank money and they expected central banks and financial supervisors to regulate e-money in advance. The ECB's proposals have not been perceived as a negative influence on either innovation or competition for different schemes and the banks' monopoly on the e-money business was contested. Innovators and operators believed that e-money technology would diminish barriers to entry to the banking industry but went against the privatisation of money. They have almost unanimously agreed on a combined card and software base as the e-money 'infrastructure' for the future. The main obstacles for e-money to replace central bank money were stated as technical infrastructure and interoperability and the dominant access medium of the future was believed to be personal computers (PCs) followed

by phones (mobile and home). Instead of a single and dominant one, the world of e-money would be shaped by two or even more operating systems according to them. Smart cards would be the most critical technology for the future success of e-money schemes and lack of co-operation with banks might be counted as the main reason for the failure of Digicash. Credit and debit card payments would be driven out by e-money applications as the future payment instruments. Impact of e-money on the financial industry was given as to decrease in the barriers to entry and increased efficiency and productivity for financial services as telcos were given a priority as the most competitive against banks. Innovators and operators almost equally favoured banks and other companies for the issuance of e-money and even the majority did not see banks as the main players in the financial service industry any more. They argued that central banks might loose their power at least to a certain extent to be the sole providers of monetary base and a re-emergence of free banking era with the flagship of e-money was supported by almost half of the innovators and operators. However, the creation of a world currency through the emergence of e-money was not supported and finally, innovators and operators went against central bank issuance of e-money.

The third survey compared the results obtained to the earlier surveys' findings, as the main aim was to collect a comparative set of data. Major differences noticed were that innovators and operators on the other side of the Atlantic were somehow relatively more concerned than their European counterparts about the negative impact of central bank regulation of e-money on innovation and competition, and they were more involved in the discussion. The second difference was that participants in the European survey stated that technical infrastructure and interoperability are the main obstacles, whereas security and privacy are regarded as the leading problems for a successful e-money take-off in the US. In another separation the American innovators and operators gave more support to ATMs and hand-held devices while the Europeans paid more attention to DTV. Another distinction was that the US participants place less reliance on smart card-related common solutions, but they did feel that virtual and conventional financial transactions might require a combined solution. As another difference, the US participants gave more support to the expectation that instead of a single and dominant medium, e-money would be shaped by two or even more operating systems. Finally, the majority of European innovators and operators did not see banks as the main players in the financial service industry whereas the US perception was almost totally different on this issue. Other responses to the questions provided similar results. Whereas eight questions underlined different perceptions in different sides of the Atlantic, the rest of the 24

questions resulted in closer opinions. As a result, overall conclusion seems to be a clear consensus among innovators and operators in Europe and the US. They could not form a base for explaining all the differences between e-money perceptions of the FED and the ECB. Similar thoughts, perception and approaches to e-money among innovators and operators clearly surpassed the differences.

With regard to implications of e-money, the major finding was that for two main reasons e-money befriends with free banking. First one is that innovation in payment technology is reducing the fixed costs of banking business. Secondly, as the computing power of new generation of computers increases, risk management and data processing with huge amounts of entries might become risk-free and less costly to process. It may then be possible that the information monopoly of banks relating to financial services may deteriorate, giving further opportunities for non-banks to supply financial services to customers. Such a development may decrease the special treatment of banks against other firms, so that the argument about the private positions of banks in an economy may become even harder to defend. E-money's impact for central banking in terms of the lender of last resort function, currency backing, and multiple currencies seems likely to be especially powerful. Technically, e-money may have different impacts for different functions of money. With regard to the unit of account function, it may be expected that e-money would decrease network externalities by both decreasing the fixed cost of networking (for example private clearing systems are already available) and by lowering the cost of switching from one local network to the other. With regard to the medium of exchange function, e-money would facilitate currency competition by allowing economic entities to provide technically efficient and effective alternative monies to reach end-users. With regard to the store of value function, e-money would increase the quality and quantity of information available and thus would greatly help to reduce imperfect information possibilities and to make easier portfolio selection procedures.

With regard to findings on the regulation of e-money, it seems that every regulatory regime has its own influence on a given type of currency that the supervision covers. When e-money is issued as a representative currency, there would be no reason why regulation would be obsolete. But, when the issuance is independent with an alternative unit of account, then e-money might be extremely difficult to be kept under conventional regulation.

1.5. CONTRIBUTIONS OF THE RESEARCH

The research's first contribution is to clarify a framework for the theoretical analysis of e-money. The enormous amount of alternative definitions have been explored and a clear distinction between electronic payment instruments and e-money has been reached, including a separation of independent and representative issue of e-money. Secondly, case studies have been used in order to provide real-life examples for e-money schemes and in order to ease the understanding of the concept. Smart card operating systems have briefly been introduced, as they are the most and almost only (at least for now) suitable technical instruments to address both conventional and virtual life and behave as a bridge between the two. Thirdly, the thesis presents the perceptions of e-money innovators and operators with three extensive surveys. The first survey addresses basic problems surrounding e-money and main potential plus obstacles for successful implementation. The second survey extends the findings from the first survey and the final survey compares earlier findings in Europe to those innovators' and operators' perception in the US. The aim of this comparison has been to test whether the different perceptions between the ECB and the FED have any support among innovators and operators on both sides of the Atlantic. Finally, the thesis describes the monetary policy implications of e-money, especially with regards the synergy between free banking and central banking and potential transformation of central banking to a contestable framework. After looking at the relationship between money and payment system technologies and velocity implications of e-money, the thesis explores whether e-money should be regulated or not.

2. AN APPROACH TO ANALYSING E-MONEY

In this research, e-money will be investigated as a phenomenon, as it is an evolving financial innovation. Consequently, an exploratory approach will be preferred in order to understand the recent phase of development, which will be followed by an explanatory approach to identify potential, obstacles and implications of e-money and to clarify speculations and controversies surrounding it.

The thesis uses *case studies* to analyse two particular e-money products, one for card-based (Mondex) and the other for network-based (Digicash). The first case covers a *field search* for 10 days in August 1998 by a visit to Exeter University to explore a close circuit e-money trial by Mondex. During the field search, all the University outlets that accept Mondex value was visited and high street shops were interviewed about their interest in the project. The University library, computer room and photocopy outlet were all visited, in order to cover multi-applications of Mondex smart cards. National Westminster Bank (NatWest) officials contributed to the search by many means including information package for Mondex cardholders, potential system upgrades and questions were kindly answered in a half an hour interview. Another field search was conducted at the Helsinki University multi-functional smart card project so as to see the equipment. It was a short visit and the aim was limited just to have a visual image of the reflections of the trial in general.

For the second case study, Digicash is chosen as a network-based e-money provider. Internet opportunities have often been used for communication purposes both with Digicash and with St. George Bank in Australia as the financial service provider for Digicash's e-cash, representing Australian Dollar. Both company officials have been very helpful in both providing insights about the project and answering questions. After the bankruptcy of the company, e-mails have been used to contact the Digicash staff about the future of the product. As soon as eCash Technologies announced the taking over the intellectual property of the company, additional questions have been sent through emails in order to keep the developments up to date. Obviously, the coverage of the thesis is not limited to these two examples of e-money. Whenever a new proposal went public, a special attention has been given to the product and as soon as anything found seriously advantageous compared to earlier proposals, more time given to analyse the product. E-gold is a good example of such a case as well as Beenz and some LETSs such as Ithaca Hours and Berkeley Bread.

Because e-money is a new phenomenon, the research method selected has mainly been *survey techniques*. The first survey was conducted between 23 and 25 February 1999 during Smard99card Exhibition in London with more than 120 exhibitors including the major innovators in smart card technologies such as Gemplus, Hitachi, Schlumberger and payment system innovators such as Mondex, Visacash, Europay and Proton. 105 questionnaire were distributed and response rate was about 49 % as 51 questionnaires have been collected back.

After analysing the outcome of the first survey, the same avenue has been used for a second survey in order to extend coverage and deepen the understanding of innovators and operators perception on e-money trends in year 2000. The survey was conducted at the 13th International Advanced Card Exhibition and Conference (Smartcard2000), which was held in Olympia 2 in London on 8 – 10 February 2000. The exhibition coverage included areas such as information technology, telecommunications, payments, identification and security, transport and access control, health, e-commerce, loyalty, gaming, multimedia, and personalisation card management. Almost all e-money scheme operators such as Mondex International Ltd, Europay International, Proton World International SA and Visa International participated at the exhibition. Maosco Ltd, the company behind Multos operating system, also joined. Innovators around the World behind the e-money technology including Ascom, Gemplus Ltd, Hitachi Europe Ltd, Oberthur Card Systems, Philips Semiconductors Gratkor, Keycorb Ltd, Racal Security and Payments, Fortress U&T Ltd and Schlumberger Systems have contributed to the exhibition, as many of them were in the first survey's sample last year as well. Total number of exhibitors was just above 90 and during the survey 107 questionnaires were distributed totally and 70 of them collected back with a return rate of 65 %.

The final survey[1] was conducted at the Cardtech/Securtech2000 Conference and Exhibition, 1-4 May 2000 in Miami in the United States (the US), which was announced as the World's premier card and security technology conference and exhibition. The venue had everything from smart cards, biometrics, public key infrastructure, identity, e-commerce, mobile telephony, loyalty, mass transit, health care, to electronic banking. All the named sectors may be accepted as directly or indirectly related to the future of e-money. During the time of the survey, most of the named sectors exhibited mostly smart card-based solutions in their field of interest. The organisers expected more that 10,000 IT professionals and solution

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[1] The Bank of Finland has sponsored this survey in full during the Research Fellowship from April to September 2000.

providers, not only from the US but all around the world (65 nations) to join the exhibition. In all, 250 questionnaires were distributed during the survey, from which 97 responses were collected, giving a return rate of about 39%. The survey covered almost all of the relevant international operators including Proton World, Visa and Mondex International, almost all of the main e-money innovators around the world such as Atmel Corp, Bull Smart Cards, Digital Privacy, Inc., Hitachi Maxell Ltd., Infineon Technologies, Gemplus, Microsoft Corporation, Motorola, Overthur Card Systems and Sun Microsystems. All three of the major operating systems developers (Sun Microsystems for Java, Microsoft Corporation for Windows for Smart Cards (WSCs), and Maosco (Multi-Application Operating System Consortium) for Multos) has been represented at the venue as well.

Relating especially to the regulation of e-money, individual interviews have been used in order to find insights from the regulators and e-money issuers. These individuals have mainly been officials from the Financial Services Authority (the FSA) as the prudential supervisory authority in the UK. The FSA interview was arranged after sending the questions in advance through. One Official responsible for the regulation of e-money has completed and returned it. During the interview, the surrounding problems with respect to the questions were discussed. Before the finalisation of the thesis, the interview notes has been updated in order to eliminate any outdated information. The BOE as the responsible institution for the overall stability of the financial sector preferred to answer the questions through emails and no interview was conducted. Later, the Official view of the Bank on the development of e-money was published at the BIS (2000). During the project at the Bank of Finland, discussions have been extended through individual interview, and through discussion sessions for the proposed publications.

Other than the central bank and supervisory agencies, there have been extensive individual interviews with e-money innovators and operators, conducted at the surveys mentioned above. For all the surveys, a lot of time spent on the interviews in order to improve the understanding of e-money potential and get up-to-date information on the recent pace of projects. Interviews were extensive enough to follow the current state of e-money. Other than being survey samples, exhibitions played an additional role in the understanding of e-money. For instance, in the US survey, actual e-money has been spent on the vending machines around the venue. It was also possible to experience how e-money may be transferred on the conventional and mobile networks. Further than this, Hitachi Europe has actually donated an

electronic wallet, which enables person to person transfer of value from one smart card to another with dual card reading potential, for the dissertation as a visual contribution.

There seems no difficulty in communication through Internet in relation to questions about both on e-money products and issues. Internet helped especially in the understanding of international issues regarding e-money. One example of this help is the membership to the e-gold discussion group for which the membership started almost a year ago. The membership did not only help to capture the developments with regards e-gold but also to be informed about the alternative e-money proposals as the group addresses the issues surrounding new applications and informed the members about interesting ideas. Main interviews with regards the follow-up of Digisash has been conducted through the Internet as well including eCash Technologies take-over and following projects.

The rest of the thesis relied on the secondary analysis techniques especially to bring out monetary policy and payment system implications of e-money. Monetary and payment statistics have been evaluated in order to find guidance for the understanding of e-money. Additionally, Association for Payment Clearing Services (APACS) provided internal research results through the Internet, which shows payment instrument trends up to 2007. The BOE data including M0 and M4 indexes have mostly been downloaded through the Internet but all records of profit and loss accounts has been collected from the annual reports at the Bank's library. The indicators with regards the Bank of Finland has been collected by the research department of the Bank during the project.

Overall, the research design is based on a critical analysis of the recent literature including evaluation of recent developments and case studies are used to investigate potential, issues, and implications of e-money. Three surveys conducted collected three sets of data to deepen the understanding of e-money's innovators and operators perception. Two groups were given special importance as it was assumed that they play one of the most critical roles on the development of e-money. Innovators have the potential to carry the reach of advanced technology to new highs whereas operators are capable of solving obstacles for e-money by manipulating the technologies discovered by the innovators. Field searches conducted and exhibitions joined have helped to capture a visual image of current e-money trials and the thesis relied on secondary analysis to find out the implications of e-money.

3. DATA SOURCES

The first set of qualitative data was collected by a survey of e-money innovators and operators, which was conducted on 23 and 25 February 1999 during Smard99card Exhibition in London. The participants were asked about the potential and development of e-money, obstacles surrounding e-money, regulatory issues relating to innovation and competition and non-bank issuance of e-money, whether e-money can replace central bank money, whether non-banks be allowed to issue e-money, potential future bases, potential access mediums for the future and whether money should be privatised or not. The sample were assumed to present basic technology developments behind e-money schemes as all the payment adaptations of related technologies were presented by major companies during the exhibition.

The second set of data was collected at the 13th International Advanced Card Exhibition and Conference (Smartcard2000), which was held in Olympia 2 in London on 8 – 10 February 2000. The data set came out as complementary to the first survey with detailed questions on the issues closely related to the development of e-money. The last four questions of the survey addressed the future potential impact of e-money on free banking re-emergence, a potential world currency supported by e-money media, whether e-money can critically decrease the power of central banks on the conduct of monetary policy and whether central banks themselves should issue e-money or not.

The final set of data came from the survey conducted at the Cardtech/Securtech2000 Conference and Exhibition, 1-4 May 2000 in Miami, the US. First eleven questions were taken from the first survey and the rest from the second survey. The set provided an opportunity to make some comparisons between the European and the American perceptions with regards e-money and has been used to analyse whether the perception differs between the ECB (an in-advance approach to the regulation of e-money) and the FED (a wait-and-see policy towards e-money developments) have been supported by innovators and operators on either side of the Atlantic.

The data for secondary analysis come from different sources. The Bank of England (BOE) and the Bank of Finland (BOF) are the main data providers for the research. Most of the BOE monetary statistics are from the web-site as downloadable Excel files, but time series data about annual profit transfer of the BOE to HM Treasury were collected from the annual reports

at the BOE library. Finally, the BOF research department has provided statistical data during the project research.

In the analysis of the payment trends in the UK, APACS provided detailed information, available on the web pages. An internal research result within APACS about projections for payment trends was privately mailed by APACS as well.

The future equipment for e-money infrastructure has been seen in both exhibitions and field searches. During the surveys at extra times available, as many different stands as possible were visited and detailed information collected on the design of the e-money equipment. This process helped the understanding of practical solutions that e-money may provide during and after the launches.

For the literature review, Internet has been a useful source of information especially for the case study on network-based e-money. Many reports were printed on the Net before the publisher such as ECB (1998) made them available through the mail. The same happened for the BIS survey on e-money developments. (BIS, 2000). Additionally, some private companies such as Consult Hyperion created a publication page on the Net and shared some of the research papers with interested parties. The company also provided invitations to two successive conferences on Digital Money in two consecutive years with full documentation. During the conferences, the discussions have been actively followed and they are used as a source of enlightenment on the e-money issues. Many of the e-money operators provide information on the Net about their products and proposals as almost all e-money proposals recently have network-based solutions. The Internet became the main source for finding the new proposals and getting to know them as they emerge. Most of central banks including the FEDs, have their web pages providing useful reports about e-money. The BIS has also provided important documents on the emergence of e-money since 1996.

Finally, macroeconomic indicators for the UK were taken from Office for National Statistics publications (Economic Trends) and Datastream.

4. A THEORETICAL FRAMEWORK AND LITERATURE REVIEW

This chapter of the thesis develops a theoretical framework for the analysis of e-money and reviews the related literature before using case studies to capture current stages of scheme proposals. The first section of the chapter provides basic information on money with its definition, functions, and features. Then, it briefly summarises the evolution of money and concludes describing the general problems surrounding money.

The second part applies the same analysis to e-money including an in-depth search of definitions given by many authors and then covers its expected functions and features. It then follows the sources of demand for e-money and addresses its potential including the general problems around the concept. It concludes with a summary of e-money's impact for central banks.

4.1. MONEY

This section is devoted to the analysis of conventional money with its definition, functions and features. It starts with the definition in the following section and concludes with problems surrounding money.

4.1.1. DEFINITION OF MONEY

In general, money is defined as anything that is a generally and immediately acceptable medium for transactions even though this core definition may be extended. For example, Rutherford (1992) defined money as anything, which is generally and immediately acceptable for the discharge of a debt or in exchange for a good and service. The author gave a separate definition for fiat money (which is commonly used in modern economies) as anything, which is declared to be acceptable as money by a central bank or finance ministry in charge of the currency. Obviously, the need for money in a society is almost inevitable and may basically arise from the fact that without it, specialisation (division of labour) may turn out to be quite difficult. Money is expected to decrease transaction costs, which may be high under barter regimes and provide a unit of account as a societal measure.

Money can appear in different forms as well. Goacher (1993) made a distinction between representative and token money, as the first one is banknotes that need a widespread confidence in its purchasing power, and the second one is financial claims such as bank

deposits that additionally need a confidence in the financial service provider and in the financial system.

4.1.2. FUNCTIONS OF MONEY

It is generally accepted that there are four main functions of money. The first one is that money is generally and immediately acceptable as a medium of exchange. This function sustains money as a payment instrument and maybe it is the first requirement that anything needs in order to be accepted as money. The second function of money is given as store of value so that wealth can be held and transferred for the future consumption in money form. The third function is a unit of account meaning to act as a common denominator for the valuation of goods, services and assets in order to make it possible to compare relative prices. This function refers to the integrity of money, which may be accepted as the most important societal function of money. Because anything from tobacco to gold may function as a medium of exchange but the same is not true for the unit of account. The last function, which sometimes cited in the literature, is that money is a standard for deferred payments.

4.1.3. FEATURES OF MONEY

Typically, money has in general the following features as outlined by Goacher (1993): The basic feature seems to be *acceptability* because without being generally and immediately acceptable, money may not function at all. *Portability* is another feature that follows. Heavy and physically inconvenient things may not be accepted as money because of the difficulties of moving around. *Divisibility* is required to guarantee that all transactions for different values can be undertaken. Denominations should be available in order to enable as small as possible and large value payments at the same time. *Durability* is needed to feel safe that money will keep its form under normal circumstances and will not be damaged easily as resistant against normal heat and cold. *Homogeneity* is a necessary feature to serve in a unique physical form in order to prevent possible confusions. The forms of money should not be confusing. *Recognisability* is preferable to ensure that there will be no need for a special expertise to identify money and 'easy to capture nature' not by only average person but children and aged as well. Being *unforgeable*, at least easily unforgeable, is another feature because forgeable money may not survive, as the cost of production is so low compared to its purchasing power. Easily forgeable

money may lead to over-issue as well and may not defend the integrity at all. Schoter and Willmer (1997) named three additional features relating to the characteristics of transactions:

a) *Atomicity* meaning that a transaction either occurs or not;

b) *Consistency* meaning that conditions of the exchange need to be agreed by all participants; and

c) *Isolation* meaning that there needs to be no interdependence on two different transactions.

After listing these features, it may be argued that purchasing power of money may play the most critical role on the generally and immediately acceptance as it creates a history of reliability.

4.1.4. EVOLUTION OF MONEY

The history of money may go as back as the history where exchange of goods and services on non-barter base started among human beings. Williams (1997) stated that the story goes back to the third millennium BC in Mesopotamia and Egypt, broadly characterised by the monetary use of precious metals and added that silver as money takes back as far as the twenty-fourth century BC in Mesopotamia. In the seventh century BC, money had a form by coinage. Paper money appeared in China in 1189. Evolution from precious metals to coinage and to paper money reached Europe in 1656 as the first banknote was issued in Sweden. In the thirteenth century, before paper money, banking emerged as a specialised profession in Italy. Banks were encouraging the use of bills of exchanges and written instructions as means of payments.

It may be worth noting that paper money both in China and Sweden were printed by private companies. Nationalisation of money started in nineteenth century after many failures of private monies mainly due to over-issue and due to financial crises (because of systemic risks) arguably arising from overspending of governments in financing wars. Private monies were generally backed by bullion mainly gold or government bonds. Backing paper money with gold lasted until the 1970s despite the short or long-term disturbances from time to time. Governmental money became almost a fashion parallel to national pride motives, even the value has fluctuated greatly.

4.1.5. GENERAL PROBLEMS WITH MONEY

It may be argued that money has always been one of the most controversial issues in the history of mankind. Chown (1994) examined the creation and transmission of money and questioned the general problems surrounding it in a historical perspective. Seigniorage, which may be defined as the charge for turning bullion into coins, was addressed as a problem. The author pointed out that seignorage may also be defined as the profit element from money business only. Recently, it is sometimes argued that seignorage is the amount of profit that has been gained by central banks from money business, especially interest earning from treasury bill and bond holdings as the counterparts of currency in circulation.

Chown (1994) addressed *debasement* (which was defined as the practice of rulers to reduce gradually the precious metal content of the coins they issued under their so-called guarantee) as another problem. According to the author, Gresham's Law, which was quoted as 'bad money drives out good' only applies if money means coins that are widely accepted and pointed out currency substitution in many developing countries. Hayek (1990) argued that Gresham's Law applies only when it is forced to fix rate of exchange between different forms of money.

Changes in the value of metals used as money were addressed as another problem as these changes caused price movements. Chown, (1994) addressed b*imetallism* as it gave arbitrage opportunities. Hayek (1990) argued that *acute inflation and deflation* are the main problems surrounding money recently. After the First World War, almost every nation preferred to have their own currency. However, especially after the collapse of Bretton Woods system at the beginning of the 1970's, acute inflation became a serious phenomenon surrounding not only developed but developing countries as well. For example, in some Latin American countries such as Brazil and Argentina, hyperinflation caused money to be re-defined sometimes more than once and in some countries inflation reached around 20 % to 150 % as it has happened in Turkey since 1980.

4.2. ELECTRONIC MONEY

This section is devoted to the analysis of e-money with its definition, functions and features. The sources of demand for e-money will be evaluated and the rest of the section will cover general problems with e-money including the future potential and its implications for central banks.

4.2.1. DEFINITION OF E-MONEY

To date, there is not a generally agreed definition and terminology for e-money in the literature. In recent discussions, it is defined in different ways and called under different names such as, smart money, digital money, electronic money, cyber-money, electronic currency, electronic purse, virtual money, internet money and electronic script.

Money and cash are sometimes assumed to be the same in principle and some writers called e-money as smart cash, digital cash, virtual cash, cyber cash and electronic cash. Additionally, there seems to be a general confusion about the money and payment instruments such as debit and credit cards. In some analysis, anything from cheques to point of sales electronic fund transfers have been included in the definition of e-money, and in other cases it is strictly limited to the electronic representation of purchasing power. In the following parts, some of the definitions given to e-money will be overviewed critically.

The EMI provided an earlier analysis of e-money potential. The aim was to improve the understanding of the functioning of multiple purpose prepaid cards also named as electronic purses which were accepted to have a potential to reduce the use of coins and banknotes significantly in retail transactions and excluded network-based e-money, which has not been developed yet at that time. The money received by the issuer of an electronic purse was, in economic terms, assumed by EMI (1994) to be the same as bank deposits. In the name of monetary policy implications, e-money was considered as a substitution of one form of money for another one and not a serious impact on monetary policy was expected at least in the short run. The definition covered only card-based e-money.

Another early official definition was given by the US Department of the Treasury (1996) and e-cash was described as a claim on a party, most commonly, the issuer, stored in the form of computer code on a card about the size of a credit card or on the hard drive of a computer. The definition covered both card and network-based e-money opposed to EMI (1994).

In another contribution to the literature, Ely (1996) defined e-money as the balance recorded electronically on a stored-value card and assumed that it is a credit for the balance on the card, which is a liability of its issuer. The author argued that specie (i.e., gold and silver coins) is the only form of money that is not a form of credit, but such coins no longer circulate in market economies and concluded that fundamentally, e-money is no different than all other forms of money in use today.

In one of the first publications on e-money in a book format, Lynch and Lundquist (1996) demonstrated that digital money is an electronic replacement for cash, which is storable, transferable and unforgeable. The authors argued that electronic commerce needs it's own type of payment instrument and with the help of advanced technology of smart cards and encryption, e-money is ready for use securely. The analysis gave an earlier picture of expected virtual life and e-money has been assumed as one of the most important complementary components in this new way of life.

One of the earlier central bank discussion papers looked at the implications of e-money from a central bank point of view. Boeschoten and Hebbink (1996) considered e-money to include multi-purpose prepaid cards as well as other electronic transactions used in internet-payments (e-cash) and EFTPOS (electronic funds transfer system at the point of sale) payments and argued that such as prepaid card payments, electronic transfers replace cash turnover and consequently currency demand. They argued that any type of payment instrument operating electronically and reducing cash circulation might be treated as e-money. Their analysis extended the definition to any electronic payment instrument that has been used for executing transactions or can be used in the future as they have taken the main criteria as 'decrease in demand for currency in circulation'. A similar line of argument was offered by Solomon (1997) as it was concluded that developments in the electronic delivery channels through electronic funds transfer (EFT) payment systems might lead to fast money flows and eventually virtual money.

As the international organisation for national central banks, BIS started to follow e-money developments as early as 1995 and produced its first report on the security of e-money issuance. Instead of giving a particular definition, BIS (1996a) preferred to make a description as, stored value products that are generally prepaid payment instruments in which a record of funds is owned by or available to the consumer's possession. The technology that can support true electronic currency has been observed as ready.

In the same year in another publication the BIS (1996b) defined e-money as the monetary value measured in currency units stored in an electronic form on an electronic device in the consumers' possession. It was demonstrated that the electronic value can be purchased by the consumer and held on the device and is reduced whenever the consumer uses the device to make purchases. That application was found contradicting with traditional electronic payment transactions such as those with debit or credit cards, which typically require online authorisation and involve the debiting of the consumer's bank account after the transaction.

Two different types of electronic devices were named: prepaid cards and prepaid software products. With prepaid cards, it was pointed out, the electronic value is stored on a computer chip (or integrated circuit) embedded in the card and value is typically transferred by inserting the card in a card reader. It was added that with software products the electronic value is stored on the hard disk of a computer and is transferred over communication networks such as the Internet when payments are made.

In another BIS initiative, the Group of Ten (the GOT) admitted the confusion on a precise definition of e-money in its 1997 publication[2]. Instead, the GOT (1997) preferred to exclude large value Interbank funds transfer systems, giro, automated clearing house and direct debit systems, new means to access credit card payments and home banking systems, from the definition. Then, the report underlined the fact that e-money devices typically represent a general or pooled liability of an issuer on a hardware device changing from plastic cards with chips to special software on personal computers.

Rossell (1997) argued that despite the recent 'hype', many people are not sure precisely what is meant by the term e-money and the 'lingo' that has developed around it. He argued that, in a nutshell, e-money refers to balances stored on a computer chip embedded in a smart card that can be used for transaction purposes.

In an individual contribution, Roberts (1997) argued that as in the case with smart cards, electronic cash resembles traditional, privately issued banknotes in the sense that it represents a liability of the issuer and not of the buyer using e-cash to make a purchase.

Another contribution to the literature came from Schreft (1997), who assumed that stored-value cards are one form of electronic cash-electronic substitutes for paper currency and indicated that the newer stored-value cards are a type of smart card in that they have an embedded computer chip that can hold much more information than a magnetic stripe. The author noted that digital cash (also known as cyber-cash or e-cash) is the other form of electronic cash coming into use today and added that it consists of bits and bytes in cyberspace and substitutes for paper currency in transactions made over the Internet.

In a descriptive analysis of the alternative e-money proposals, Wayner (1997) underlined the differences between account-based e-money that stores value in a ledger of a trusted third party and exchanged by subtracting the amount from one entry to another, and

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[2] The publication was mainly about the consumer protection, law enforcement, supervisory and cross border implications of e-money and has been written by the working party on e-money for Group of Ten.

token-based e-money that revolves around unforgeable packets of bits that are traded such as pieces of paper and coins. This definition separates e-money from advanced payment solutions. But, Warwick (1998) gave a description for e-money, as being electronic circulation of the US dollar and everything that eases this circulation has been included within the definition. The author actually proposed a 'federal electronic currency system' to eliminate the cost of banknotes and coins, which was estimated to be around $60 billion annually in the US.

The European Commission Draft Directives (1998) argued that e-money can best be conceived as a digital form of cash as it has many of the characteristics of cash and gave the primary similarity as that to use e-money, authorisation is not required from a bank or other third party. The Draft defined e-money as monetary value, which is;

1. Stored electronically on an electronic device like a chip card or a computer memory;
2. Accepted as means of payment by undertakings other than the issuing institution;
3. Generated in order to be put at the disposal of users to serve as an electronic surrogate for coins and banknotes; and
4. Generated for the purpose of effecting electronic transfers of limited value payments.

After two years of discussions on the European legislation procedures, this definition has been finalised with some changes. The final version is that e-money means monetary value as represented by a claim on the issuer which is (i) stored on an electronic device; (ii) issued on receipt of funds of an amount not less in value than the monetary value issued; (iii) accepted as means of payment by undertakings other than the issuer. This is one of the first legal definition given to e-money up to now.

In this research, e-money will be defined as in the ECB (1998) which defined it broadly 'as an electronic store of monetary value on a technical device that may be widely used for making payments to undertakings other than the issuer without necessarily involving bank accounts in the transaction, but acting as a prepaid bearer instrument'.

This definition covers the following aspects of e-money:

1. E-money is a prepaid bearer instrument excluding all kind of electronic payment instruments such as credit and debit cards and EFT payments. Obviously, the word 'prepaid' should be taken with cautious as e-money may also be earned directly or be owned as a credit.
2. It covers payments to undertakings other than the issuer which is a required aspect to differentiate e-money products from single purpose prepaid cards such as telephone cards.

3. Transactions do not necessarily require a bank account or any other financial service providers' authorisation. This potential excludes all kind of account-based (debit or credit) payment instruments.
4. E-money stores monetary value on a technical device with a capacity to be used widely for making payments. The definition does not specify the type of technical device, which may be accepted as a better approach to the definition of e-money as it is in an emerging stage and technical potential of proposed devices are not fully clear yet.

From this point, the ECB definition of e-money will be accepted as the most convenient definition, as it covers almost all of the accepted aspects of e-money. However, technological developments relating to e-money products should be watched carefully as these may still have an influence on the above definition with an unexpected innovation changing some basic features of e-money. On the other hand, the definition seems to cover just representative issue of e-money as it limits the definition to prepaid instruments, which means that e-money may be used only as a medium of exchange that has been covered by a current monetary system. In order to make a purchase, for example, first electronic value should be paid for so that it can be owned and transferred to complete the transaction. As a result, e-money for euro-zone becomes e-euro and e-money for the US becomes e-dollar. Unfortunately, this definition does not cover all type of e-money proposals that are available in the e-money market at the moment. Just to give an example, Beenz[3] can only be earned on the Internet services and it can not be paid for by the end-users. Consequently, the definition does not cover the electronic issue of independent e-money, which is that the monetary value held by the electronic device does not represent any given national or international currency. In this case, anything from tobacco to time or bread that is used as money on an electronic environment may be included on the definition. These kinds of practices are already available in different parts of the world through LETS[4] but not limited to locality only. At least one company at the moment has been trying to circulate gold digitally as a medium of exchange[5]. To conclude, it is better to be cautious not to limit the definition of e-money to prepaid instruments as it is not only limited just to represent a given national monetary frameworks' medium of exchange but it may be an independent part of a competitive monetary arrangement.

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[3] www.beenz.com

[4] BREAD is local money that comes in denominations of 1Hour, 1/2 Hour, and 1/4 Hour. It is backed by labor and valued in Hours, but it can be thought of as $12 per Hour. Everyone is encouraged to participate and offer goods or skills for local money. (http://www.breadhours.org/)

4.2.2. FUNCTIONS OF E-MONEY

It may be argued that the expected functions of e-money would be the same as traditional functions of money, which were discussed in section 2.1.2. However, e-money is in its emerging stage and it may generally be accepted that it needs to prove itself as a medium of exchange in the first place. Without functioning as a medium of exchange, other functions may not follow. Obviously, it may be a mistake to limit e-money's whole function to medium of exchange, which was mostly captured by advanced electronic payment instruments such as credit and debit card schemes in many developed economies.

4.2.3. FEATURES OF E-MONEY

It may not be wrong to argue that e-money needs to have all the features of traditional money, -acceptability, portability, divisibility, atomicity, consistency, isolation, durability, homogeneity, recognisability, and unforgability- as analysed at section 2.1.3. On the other hand, because e-money can most probably and naturally be presented by a technical device, below mentioned features may help for the wider acceptance of e-money (Schoter and Willmer, 1997):

1. Economy: Transaction costs arising from the usage of e-money should be as low as possible and competitive against other payment instrument like cash and access products (credit and debit cards) in order to attract more customers. Basically, e-money has its real potential if it can decrease transaction costs below banknotes and coins. It may be wrong to assume that currency in circulation is cost-less to the society. The simplest cost is the interest that has been given up to keep the change in the pocket. Additionally, the real societal function of money in a society is to support division of labour by decreasing transaction cost as low as possible and if e-money can decrease this cost further, then its chance for being demanded might increase.
2. Interoperability: It is defined as compatibility of different e-money devices to each other. This feature may be accepted as one of the most critically required feature of e-money because unless interoperability of e-money is sustained, the number of potential users may not reach a level to support the critical mass required to maintain the cost of investment. Without interoperability, e-money products may not be accepted widely, which is a necessary requirement to fulfil the medium of exchange function. This requires

[5] www.e-gold.com

compatibility of all electronic equipment so that one e-money holder can make spending anywhere, anytime and anyhow (with any instrument such as TV, mobile or conventional phones or PDAs).

3. Conservation: This feature is required to guarantee that money hold its value over time securely without any technical disturbance. Unless used or destroyed, e-money should be fungible. As a result, the software to store value for the holder should always and for a very long time be reliable to keep the records safe and sound and revocable. Additionally, hardware that may get damaged as years pass by may cause loss of value and lower the potential demand for e-money.

Security of e-money, which will be analysed in more detail in the following sections, may be compared to unforgability of traditional money. E-money needs to be user friendly requiring an ease of use further than recognisability. It should support disabled, aged and under-aged groups of the social life in order to sustain acceptability base. A very complicated software and hardware solution for e-money issuance may not create demand at all just because of the preference for simplicity.

Anonymity of e-money may also be addressed as a privacy concern although even traditional money provides a limited anonymity. Off-line capacity to both transfer and receive e-money may extend the acceptability as well.

4.2.4. DEMAND FOR E-MONEY

Whatever the definition, or functions or features of e-money is, if there is no demand for it, any analysis may be in danger of being no more than an imaginary practice. However, the theme of this thesis is that there is already a real demand for a new payment alternative especially for international payments. An example can be given from personal experience with the difficulties of sending around £8 to the FED as a payment for a certain publication. At least two high street banks visited wanted to charge a transfer fee of not less than £5. The way money sent was to put £8 worth of the US dollars into an envelope and mail it to the address. It worked even though all the risks that had been taken. No other payment instrument offered by the banks seemed more convenient than this risky practice. It may seem quite primitive but it proved itself satisfactory at the end of the day. From this point, e-money may address similar problems that current monetary frameworks seems to be stuck and there seems to be a clear lack of solutions in international small value payments.

In this framework, Birch (1997) tried to find an answer to the question whether the existing and familiar payment technologies such as notes, coins, cheques, debit cards, credit cards, charge cards, wire transfers and so on extend their reach from the real to virtual worlds. The author argued that one particular sector named as micro-payments is of particular interest because banks' existing payment offerings stop being useful as the size of transactions falls below around £5. It was pointed out that potential of Internet payments innovation should fulfil these gap because it is not possible to use coins and notes on the Internet as a real life solution to the above problem.

In a very useful analysis, the author broke down online payments sector into four subsections as:

1. *Macro-payments*, which are payments in access of £10.000 and can only be made convenient and cost-effective by using electronic funds transfer systems.
2. *Mini-payments,* which are payments from £10 to £10.000 and can be made using a variety of means ranging from credit cards to electronic cheques.
3. *Micro-payments,* which are payments from 1p to £10 and cannot be made convenient and cost-effective using existing payment means.
4. *Nano-payments* which are payments that can not be made using any existing payment means whether cost-effective and convenient or not, such as a payment of 0.5p.

The author excluded macro-payments from the analysis assuming that they will be conducted by wholesale payment systems and assumed that mini-payments are made by using credit and debit cards basically. Micro-payments were accepted as the main type of payments that attracts the most attention with two principal categories of implementations: software-only and smart card-based e-money schemes.

In a similar analysis, Bauer (1995) described the cyberspace as the collection of computer communication networks that has evolved since the early 1970s and argued that there are three main reasons that attract vendors to cyberspace. The first one was given as millions of young, educated, and wealthier than average people throughout the world that have at least some access to Internet and the characteristics of these people are very attractive to marketers. The second one was given as that a business can offer its goods and services relatively cheaply, world-wide and 24 hours a day by just building a presence in cyberspace. The final reason was given as that the presence in cyberspace might boost sales by distributing detailed information to potential customers. The problems that should be overcome as the cyber-market evolves were named by the author as the difficulties in access by everyone, procedural and legal

challenges, controlling the content of material sold, copyright issues and as the *most important problem of how to pay for cyber-goods and services*. The author discussed why new payments instruments are needed for cyber-market. One reason was stated as the problems of trust, security and size for transactions arguing that a customer can mail the seller cash or cheque even if it is unlikely to be a satisfactory solution because of the lack of necessary trust between two strangers in cyberspace. Credit and debit cards may be accepted as a better alternative but as an open system, the potential for fraud was described as huge for credit and debit cards in cyberspace as someone with only a little technological expertise could get information about card numbers. Credit and debit cards were also said to have a problem in small value payments because the average cost for a credit card transaction was given as around 88 cents which makes them an uneconomical means of paying for small-value items. Lack of anonymity was stated as an additional problem. It was argued that once the security issue is resolved, new methods of payment would widen access to cyber-markets and stimulate the development of new products. The author concluded that e-money proposals have clear advantages as they may lower the transaction cost and spur the development of many new products parallel to e-commerce developments.

On the same argument, Birch and Shaw (1995) tried to demonstrate the radical changes that e-money allows in Internet-based businesses such as computer programming, text marketing such as newspapers, video business as interactive TV or alike, music industry and new products composed of combinations of these services. They analysed recently available payment methods such as billing and subscription and realised that all available payment systems can technically not support Internet-based businesses. Consequently, the authors stated that what is required is a form of e-cash that allows consumers to pay the cost for their purchases at the time of sale and have that payment transmitted directly to the content-provider as the goods are being transmitted to the consumer.

This potential for electronic payments have been analysed by others as well. For example, Fiske (1997) argued that all kind of mass-market payment schemes would benefit by using a technology that provides the following:

- Transfer of e-money over digital networks in real time, which seems possible after several schemes supported by cryptography, (some on software and some on smart cards) have been developed in recent years.

- Widespread acceptance in the physical world as well as in cyberspace which requires that the value issuers should be as trusted as those in the real world who issue real notes and coins and the payment methods should be acceptable in everywhere. In the long term, it may be cheaper and more flexible to use digital cash.
- The devices that connect the payments to the digital networks must be cheap and widespread.

The author mentioned that e-money may begin to influence existing billing systems, because the payment processing components will need to be modified to take into account of the online nature of the new medium. It was believed that an exiting opportunity exists to leverage the real time cleared funds nature of e-cash to provide new online digital services, which would otherwise be commercially unfeasible. It was concluded that traditional billing is a barrier to profitable business and e-cash provide a major opportunity to service providers.

After briefly summarising the source of demand for e-money from the virtualisation of life, the next section looks at the potential of this new instrument. Before that there may be one source of demand for e-money that needs to be addressed: Currency substitution in many countries seems to be a reality in recent years[6]. One of the basic reasons for this phenomenon is the unreliability of the national monetary framework that serves the society. But, the phase of substitution is generally limited to the store of value function of money and even foreign banknotes and coins are sometimes used for transaction purposes, the reach is most of the time limited to certain relatively developed regions in those countries. If it is assumed that e-money could provide an alternative as a medium of exchange in countries where there are conditions leading to currency substitution, the pace of it would be faster and wider. As a result the reach of 'good money' increases and 'funny money' may find less and less circulation basis unless the monetary policy regime has been transformed to a competitive base. In short, the demand for e-money may be extended further with the virtualisation of life and there may be increased demand for cyber payments that is not feasible with currently available instruments. There may be a demand even from conventional life for relatively more stable payment mediums in different parts of the world in a way of enriching the reach of 'quality' monetary frameworks.

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[6] The rate of currency substitution in Turkey, for example, has kept changing between 30% to 55% since 1980.

4.2.5. POTENTIAL OF E-MONEY:

There seems to be quite a lot speculation about the potential of e-money but most of them are based on different assumptions. In this section, some of the relatively obvious potential will be discussed.

Micro-payments seem to create a real demand beyond any speculation and this demand may be observed in many e-commerce practices, as there are still going on discussions about security of credit and debit card payments on the net. Other options may stop being useful for distant micro-payments. To give an example, if an entrepreneur wants to have a business to sell valuable information in the form of content trading for 5p per page, there seems no single payment instrument available for such a transaction to be completed instantly and independently without accumulating. If an author wants to publish a book on the internet for £1, it is again the same and there is no alternative to send a cheque, which even mailing cost becomes a serious portion of the cost of the good being bought.

The cost of money transfers, especially international, seems to add another dimension of the demand for e-money, which may also be pointed out as a barrier to international small-scale trade. The example given at the beginning of the earlier section may fit well as an example. Maybe, systems such as SWIFT or national wholesales real time gross settlement payment systems managed to enrich payment options but the cost reflected to the end users came out to be unacceptably high. Any e-money scheme that can decrease the cost of international transactions and enrich alternative ways may create demand for the solution. To enrich the argument, one recent discussion in the UK may be given as an example of this point. For the ATM withdrawals, the banking industry want to charge a fee structure and consumer associations refused the proposals. Any new payment systems that can decrease current cost structure of payments seem to have a potential to guarantee a chance of survival against conventional solutions in this sense.

Another interesting potential lies on the multi-purpose smart-card applications. It is getting to be generally accepted that technical developments on smart cards have been increasing the amount of data that smart-cards can hold and manipulate and security has been increasing as new applications on software are designed with cryptographic solutions. As smart-cards get more integrated to daily social life, e-money may play a wider role than recently observed potential.

The US Treasury (1996) named two underlying developments that supports e- money:

1. Decline in the cost of computing power and increase in processing performance.
2. Advances in communication technologies with continuing increase in the application of computer technologies to communication systems and sharply growing capacity of communication channels in addition to the reductions on the time needed to transmit text and graphics as a whole.

Four basic benefits of e-money were stated as the lower transaction costs, reductions in alternative payment instruments (such as credit cards) fraud, reduced risk of theft and vandalism in retail outlets and increased convenience for consumers. The study explored forces for e-money growth and argued that expanding electronic-based government payments and collections may be a turning point in e-money products. If, for example, government unemployment benefits and the like are paid in e-money form, the essential critical mass for the development of e-money may be easier to reach (the US Treasury, 1996). Recently, the US government preferred to transfer all kind of benefits in electronic form, which is knows as electronic benefit transfer system.

Birch (1996) made some suggestions as to the likely retail-banking environment in the coming world of e-money and the Infobahn. The author argued that there are two reasons why e-money is going to establish a presence more rapidly than many people imagine at present. The first reason stated as increasing cost of physical cash because of labour costs and counterfeiting and the second reason as decreasing cost of e-money due to advances in smart card technology. It was noted that the UK is an important player in card markets because there are more payment cards in circulation (around 86 million) than any other country and nearly four-fifths of the population have a credit, debit, ATM or charge card with 3 billion transactions annually. Birch (1996) predicted that if banks use smart cards and superhighways to respond to the threats to their business, then; the retail bank of the future would operate by serving customers with smart card-based e-money and an all-pervasive digital network for which the Internet is a precursor. The threats were named as banking competitors which use fully digital channels and achieve much lower cost overheads such as First Direct (telephone banking) and non-banking competitors using electronic channels to bypass retail banks completely such as supermarket chains and telephone companies issuing prepaid cards. E-money to the banking environment was expected to extend on-line banking.

Another contribution in this area came from Brooks (1997), who argued that treating e-purse simply as a replacement for small change in the high street and analysing its impact on this basis may provide limited insights into the future. The cost of the cards and the

infrastructure may cause a proven business case hard to come and early experience has shown that increasing the functionality and utility of the smart cards is the only way to justify the necessary investment. Multi-function closed community cards was found to offer the best hope of justifying investment in the short term and the emergence of consumer electronic commerce, enabled not just by the PC but also by DTV and GSM or even PDAs, could become a significant driver in the medium term. Card-based loyalty schemes in the retail sector were addressed as starting to overlap with payments, and helping to provide a critical mass of smart card readers. The widespread deployment of smart card-based digital certificates to provide remote identification and authentication was demonstrated as a feed back into e-purse deployment.

And final contribution to be cited here is from Birch and McEvoy (1997). They attempted to synthesise directions in payment cards, the Internet and physical cash to make some suggestions as to some of the ways in which e-cash will be the trigger for major changes in both business and society over the coming years. It was argued that emerging technologies, particularly the synthesis of cryptographic software and tamper-resistant smart card hardware into the electronic purse, will make the cost of entry into the currency issuing market quite small both as a means of supplying credit or raising finance with encouraging customer loyalty. The paper indicated that, the more revolutionary impact of e-cash might come from its ability to create new stores of value rather than its ability to act as a means of exchange. According to authors, the addition of e-cash to the banking environment will change bank's basic functions namely, the deposit and withdrawal of cash, by making remote banking the dominant channel.

To conclude this section, it can be argued that e-money is not simply a dream for technology buffs. Just the opposite, there seem to be clear sources of demand for such an alternative not just in the future but for the present.

4.2.6. GENERAL PROBLEMS WITH E-MONEY

For the earlier version of e-money, there was a huge hope for very successful launches and soon-to-be-proven business cases at least in the medium term. But, the hype has not been realised. Most of the earlier versions have gone. BIS (2000) listed some of those unsuccessful schemes as Barclaycoin in the UK, Visacash and Mondex New York and CyberCoin for the US, Primeur Card in Netherlands and Digicash (the first version) in Germany and Australia. The list may be longer but even with its current form, it mentions some serious problems surrounding the future of e-money. This section addresses these issues briefly.

Basically, most of the current problems were noticed at an early stage. For example, Wennigner and Laster (1995) stated c*ompatibility* as a problem, especially for card-based e-money projects. They also proposed solutions. One option was to concentrate on contact cards, which touch a card reader when registering a transaction and the other was a contact-less card, which only need to come in proximity to a card reader. Another issue named was *traceability,* arising from the need to record of each transaction, which is burdensome and expensive and may represent an invasion of *privacy. Clearing and settlement* when more than one issuer share the same scheme, *issuance by non-banks*, *consumer protection* and *money laundering* were other problems addressed by the authors.

In an earlier official publication, the US Treasury (1996) investigated *obstacles* to growth of e-money naming them as security especially Internet security, authentication, interoperability, and technological change. Technological change named as an obstacle by the report, because the march of technological innovation seems unending, offering opportunities for improving communications and computer capabilities but at the same time, it clouds, rather than clarifies, the future, creating incentives to wait for the next round of improvements. Currently, it seems still holding. To give an example, as soon as WAP technology have been discovered, conventional Internet seemed to loose its priority for payments and mobile phone handsets have been given more hope as to act as both holder and transmitter of e-money.

In a FED working paper, the role of cash in payments was investigated by Good (1997) and three main reasons were given why economic units prefer cash as their main choice in payments as (i) cash is convenient for small, inexpensive purchases, (ii) force of habit and finally (iii) recipient prefers or only accepts cash. The author compared accountable and non-accountable schemes, as they are competitive to each other. It was assumed that in an accountable scheme, the smart card does not act as a universal cash replacement, but it acts as an added payments medium for low value cash transactions. Anonymity is not as strong as cash. On the other hand, it was stated, an unaccountable scheme has a fundamental difference that is manifested in the ability for transfers between smart cards of monetary value to occur with an unauditable transfer, which is not very different from an exchange of paper money. The author argued that this fundamental difference essentially creates a form of private money, which puts the creation of value into the realm of the private rather than public sector. It was mentioned that the location of money in an unaccountable scheme might never be fully known until the cards are redeemed for value.

Most of the problems sited in the literature obviously contributed to the failure of earlier versions of e-money proposals. But non-of them may have a serious impact as the one that will be analysed in the following section. It is the security of e-money and unless the end-user is fully convinced in one way or another, the demand might never get to a level of sustaining a critical mass for a potentially executable e-money system.

Security of E-money: Security of e-money is not a technical issue only. It has a social dimension as well. Unless the holder of e-money feels fully defended against any fraudulent attack on the amount that is held in the electronic device, the willingness to replace conventional options with the new instruments may never be realised. That's why security of e-money is given a subsection here to fully cover all the aspects of it. The section will be a brief summary of an influential report produced by the BIS and since then it seems to be one of the most reliable analysis of the security of e-money.

BIS (1996a) report focused on stored-value products. It found many major differences as regards design and implementation of e-money products as *technical presentation* of money differs[7]. *Transferability* was also mentioned as a difference, meaning whether participants can undertake transactions with one another without participation by the issuer or another central authority. It was argued that free transferability, in which consumers, merchants or banks may make unlimited direct transfers between one another, is a theoretical concept only and transferability is restricted in one way or another even the level of restrictions differ among different products. *Issuer structure* may be another area that e-money products may differ. If there is more than one issuer for a single type of product, then the scheme needs clearing and settlement and the card number or a cryptographic certificate is needed for the identification of the issuer. Additional areas that e-money products differ among each other are mentioned by the report as well[8].

BIS (1996a) discussed the security risk focusing primarily on those aspects of e-money products that are different from the conventional payment instruments such as credit and debit cards and electronic fund transfer systems and grouped them into two: fraud risks and

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[7] If the device stores and manipulates a numeric ledger, with transactions performed as debits and credits to a balance, it is called as a 'balance-based' product. If the device stores electronic notes that are uniquely identified by a serial number and are associated with a fixed, unchangeable denomination, it is called 'note-based' product.

[8] On-line authorisation: This requires an additional communication, which adds greatly to the cost, and time required for transactions. Information Collection: Some e-money products collect all the data and some collect just as little data as possible due to privacy concerns. Ability to Reload Devices, and Single or Multiple Applications were named as other areas that e-money products differ than each other.

malfunctions. Fraud risks were stated as duplication of devices, alteration or duplication of data or software, alteration of messages, theft and repudiation of transactions.

Against these risks, security measures were categorised into three parts **as prevention, detection and containment**. The aim of these measures in general terms was said to safeguard the integrity, authenticity and confidentiality of critical data and process, as well as to protect against losses due to fraudulent duplication or repudiation of transactions. First **Preventive** measure was given as *tamper-resistance of devices.* The report indicated that the electronic devices used in e-money products provide the first line of defence against outside attacks. Active tamper-resistant features include sensors within the chip that detect unusual levels of heat, light and electrical current and render the chip inoperable under an attempted attack, as well as providing evidence that tampering has been attempted. This measure is valid for card-based products. For software-based products, the software itself has access control mechanisms to prevent the user from changing or duplicating data in an unauthorised manner.

Second **preventive** measure was named as cryptography by the BIS (1996a). It was argued that cryptographic techniques provide the logical protection of e-money systems by ensuring the confidentiality, authenticity and integrity of devices, data and communications used in transactions. Encryption was defined as a technique to protect the confidentiality of data during transmission or while stored on a device and may be particularly important for certain types of sensitive data used in security processes such as cryptographic keys. Other areas that cryptography is used were given as to authenticate the identity and privileges of devices in transactions, to certify the validity of electronic notes or other data created by an issuer or system operator and to verify the integrity of messages exchanged between devices to detect whether or not a message has been altered before reaching its intended recipient. It was argued that the use of active or dynamic asymmetric cryptography, in which chip cards generate digital signatures or perform other cryptographic calculations, can be applied to prevent attacks that may be attempted through replaying previous messages and observing the exchange of cryptographic information. Relating to key management and storage, the report indicated that all the e-money systems involve cryptographic keys that must be kept secret, or secure against unauthorised observation, in order to prevent unauthorised duplication or alteration of data.

On-line authorisation was named as the third **prevention** method. As mentioned by the report, in card-based systems, on-line authorisation is only required at the time the device is loaded by a debit to a bank account but as a prevention method additional on-line authorisation

may be asked for increasing security. For software-based products, on-line authorisation was considered to be necessary for all transactions. Other **prevention** measures listed by BIS (1996a) as verifying expiration dates, number of transactions executed with the device, balances on the device against a possible maximum balance limit, maximum balance limit itself procedural and administrative controls during manufacturing and lastly cryptographic key management and card personalisation.

The report discussed *transaction traceability and monitoring* as the first **detection** measure. It was observed that transferability and strong traceability might be chosen by e-money issuers as a detection measure in order to reduce security risk. *Interaction with a central system* was stated as the second **detection** measure which allows the central operator to check security parameters on the card for consistency, to update security measures on the device, such as cryptographic keys, and, in some cases, to gather additional transaction data from the device. *Limits on transferability* was the third **detection** measure stated by BIS (1996a). It was argued that such limits placed on the transferability of stored-value balances or notes may reduce the opportunities for fraudulent balances to be used without detection. *Statistical analysis* was the last **detection** measure and it was named as to check system-level data on payment flows in order to detect unusual volumes of payments that could be indicative of fraud.

Containment measures were stated by the report (BIS, 199a) as: *time and value limits on devices* to reduce the potential financial gain from fraud, *registration of devices* to facilitate investigation of any attempted fraudulent activity, *hot lists* to check for suspect cards at each point of interaction with the system, *disabling devices* for multiple attempts to enter a PIN or multiple failed transactions, and *system suspension* when a wide-ranging fraud is detected or suspected.

The security measures was evaluated and it was stated that potential measures were acknowledged as available to provide *adequate security for e-money systems*, in particular compared with other common forms of retail payment. According to BIS (1996a), a wide range of options which also presents trade-off in the areas of cost, functionality, speed and reliability are available to product developers in terms of specific chip card security measures, cryptographic algorithms, key lengths and transaction monitoring. It was indicated that international standards have been developed for particular aspects of e-money products, such as the basic functionality of chip cards, certain cryptographic techniques and communication protocols. These developments were not found enough for the security and it was argued that it is more important to focus on the overall security risk management approach for a particular

product, rather than on the use of individual measures. It was added that relatively low maximum balance limits on devices might represent one of the simplest yet most effective deterrents to fraudulent attacks. In a comparison to other forms of payment that are paper-based or rely on plastic cards with magnetic stripes, it was accepted that microchip cards are much more difficult for counterfeiter to fraudulently alter. The physical barriers against tampering with devices were supported to provide one of the most important security measures for e-money products. It was mentioned that tampering with microprocessor cards is beyond the means of the casual criminal, while even for experienced or professional computer thieves, tampering with chip cards would also be extremely difficult and costly. On the other hand, continual strengthening of the tamper-resistant features of card-based products were mentioned as necessary because as time passes by, attackers may have enough experience to misuse e-money products.

For software-based systems, on-line, real-time authorisation was accepted by BIS (1996a) as a 'must'. Cryptographic algorithms with especially longer key lengths were valued as a high level of security for e-money products. Relating to the feature of transferability between users, it was not believed that this would pose greater security threats due to permittance of full traceability of transactions so that shadow-balance accounting may be used to provide a very high degree of detection of possible fraud. Statistical analysis of payment patterns was advised on the belief that this might increase the cost of attempting fraud because of more care needed not to be caught.

BIS (1996a) named three additional considerations for the use of e-money products as the criminal activities, reliability and privacy. For the use of criminal activities, it was concluded that the security features such as unique serial numbers that suppliers intend to implement in order to protect issuers from fraud risks might make these products less attractive for use in criminal activities than many existing payment instruments. Limits on transferability and expiration dates on devices or balances were also mentioned to constitute practical obstacles to the extensive use of e-money products for money laundering. In the discussion of reliability, it was concluded that clearing of transactions, storage of cryptographic keys or other critical functions, contingency arrangements for the systems would be important factors in ensuring reliability. With regard privacy, it was argued that advanced cryptographic techniques offer the potential for a greater degree of privacy in financial transactions that has been possible with other types of electronic payments. Especially blind signature technology may extend the reach of privacy to the virtualisation of money.

BIS (1996a) concluded that e-money systems especially with network-based schemes seems to satisfy an adequate level of security but no single measure or set of measures might be sufficient for a particular product unless a combination set of measures with the rigour with which they are implemented are used to serve to reduce the risk. It may be wrong to argue that secure e-money is not possible as it may also be wrong to argue that e-money is not risky at all. Money will obviously be the most valuable electronic product and all the scheme holders need to pay enough attention to the security as it is one of the most important requirement for the sake of the future of e-money.

The next section will look at another import problem surrounding e-money developments.

Legal Issues: Group of Ten report[9] on e-money (GOT, 1997) investigated legal issues relating to e-money including consumer protection, law enforcement, supervisory and cross border issues and this section will rely on that analysis.

Consumer risks posed by e-money were grouped into three. The first group covered financial loss risks including; theft of the consumer's card, manipulation or interception of the electronic messages sent over computer networks, accidental loss or damage of an e-money device, operational errors and malfunctions, insufficient transaction records to allow prompt resolution of errors and disputes, insolvency and bankruptcy of the issuer and any other reason that may dishonour e-money payments. Second group covered consumer risks that may cause incomplete payments in the amount or at the time and location that was desired because of malfunctions of terminals and lack of merchant acceptance or interoperability between different products. Third group covered consumer risks that consumers may face for the information generated through their use of e-money products, which may be disclosed without their consent or used for fraudulent purposes.

Private measures to address consumer risks were analysed including measures such as potential PIN numbers, limiting the amount of funds held, carrying more than one type of instrument, analysing the terms and conditions of the contracts for privacy concerns, physical

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[9] GOT (1997) named the underlying objective authorities may have in the banking and financial system report as: 1. Limiting systemic and other risks that could threaten the stability of financial markets or undermine confidence in the payment systems. 2. Providing consumers with adequate protection from fraud and unfair practices, financial loss or unnecessary instructions on personal privacy. 3. Encouraging the development of effective, low-risk, low-cost and convenient payment and financial services for consumers and businesses. 4. Ensuring the central bank's ability to conduct monetary policy and 5. Not hindering the ability of law enforcement authorities to prevent and detect movements of funds associated with criminal activity.

and electronic security features of devices such as tamper-resistance and co-ordination between consumers and issuers for voluntary insurance and loss sharing arrangements.

Relating to the potential policy approaches to consumer protection, GOT (1997) found that various risk control measures that could be taken by consumers, industry and governments may be complementary. It was advised that governments should further their policy objectives in the banking and payment sectors by ensuring that the relevant legal framework provides adequate incentives for fair practices and a strong foundation for reasonable private agreements and contracts.

The policy of **law enforcement,** according to GOT (1997), should be to prevent, investigate and prosecute criminal activities affecting the payment systems. These activities was identified in two general types: First one was the exploitation of payment systems in connection with criminal activities such as money laundering, tax evasion or illegal gambling. Second one was the attack on e-money products themselves such as counterfeiting, fraud or disruption of the system. It was noted that e-money may have the potential to bring benefits to law enforcement efforts, like reduced usage and theft of cash and greater electronic record-keeping capabilities compared with some existing means of payment. Potential measures against criminal activities were named as the use of tamper-resistant smart cards or other devices, cryptographic protocols, on-line authorisation of some or all transactions, administrative controls on transactions and participants, record-keeping systems, expiration dates and value limits. GOT (1997) noted that in order to prevent illegal movements of funds; law enforcement and regulatory officials have historically relied on the intermediation of banks and other financial institutions where records of both transactions and customer identities are typically maintained. Continuing dialogue and co-operation with developers and providers of e-money products was found necessary to detect and address potential law enforcement problems at an early stage.

GOT (1997) investigated **supervisory issues** as well. Potential risks to providers of e-money were named as operational and liquidity risks, credit and market risks depending on policies for investing the proceeds from issuance, risks arising from participation in loss-sharing or guarantee arrangements among issuers, clearing and settlement risks, foreign exchange risks, risks of fraud, operational failure or redeeming counterfeit e-money, strategic and reputation risks, compliance risks and risks associated with outsourcing of operations. Private sector measures to address those risks were given as maintaining sufficient liquid assets on hand to meet demands for redemption, investing the proceeds from issuance in high-quality,

short-term, liquid securities, establishing strong internal controls to prevent employee fraud, instituting risk management procedures for new products, designing robust security measures and procedures to defend against external fraud and counterfeiting attacks. It was argued that a combination of security measures for an e-money product, rather than any single measure of standard should be most effective against all kinds of above-mentioned risks. Due to immature nature of e-money products, no clear potential supervisory approaches in G-10 countries were determined.

The cross-border issues were addressed by GOT (1997) considering whether the potential international operation of e-money schemes raises additional concerns for the effective implementation of monetary policy, consumer protection, law enforcement or supervisory objectives of individual countries including the potential effects of differences in laws or policy approaches in these areas. The report named two potential cross-border concerns. Firstly, consumers could use prepaid cards issued by domestic institutions to make payments to foreign-based merchants while travelling or in making purchases over a computer network such as Internet. Secondly, an issuer in one country could issue e-money to consumers in another country, potentially in the consumer's home currency, for use at either domestic or foreign purchases. It was found appropriate for supervisors to share information on e-money schemes with international ownership and operation to understand fully any cross-border issues that affect institutions in any particular countries in order to find out the best approaches to addressing cross-border concerns. Four key considerations to which consumers, e-money providers and authorities may wish to give attention in the implementation and use of e-money products as well as in the development of national policies were stated as transparency, financial integrity, technical security and vulnerability to criminal activity.

Other than the security and legal issues, maybe retail characteristics of e-money has been underestimated during the earlier versions as a serious problem surrounding e-money. In a typical advanced economy, it is a general observation that most of the wholesale payments has been electronised already in case of the value so that they represents more than 70 % of all transactions. However the comparison of the volume is just the opposite and banknotes and coins represents more than 70 %. As a result, any e-money scheme seems to be at the middle of a jungle to address extensive problems for small value payments. Obviously, once a proposal proves the capacity to find a solution to address the demand for e-money, then; it might be in a 'once and for all' base. It may be quite a long way ahead but once e-money manages to address

all the complications of micro-payments, then there might be no way back to banknotes and coins again.

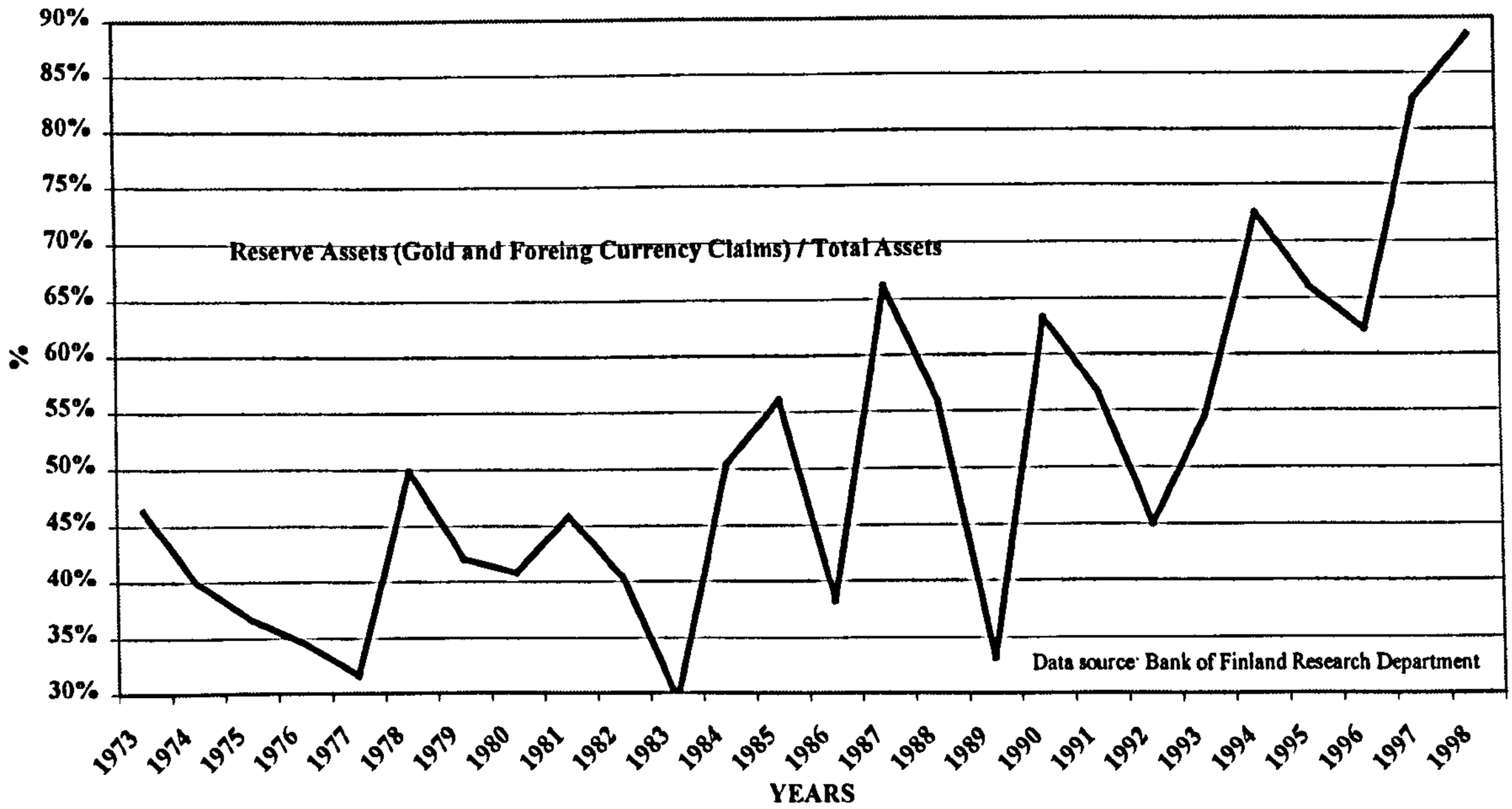
4.2.7. IMPLICATIONS OF E-MONEY FOR CENTRAL BANKS

This topic seems to be on the agenda since the beginning of the 1990's but the official reports came through the middle of the decade. BIS (1996b) became one of the leading contributors to the literature grouping them into four as safety and soundness of payment systems arising from the central bank's oversight function, seignorage, the operation of monetary policy, and possible financial risks borne by issuers of e-money to the supervisory responsibility extent.

According to report, e-money could lead to shifts in the velocity of money, which might temporarily *reduce the usefulness of the monetary aggregates*, especially narrower ones, for countries that rely on them as targets or indicators. It was believed that if e-money replaces only cash, there may be no need for an adjustment in monetary policy operating techniques but if e-money has also a potential to replace deposits, then; this may complicate the ways by which central banks influence money market interest rates. Replacement of cash causes also shrinkage of central bank balance sheet and this may result in problems in large scale reserve-absorbing operations when necessary. This concern seems to decrease lately as more and more central banks managed to follow direct inflation targeting monetary policy frameworks.

It was indicated that since banknotes in circulation represent non-interest bearing central bank liabilities, a substitution of e-money for cash would lead to a corresponding decline in central bank asset holdings and the interest earned on these assets that constitutes central bank *seignorage* revenue which generally exceeds the operating cost of central banks. The loss of seignorage revenues may force central banks to become more dependent on other revenue sources. It may be, on the other hand, wrong to argue that central banks have some difficulties in finding alternative independent source of revenues like earnings from clearing services or flows from the partnerships on the wholesale payment systems. It may be worth mentioning that operating cost of central banking might decrease seriously with the efficiencies brought by e-money and related technologies. Additionally, the role of reserves may actively contribute to e-money discussions. The proportional increase in foreign assets on central bank balance sheets may decrease the reliance on banknotes and coins in circulation as well. The BOF balance sheet may be a good example for this trend, which is exhibited in the following chart.

CHART: 4.2.1. BANK OF FINLAND RESERVE ASSETS AS A PROPORTION OF TOTAL ASSETS



Possible policy responses to the development of e-money were also addressed by BIS (1996b). In regulatory framework, it was found unclear whether e-money will be judged under traditional financial products and treated according to recent financial regulations or there is a need for a totally new legal framework. The response to loss of seignorage revenues may not be needed until a serious shrinkage in central bank balance sheet as long as the balance sheet gives a particular central bank enough options to conduct monetary policy effectively. The report concluded that two options, namely central bank issuance of e-money and expanding (non-interest-bearing) reserve requirements, would not only increase the size of central bank balance sheets but would also help to offset any loss in seignorage. As an alternative way to offset seignorage loss, central banks could consider charging banks for various services they provide.

In another contribution to the subject, Boeschoten, and Hebbink (1996) estimated the impact of the use of e-money on currency demand and its possible consequences for seignorage loss in the G10 countries The authors defined e-money as multipurpose prepaid cards and other electronic transactions used in Internet and debit (EFTPOS) payments. They intended to use all kind of payment instruments that replace cash turnover and thus decrease currency demand. The implications of e-money on currency demand were estimated under different assumptions for G10 countries[10].

[10] Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, United Kingdom and United States.

First, the decrease in currency circulation was estimated by different methods. The first method assumed all the citizens in the national economy have a prepaid card and cards hold an average amount of USD 100. For the UK, 1994 population was taken as 58.3 million which means that the total amount that prepaid cards hold equals to USD 5.8 billion. This amount was 16 % of total currency circulation and 3.5 % of GDP in 1994.

Secondly, it was assumed that all denominations with a face value of up to USD 25 will be replaced by prepaid cards, meaning that everybody will use a prepaid card in transactions that needs money denominations which are equal or smaller than USD 25. According to this method, total currency outstanding for 1994 in the UK was USD 36.1 billion of which USD 18.4 billion was of up to USD 25 denominations. This was equal to 51 % of total currency circulation, meaning that prepaid cards may decrease currency demand by 51 %.

Thirdly, the decrease in currency circulation was calculated by assuming that all the cash payments in transactions below USD 25 will be carried out by means of prepaid cards. According to the results, percentage decrease in need for notes in the UK may be 40 % and for coins 87 % which was equal to a 23 % decrease in banknotes circulation and 87 % decrease in coins circulation for 1994. Total percentage decrease in circulation equals to 36 %. In calculating these ratios, it was assumed that a payment would be performed by using a minimum number of notes and coins given a country's available denominations. This method was stated by authors as more advanced.

Boeschoten, and Hebbink (1996) also calculated the consequences of e-money for seignorage. Relating to the methodology to calculate seignorage, they used a definition based on opportunity costs,

$$S = iA$$

with S being the amount of seignorage received by the central bank per year, i the nominal interest rate and A central bank assets. They argued that, if central bank assets equal the monetary base (H) and if reserves (R) remain unchanged, then;

$$\Delta S = i\Delta H = i(\Delta Cu - \Delta Co)$$

with Cu and Co being the amount of currency and coin in circulation, respectively. According to the authors, the above method for calculating seignorage may be extended by subtracting interest payments by the central bank on bank reserves and cost of managing seignorage and differentiating between interest rates. The calculated opportunity cost measure of seignorage foregone due to a widespread use of e-money for the UK (using long term

interest rates) calculated as USD 2.96 billion and it was equal to 0.28 % of GDP. This amount was implied to be the potential revenue of e-money issuers but it was reminded that with increasing international competition in the banking sector, the issuers might pay interest on accounts, which will cause erosions on this potential amount.

Boeschoten, and Hebbink (1996) concluded that seignorage loss due to the use of prepaid cards per se is expected to be limited, as long as these cards are used only for small value payments. The eventual effect, it was argued, depends on the degree of acceptance of these cards, on the amount up to which they are used for payments and on the maximum value stored on these cards. Seignorage may be affected, however, by the combined use of e-money for small value payments by means of prepaid cards and large value payments by means of other types of e-money. Such an overall use of e-money would eventually result in a complete or almost complete elimination of transactions cash balances. This would imply a seignorage loss of between 0.2 % of GDP and 0.4 % of GDP (for G10 countries). An even larger seignorage loss of between 0.3 % of GDP and 0.7 % of GDP (for G10 countries) would result if currency hoards would disappear as well. The authors added that this analysis is basically static and all the mentioned developments depend on many factors such as technology, risk of loss and frauds, possible credit facilities and, especially costs and tariffs.

In this discussion, the authors preference to include all kind of electronic payment instruments on the effect of e-money may be a proof of inevitability of total electronification of payments. E-money in this argument seems to be the final frontier for currency in circulation. It also underlines the fact that e-money may not be a concern with regards the decrease in currency circulation as this has been an historical phenomenon that has been supported by electronic payment instruments. In the next part, the thesis will look at two examples of e-money solutions that are currently available.

5. CASE STUDIES ON THE USE OF E-MONEY

This chapter of the thesis analyses two real life examples of e-money proposals. The selection of the cases has actually been shaped by the characteristics of the schemes. First of all, academicians, practitioners and central bankers around the world have acknowledged both schemes as among the best examples of e-money projects. Both allowed person-to-person transactions, for example and it may be argued that both fit to this thesis, as they are representatives of e-money schemes and they are more than just another payment solution. Secondly, both schemes have their own independent clearing system and both targets to replace coins and banknotes circulation by fulfilling the demand for them. Thirdly, there has been a clear distinction between card and network-based e-money for a few years and Mondex was coded as a good example of card-based schemes and Digicash as network-based schemes. This distinction need some caution recently because smart cards became more and more network adaptable and any card-based scheme might function as a network-based solution. The opposite is also true. Arising from this development, operating systems for smart cards will be analysed at the end of this chapter after first investigating Mondex in the first section and Digicash in the second section.

5.1. CASE STUDY 1: MONDEX AND EXETER UNIVERSITY TRIAL[11]

The aim of this section is two folds. First one is to give a clear description of Mondex scheme and the second one is to express the findings of a field search at Exeter to see the university trial.

5.1.1. MONDEX IN GENERAL

Mondex is an electronic cash product that was invented by then deputy director of payment services Tim Jones and then Manager of Card Strategy Group Graham Higgins of the National Westminster Bank (NatWest) in 1990. The idea was to store money in electronic form

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[11] This section often visited the web-sites listed: http://www.mondex.com; http://www.mondexinternational.com; http://www.mondex.co.uk; http://www.exeter.ac.uk/mondex; http://www.mondexusa.com; http://www.mondex.ca http://www.multos.com. Mondex Magazine, has been followed as well including issues: Summer 1996, December 1996, July 1997, November 1997, April 1998 and September 1998 and all the issues then on. Mondex Publications that have been used as source of data are: 1.Vision & the Internet: the Structure of the Mondex System. 2. Security, Risk Management and Organisation. 3. Mondex around the World. 4. Mondex on the Campus. 5. Mondex: The Worldwide Alternative to Cash. 6. Technology and the Future of Money. 7. The Future is Built in Multos Chip 8. The Future of Money. 9. The Mondex Opportunity: A Guide to Merchant Acceptance. 10. Cash in on: The Future Mondex and 11. "Smart Cards: A Revolution in Plastic Cards" Mondex UK Limited, 1997.

on a smart card. The first type of money in electronic form was called as "Byte" by the innovators and the first trial was conducted as an in house project at NatWest in London in 1992. During the same year, the Mondex team established relations with leading electronic companies around the world and detailed market research were undertaken including 47 consumer focus groups and over 5,500 consumers. Just from the beginning, as a result, Mondex turn out to be an international project in character.

In 1992, the BOE was informed about Mondex and further intentions to establish a global e-cash payment scheme. In 1993, Midland Bank joined as an equal partner to NatWest. During 1994, over 400 manufacturers from 30 countries had expressed interest in developing Mondex devices after the first set of product development specifications was announced to enable manufacturers and Mondex was awarded as the "Most Innovative Smart Card Accomplishment of the Year" by the European Smart Card Applications & Technology. The first franchise rights were sold to the Hong Kong and Shanghai Banking Corporation Limited in the Far East during the same year.

In 1995, Bank of Scotland announced intentions to join the other two banks to support Mondex in the UK. More Franchise rights were sold in Canada but the main event of the year was the first trial of Mondex in Swindon and journalists and TV crews from 15 countries observed the first electronic cash transaction. British Telecom tried Mondex compatible 200 payphones and 2000 private phones. All of them acted as Mondex cash points. Another trial was conducted in the US by Well Fargo Bank at their San Francisco headquarters and close retail outlets.

During 1996, Mondex was introduced in Canada by a consortium and franchise rights were sold in Australia and the US. One important development was the establishment of Mondex as an independent payment organisation under the name Mondex International Limited by a group of 17 major organisations. Projects on compatible payment products for vending machines, payments on the Internet and supply of smart cards for Mondex's global implementations were developed during this year with different companies around the world.

In 1997, MasterCard International acquired 51% of Mondex International. A solution, which was first to bring the benefits of Mondex chip-to-chip technology to Internet commerce, for making payments over the Internet commercially viable was announced by AT&T and Mondex International. In May, a consortium lead by Mondex International introduced Multos, which is an international operating system for smart cards. A consortium named Maosco was formed to support Multos as an industry standard. Bank of Scotland with the University of

Edinburgh and Aston University announced new trials in the UK. During 1997, more banks and companies from different countries around the world joined Mondex in order to stimulate the concept throughout the world and to further develop the Mondex devices. A program to transfer e-cash via digital mobile phones was started jointly with Cellnet Company. Mondex was launched in New York, Hong Kong, New Zealand and Australia. Cardholders became able to use personal computers and the Internet to access bank accounts to download cash from home.

In 1998, the first international e-cash transaction was completed to prove that international capabilities of Mondex card allow users to carry a single card for transactions around the world and international multi-currency potential of the scheme was being tested positive. Mondex was declared as a Millennium product in the UK. Maosco, in partnership with leading smart card manufactures, announced the creation of a global supplier network in readiness for the mass-market deployment of Multos, This was a further step to secure the multiapplication platform of Mondex to be promoted all around the world.

In 1999, the first multi-currency smart card capable of carrying an electronic version of the European currency unit, the Euro, was demonstrated. E-cash franchise for Japan was sold to a Japanese company. The UK's first demonstration of a set-top box, which would allow consumers to pay for programs and data of all kinds on DTV using Mondex electronic cash, was presented to promote DTV applicability of the scheme. First interactive loyalty capability was tested to stimulate the ability to reward a consumer's purchases, update their records and allow the merchant direct access to that updated record -all in real time as the consumer is in-store. SmartAxis has been launched this year to promote cross border payments as a critical enabler for e-commerce. Credit Mutuel –a bank in France- was the first bank to commercially introduce electronic Euro using Mondex. The University of Exeter in the UK launch new software to facilitate the Mondex e-cash payments over the Internet for 'pay-as-you-go' distance learning study courses. Mondex was awarded a rating of ITSEC Level E6, - the highest possible rating achievable in ITSEC (Information Technology Security Evaluation Criteria), which has boosted the security confidence of the product. Other than selling the product in more countries such as Korea and Taiwan, 'www.beenz.com', creator of the web's currency Beenz and Mondex announced a technical marketing agreement to develop a smart card capable of carrying Mondex e-cash, beenz and complementary e-commerce services. This agreement proved the closer gap between network and card-based e-money schemes.

In 2000, the Norwegian State Lottery became the world's first lottery organisation to provide players the option of paying for games and receiving winnings with Mondex cash. Through the middle of the year, Cable & Wireless (Hong Kong Telecom) and The Hong Kong and Shanghai Corporation Limited (HSBC) launched i.Life card, a high capacity smart card bringing enhanced security and convenience to online shopping which was powered by a Multos chip. It is a multi-functional smart card that has been developed to meet the need for sophisticated e-commerce applications and includes Mondex e-cash, credit and debit card functions, international calling service, and chip-based e-commerce applications -all on a single card. This year more franchise has been sold as well.

5.1.2. THE MONDEX STRUCTURE

Mondex International is based in London and holds the intellectual property rights of Mondex e-cash and franchises it around the world. In general, in every country or region, a consortium of banks and related companies such as telecoms and payment system related companies was established in order to promote Mondex devices in that particular country or region. Recently, Mondex International, which has registered trademarks in over 80 countries, is responsible for global marketing and management of Mondex and defines standard operating regulations to ensure that all Mondex cards around the world are interoperable.

As the owner of the intellectual property rights of Mondex, Mondex International signs agreements with Shareholder Franchisees (those that have a share in Mondex International), and Ordinary Franchisees (those that have no share in Mondex International) in order to let them have the right and obligation to manage, promote and exploit Mondex in their specified territory. Franchisees are responsible to ensure that a regulated **Originator** will be formed in their territory to issue and manage Mondex value for banks and their customers. Mondex International will license such Originator. Obviously, the originator is where the electronic value is created. For the time being, the main target is to represent major national currencies but the concept may reach to private money incentives in case there comes a demand.

Members are the financial service providers such as banks and telecomm companies to provide Mondex instruments to final users. Mondex International licenses manufacturers to produce Mondex equipment ensuring that compatibility with Mondex specifications is guaranteed. Final members of Mondex scheme are consumers holding cards and merchants to accept Mondex value as payment for goods and services. Mondex International's primary role was explained by the Company as to establish, manage and exploit the Mondex scheme with

the responsibilities to encompass franchisee recruitment and support, marketing, operations, regulatory and scheme governance, procurement, brand development, security and administration functions. It was argued by Mondex International that the roles of the central bank in supplying cash and investing the proceeds of cash sales will be assumed by a bank or a regulated consortium of banks known as the Originator which will issue Mondex value to members under the Mondex scheme.

In the UK, Mondex UK Limited owns the franchise and its current Members and owners are HSBC (ex-Midland Bank), NatWest, Bank of Scotland and National Australia Bank (NAB). HSBC and NatWest are also the Originators. Membership is not exclusive in the UK and other banks and non-banks may join the scheme.

How Mondex works was explained by Mondex International on the Web pages[12] as follows: The Mondex electronic cash system operates on a smart card - a plastic card that looks such as an ordinary debit or credit card which stores information on a microchip. The microchip contains a 'purse' in which Mondex value is held electronically. The purse is divided into five separate pockets, allowing up to five different currencies to be held on the card at any one time. The microchip also contains the Mondex security programs to protect transactions between one Mondex card and another.

According to Mondex International; being electronic, Mondex provides significant advantages: it can be transferred over a telephone line or the Internet; the microchip maintains a record of the last ten transactions and the e-cash can be locked into the Mondex card using a code chosen by the user. The Company believes that Mondex has the following unique features[13]:

1. *Multi-currency* as being the only electronic cash smart card to allow 5 different currencies to be carried on the card at the same time.
2. *Telephonic transfer* as allowing to download money from bank accounts to Mondex cards by using telephones (conventional and mobile) and thus by making all the telephones to function as ATMs.
3. *Large & Small Payments* as Mondex cards can be coded to store any amount of money to be used conveniently.

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[12] http://www.mondex.com/intro/index.html
[13] http://www.mondex.com/intro/index.html

4. *Immediate Transfer of Value* as the cash is on the card itself and no connection to an account is needed.
5. *Globally Interoperable* as being the only electronic cash smart card to carry 5 different currencies, and with Multos operating system, a Mondex card can be used in any country.
6. *Person-to-Person* as being the only smart card with the security and sophistication to permit person-to-person movement of electronic cash without a need to report cash movements to a central computer system.
7. *Payment over the Internet* as being able to enable customers to buy goods and services on the Internet.

Mondex UK Limited argued[14] that Mondex has many benefits to customers and retailers. The first consumer benefit is given as ease of use because of withdrawing or depositing value by telephone, paying the exact amount (no fiddling for change), no authorisation or signature during the transaction, immediate payment, and finally mobile telephones, allowing Mondex e-cash being available anytime, everywhere. Second group of consumer benefit was named as flexibility arising from transferring value by telephone, capabilities of person to person (P2P) payment, allowing both low or high values transfers and finally its multi-currency capability with no age limit so that it is suitable for all the family. The third group of consumer benefits was listed as accessibility and convenience because of Mondex e-cash machines and telephones giving more access points to funds in personal accounts for 24 hours/365 days. It was underlined that e-cash machines and telephones will never run out of value. The final consumer benefit was mentioned as safety and control because of spending only what the card holds, lockable card or wallet, readable balance, loading value at home, keeping track of the amount spent (including where), and traceability when a lost card is found.

Retailers benefits were given as more efficiency, less cost, better financial management and lowers risks. More efficiency was expected because there is no need for customer identification, authorisation or signatures and no clearing period - unlike cheques and credit cards - and the value is immediately received, and is guaranteed. Additionally, correct value is tendered every time, no counting is needed to check how much is on a retailer terminal, Mondex payments are said to be fast and accurate and the scheme is suitable for all types of retail environment. Less cost was planned because of less need to handle, store and transport banknotes and coins, improved security for currency handling and reduced pilferage from cash

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[14] http://www.mondex.co.uk

tills when the retailer's card is locked. Better financial management opportunity was supported by quick and easy totalling, analysing and reconciling of the takings. E-cash can be converted into a designated interest earning account at any time, and money paid into an account is instantly available for further investing or transferring. Finally Mondex e-cash is less risky compared to hard currency because of reduced likelihood of raids and attacks on staff. There seems no need to store large amounts of cash on site overnight and Mondex is more impervious than cash to fraud, forgery and theft. Retailer terminals might have both physical and electronic locks as well.

It was further explained[15] that if used with the Mondex wallet, the card enables payments to be made between individuals. The only difference seems that cash value is transferred from one chip to another chip rather than hand-to-hand. As Mondex e-cash is digital, transactions can also be carried out remotely across national and international telephones lines including mobiles, making Mondex ideal for home shopping and Internet transactions.

Mondex International named *four benefits[16] to issuers*. The first benefit is the *enhanced services* arising from the potential that Mondex can help to improve and differentiate customer services such as on-line banking, telephone banking and home shopping. Issuers take full advantage of the expansion of the Internet and electronic trading. The second benefit for issuers is the *corporate and brand image* that will be supported by Mondex by allowing issuers to price their services as they wish and to package their services according to their customers needs. The third benefit is the *new customers* arising from the new markets that will inevitably be opened by Mondex. The last benefit is *cost cutting* for the issuers because Mondex will decrease the cost of handling cash.

5.1.3. LAUNCHES[17]

Maybe the first launch of Mondex was the one tried at NatWest Tower in London. **'Byte'** smart cards were distributed to the staff of the Bank in 1991 enabling them to pay for goods and services. It was an in-house trial.

The second launch was in **Swindon** in July 1995 and ended in July 1998. The number of cards distributed reached to 14.000 and the average transaction during the trial was

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[15] http://www.mondex.co.uk
[16] http://www.mondexinternational.com
[17] http://www.mondex.co.uk

determined as £6.70. Around 600 retailers joined the trial. It was observed that Mondex replaced % 91 of cash and only % 9 of other payment methods. Mondex UK announced the reasons to close Swindon trial after the closure:

- It has proved that the technology works in a demanding high street environment.
- It has proved an immense amount of data from which the company can build its strategy for wider commercial development of Mondex in the UK.
- The trail acted as a 'world showcase' and helped in the sale of Mondex franchises in over 70 countries around the world.

The company decided to refocus the resources that were involved in running the trial on building up to commercial implementation. The NatWest and Midland Bank conducted the Swindon trial and The Bank of Scotland launched the third trial in Edinburgh in its offices as an internal staff trial in October 1995.

Other trials were conducted at universities in the UK. The first examples of university trials included the Exeter University, which will be discussed later in detail, and the York University both started at October 1996. In October 1997, 3 more university trials began namely the Aston University, which has plans to develop further applications for the cards to run on the Multos platform, the Nottingham University and the Sheffield University. Either the NatWest or Midland Bank conducted university trials. Bank of Scotland and the University of Edinburgh launched another trial in 1998.

Other than that, the Mondex scheme has more trials all around the world. In Canada, for example, the first trial has been conducted in Guelph. According to the company, the implementation has been recognised as one of the most advanced electronic cash programs world-wide and has grown to include more than 560 merchants, 12,000 cardholders and $2 million of e-cash issued. Sherbrooke region of Quebec was the second trial region in Canada. Among the most advanced implementations of Mondex in North America, the launch represented the next major stage in the development of this new technology in Canada. The Sherbrooke Mondex program is defined by the company as offering consumers the first combination of Mondex e-cash and debit on a single card and the first test of new e-cash Internet loading technology. Additional trial sites were quoted as Bishop's University and Champlain College.

The trials are not limited to above list. Mondex has been conducting more almost all around the world; including Hong Kong, South Korea, Australia, France, Japan and the US.

With the help of the organisational structure, the lessons learned from the trials have been pooled at Mondex International and shared by the partners to develop the product further. The mission of the company has been announced as to ensure Mondex is the world's leading e-cash product and all the trials and investment has been directed to complete the mission.

5.1.4. THE UNIVERSITY OF EXETER LAUNCH[18]

This trial was officially announced on March 28, 1996 and launched on October 1996 with the start of new term at the University. The project financed and conducted by the NatWest with the backing of both the University and the National Union of Students (NUS). The NatWest University Card that was distributed to over 10.000 students and staff had the following features[19]: (i) Mondex electronic purse for cash-less purchases to be used at outlets on campus, vending machines, photocopiers, launderettes and payphones. (ii) Student Identification Card with printed student details and a photograph. (both Guild and the NUS card). (iii) Library card. (iv) Access control card (only in the Computer Science Suite and a student hall). (v) Voting cards for student elections. (vi) Discount card for a range of goods and services.

Additional projects for electronic lunch tickets and computer access was planned as extra features. The benefits of a card to anyone at the University were named as[20]:

- A single but multifunction card is more convenient for all students and easier for the University to handle and manage.
- The smart cards offer secure means of building access controls.
- Electronic purse function creates convenient access to money at the Bank accounts through ATMs and with extra facilities like special payphones and Mondex Loading Points. Payment with the card is guaranteed, quick and easy with the exact amount. The Mondex card requires no signature, form of identification or authorisation.
- Mondex will reduce the cost and effort of managing cash for the University.
- Easy to use.

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[18] http://www.exeter.ac.uk/mondex. Other than that; University Card User Guide, NatWest, August 1996, University of Exeter Smart Card User Guide, NatWest, August 1997, University Smart Card User Guide, NatWest, August 1998, University Cardholder Terms and Conditions, NatWest, April 1998 and "Mondex Survey Final Report" Department of Mathematical Statistics & Operational Research, 1997 provided data and information about the Exeter University trial.
[19] http://www.exeter.ac.uk/mondex/
[20] http://www.exeter.ac.uk/mondex/

- There is no need to have a NatWest account because it is possible to download money from other bank accounts, too.

All cardholders received a balance reader during the registration. When the Mondex card is inserted to the Balance Reader, it shows the amount of monetary value under five different currencies that the smart card holds. As a security measure, cardholders were given a 4 digit Personal Code to lock and unlock their cards. NatWest account holders were allowed to link their cards to their bank accounts. Then, monetary value could be downloaded to Mondex card by using either Mondex adopted cash machines or 30 British Telecom Mondex compatible payphones around the University or Mondex Loading Points. Each Mondex card had a maximum value limit for £100 Mondex Cash and holders were allowed to deposit Mondex cash back to their account. Cardholders banking with other banks were asked to buy Mondex cash by using their Switch or Delta debit cards. Each card holds the details of the last 10 transactions that can be viewed through ATMs and payphones.

Person to person transactions was only allowed via payphones and Mondex Wallet was not distributed around the University. Some of the services provided by Mondex card were[21]: (i) Loading Mondex cash from the NatWest bank account. (ii) Depositing unspent Mondex value to NatWest account. (iii) Reading the balance of linked NatWest account. (iv) Check the Balance on the card. (v) Changing and selecting a Personal Code. (vi) Show the last 10 transactions.

The lost or stolen cards have no graphical security other than the photograph since their use remains protected by the purse's Value Transfer Protocol and other smart card security features, so that they cannot be used by any other person. Students and staff were not charged for renewing the stolen or lost cards for the first year but from the second year, they were asked to pay £10 for lost cards only. If a card is not locked when it is lost, someone else can use it but even if it is locked, the holder of the card loses the monetary value that the card holds unless the one who found it returns it. Computer registration of students started in 1997 and 84.99 % of students were registered via their Mondex cards. Central computing facilities like e-mail, Internet access and secure on-line file space became usable via Mondex cards in the second year of the trial.

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[21] http://www.exeter.ac.uk/mondex/

It was announced in 1998[22] that the project moved from pilot to rollout technology. All the cards renewed with a new technology and all the students need the card for their registration. There will be 5 food and drink vending machines for the new cards, around 20 BT payphones and 11 Mondex Service Points will replace Value Loading Points, which were placed on September 1998. ATMs will not be used for Mondex features. From October 1998, the number of buildings that accepts only Mondex card for access increased to 6. Three high street stores joined the scheme in November 1996 and as it is the rollout phase, the number of stores joining is expected to increase in the following years.

5.1.5. UNIVERSITY CARDHOLDER TERMS AND CONDITIONS

According to Terms and Conditions, which were set on April 1998, without a Personal Code Number (PCN) and a link that will be set by the Bank due to cardholder's demand between Mondex card and NatWest Account; the cardholder can only use the Mondex card for the University functions such as identification, library, voting and building access. PCN will be used to lock and unlock the card. Mondex e-cash can not be transferred from the card when it is locked but it is possible to transfer e-cash to the card in either position.

A withdrawal of funds from one account in the form of Mondex e-cash was accepted to have the same effect between the cardholder and the bank as a withdrawal in the form of notes and coins. The cardholder bears the risk of loss, theft or misuse of e-cash on the card. The Bank regulates overdraft facilities through the bank accounts and Mondex card does not entitle cardholders to overdraw.

The Bank reserves the right to limit the amount of Mondex e-cash that the cardholder may withdraw from the account or which he or she may hold on the card at any one time. Relating to privacy issues, it was declared that the Bank may hold and disclose information about the cardholder, the linked bank account, and use of the card to the police and other authorities. However, in relation to other cardholders, this will be done only where it is considered necessary for resolution of fraud and dispute. If a lost, stolen or misused card is returned to the Bank, the Bank will reimburse the rightful owner with the amount of any cash on the card at that time but the Bank will have no further obligation.

Relating to security and consumer protection, it was announced that if Mondex value is obtained by an unauthorised withdrawal from the account before the Bank is informed that the

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[22] http://www.exeter.ac.uk/mondex/

Mondex Card has been lost, stolen or been liable to misuse, the cardholders liability to the bank is limited to a maximum of **£50** unless the cardholder acted fraudulently or with gross negligence.

The Bank rely on the data in the card and any other equipment as conclusive evidence of the amount of cash on the card except in the case of manifest error. The Bank may also rely on the Transaction Record and the Exception Log on the card as conclusive evidence of the matters recorded in them and that the transactions described by them actually occurred. The Mondex scheme may be terminated or suspended by the Bank at any time without any prior notice and a date may be specified after which Mondex value will not be accepted for refund. Changes will be made in accordance with the current Code of Banking Practice.

The information above has outlined the relationship between the e-cash issuer and the cardholder and may be the evidence of effectiveness of private contracting for financial services. As e-money is not officially regulated in the UK, the Bank, the University and the cardholders including the students and staff had mutually agreed on the terms and conditions.

5.1.6. CRITICS OF THE EXETER UNIVERSITY LAUNCH

On August 17,1998; Exeter University was visited in order to see the trial and observe the process as a field search. The aim of the field search was to have a personal experience for Mondex scheme visually and to talk to related parties in order to get an idea about the trial. During the search, two interviews with the NatWest staffs that are responsible for customer relations were held. The library, all the outlets were visited, vending and photocopy machines were being checked. A Mondex card and a Card Reader have been obtained. The field search continued in Exeter until the 29th of August.

The Mondex Survey Final Report that was dated 1997 and written by the Department of Mathematical Statistics and Operational Research of the University proved the progress that was made for three years. The number of students that used Mondex cards to make phone calls and photocopying increased continuously. The report concluded that Mondex has been well received and more students and staff have tried Mondex facilities finding it convenient to use. Popularity of Mondex has increased and vast majority wishes its use to continue beyond 1997. Basically, the trial at Exeter University may be accepted as proven successful due to the University's decision to carry the trial to rollout phase.

Exeter University trial field search provided useful information in understanding e-money. The observations may be summarised as follows:

1. Micro-payments may be the main target of e-money schemes as it is in Exeter University. For example, the insurance company located at the campus did not join the trial and the explanation for that was given as the nature of payments, which is generally made by credit or debit cards.

2. Universities and similar closed environments may be the frontiers of e-money schemes as they provide enough opportunities both to test and analyse pros and cons of the schemes and limit the risks.

3. Human perception of technology may be more critical to the future of e-money than already expected by researchers as many cardholders interviewed raised their unwillingness to learn how to use the multipurpose Mondex cards and prefer to enjoy University facilities only. Familiarity of consumers and retailers to banknotes may influence negatively the desire to use a new payment instrument. Many cashiers working for University outlets expressed their preferences to banknotes and coins due to their ability to solve banknote related problems. It seemed that most of them did not want to accept Mondex e-cash just because they did not exactly understand what it is. This observation is also supported by many cardholders that did not spend the bonus Mondex e-cash values already downloaded as the cards were distributed.

4. The main support to e-money may come from multi-functioning smart cards. As expected by many observers, it may be possible for integrated circuit technology to develop even further to store and manipulate even more data. This may give more multi-application potential for cards such as Mondex and increase the potential demand for e-money. The University of Exeter seems to decide to use Mondex equipment in the premises not because of Mondex e-cash but because of the convenience of this equipment as student identity card, as library card, as access card and other potential such as providing lunch coupons for students. The University openly decided to take advantage of technological development in the area of smart cards.

5. Trials such as Exeter collects actuarial data to analyse consumer behaviour and market reactions to e-money and this type of data may help to design potentially successful future schemes. Mondex may be accepted as very successful in this area because all the data provided by not only Exeter University trial but all the others around the UK, Hong Kong, Canada, USA and other parts of the world is collected and analysed overall by Mondex International. Data from Exeter University is collected by NatWest and is passed to Mondex UK, which passes it to Mondex International. Due to the company structure, it is easy to

compare results from trials to each other. Obviously, this will contribute to the future design of e-money products for success.

6. Mondex strategy may be to take time for regulatory and infrastructural developments and concentrate on creating international standards for international interoperability of all Mondex cards and equipment around the world. In Exeter, Mondex preferred to concentrate on the campus only and it was not insisted on finding more retailers on high street to join the scheme. Most of the retailers that were interviewed were even not informed about the trial by Mondex and those that know has mostly learned from students asking whether they accept Mondex cash or not.

7. Up to now, NatWest did not loose any money due to fraud arising from the trial. £100 limit for maximum value to be held on a card as Mondex cash seems to contribute to the security of e-money.

8. There were some incentives to increase the number of students and staff that use Mondex cash. One obvious incentive was the discount of photocopying cost when it is paid by Mondex card. If paid in coins, it costs 5p per A4 page but when it is paid by Mondex card, it costs only 4p.

5.1.7. CONCLUSIONS AND RECOMMENDATIONS

Mondex may be accepted as a close challenge to cash on a card-based e-money system. Because it is an international project, it needs to be understood by central bankers fully in order to be well informed before any action is taken to regulate e-money or to adjust monetary policy or monetary policy operating procedures. Mondex seems to be one of the rare projects to allow person-to-person transactions. Even if it is not totally anonymous as cash due to the registration of transactions through chips, Mondex e-cash seems to have a serious potential to replace central bank banknotes and coins. Mondex has also many projects to progress in the field of e-money technology including adaptation of Mondex cards to networks such as Internet, integration of mobile telephone technology for telephonic transfer of Mondex e-cash, increasing the malfunctions of Mondex equipment to all the fields that smart card technology can reach.

One important development is the creation of a consortium called Maosco to promote an internationally accepted operating system called Multos, which will be analysed in depth in later sections. Multos gives further international support to the concept of e-money by creating an internationally compatibly operating system.

Another development is the replacement of magnetic stripe payment cards including debit and credit cards by smart cards because it was proved by the case of France that smart cards decrease the level of fraud compared to magnetic stripe cards. Mondex has already started to negotiate with similar projects to include Multos as operating system, in order to allow such e-purse schemes to be featured for multi-application, that other schemes do not provide. Such a development may suddenly open a new usage and distribution infrastructures to launch Mondex e-cash nationally sooner than expected. The necessary critical mass problem may be solved by similar national projects around the world. On the other hand, due to fast developing technology, Mondex may loose comparative advantage to small but dynamic smart card projects in closed environments such as underground systems, mass city transportation and supermarket cards.

To conclude, Mondex is one of the most influential e-money project with its own operating system and with its international character that has already expended to more than 80 countries. Multi-currency application and the Originator concept increases its challenge to central banking as it intends to create an infrastructure to issue any conventional or newly designed or developed currency that may intent to challenge current monetary systems. The company never planned to challenge any central banks around the world. Just the opposite, it prefers to co-operate with them. (BOE has been informed quite early about the project and flow of information is still said to continue). However, Mondex scheme has its own clearing and settlement mechanism to create alternatives to central bank controlled wholesale payment systems. Once the circulation of Mondex e-cash is fully supported by conventional channels such as card readers and retailer machines and the virtual channels such as the Internet, DTV, PDAs and mobile phones; anonymous circulation may be ensured with disposable cards that will carry e-cash to address privacy concerns from the general public. Even the main target is given as to replace conventional banknotes and coins in order to provide a better alternative to the medium of exchange function, once the technology is ready and another monetary policy framework is demanded, then; Mondex e-cash seems to have the design to supply. Finally, currency substitution in countries with 'funny monies' may further be supported by the Mondex e-cash scheme as the nature of the project allows the end-user to have more than one choice of currency downloaded on the smart cards.

5.2. CASE STUDY 2:NETWORK-BASED E-MONEY AND DIGICASH[23]

This sections overviews the second case study of the thesis. Digicash has been chosen because of its acknowledgement not by central banks only but also by almost all Internet enthusiasts, almost all e-money practitioners and many academicians. The popularity of the company did not seem to pass even the difficulties surrounding the network-based e-money schemes around the world.

5.2.1. COMPANY PROFILE

Digicash was founded in 1990 and its products are based on patented developments in public key cryptography devised by Dr. David Chaum who was also the innovator of the product and founder of the company. Network-based e-money was not the only product that the company has been involved. It also had different projects such as roll-tolls, which used a system of radio beacons to debit the prepaid cards displayed by a vehicle, and such as CAFÉ (Conditional Access for Europe), which was a project developed as a secure electronic payment system (European Commission Project numbered 7203).

5.2.2. PRODUCT

Digicash named its network-based e-money product as **e-cash** and defined it as follows[24]: 'Digicash's e-cash is a software-based payments system that sends electronic payments from any personal computer to any other workstation, using any computer network including the Internet. Actually e-cash is designed to convert money into a digital form, a string of numbers which can be represented in different forms and transmitted over any medium from telephones and fax machines to television cables'.

The company used cryptographic patents registered by Dr. David Chaum to develop e-cash as a software-only payment system that provides tamper proof, anonymous transfer of

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[23] Web-sites visited often for this section: http.www.digicash.com; http://www.stgeorge.com.au; and Digicash publications downloaded from those sites: 'Digital Signatures and Smart Cards', Digicash Publication, Information Package, 1998; 'Digicash Profile and Press Releases', Digicash Publication, Information Package, 1998; 'An Introduction to how ecash Works' and 'The Ease of Ecash', Digicash Publication, Information Package, 1998. 'David Chaum on Electronic Commerce: How Much do you Trust Big Brother'. (http://computer.org/internet/v1n6/w6chaum.htm); 'Ecash Purse User Manual for Windows', Digicash Publication. (http://www.DIGICASH.COM/index_e.html); Law, L., Sabett, S., Solinas, J.; 'How to Make a Mint: The Cryptography of Anonymous Electronic Cash', National Security Agency, Cryptography Division, 1996. (http://jya.com/nsamint.htm); Schoenmakers, B., 'Basic Security of the Ecash Payment Systems', Digicash Publication. (http://www.DIGICASH.COM/index_e.html)

[24] http://www.DIGICASH.COM/ecash/intro/index.html

money over networks such as Internet. E-cash was developed technically in late 1994 and over 25.000 testers joined the 'Cyberbucks Trail' in 1995 during test phase on the Internet.

The company provided more information about e-cash via web pages[25]: The e-cash coins are actually very long strings of characters sent from a bank to its account-holders over a network connection (i.e. the Internet) in such a way that the serial numbers are not known to the bank. The e-cash coins, each of which has a specified value, are stored on the user's hard disk and can be transferred in e-mail or as data files exchanged online between payer and payee. To receive the value, the payee confirms the validity of the coins by depositing them online into an e-cash account. This transaction will not reveal the name or address of the payer unless the payer has added this information'.

Digicash argued that e-cash ensured both privacy and security and technology provided speed, accessibility and ease of use. Compared to other options, e-cash eased micro-payments on the Internet by guaranteeing cheap transaction cost by using network lines instead of relying on expensive telecommunication bands.

The company mentioned that[26]; 'like banknotes or coins, e-cash can be withdrawn from and deposited to transaction demand deposit accounts. And like banknotes, one person can transfer possession of a given amount of e-cash to another person. But unlike cash, when a customer pays another customer, an *electronic bank* will play an unobtrusive but essential role'.

5.2.3. HOW E-CASH WORKS

Founder of Digicash, Dr. David Chaum, explained in an on-line interview with The Computer Society how e-cash works as[27]: 'E-cash is the first digital bearer instrument, and so an e-cash coin is simply a number that's worth a certain amount of money. You get e-cash coins the same way you get paper money, except that instead of going to, say, an ATM machine in person, you connect to your bank's digital branch over the Web. Just like at the ATM, you identify yourself and request, say $100 from your current account. Instead of issuing you electronic coins e-bank chooses, which it could later recognise and trace to you, the banknotes with electronic signatures for you in a way that lets you protect your own privacy. Your PC first creates "blank" coins that are actually just random numbers. It then hides or "blinds" these by placing them in envelopes, actually just a layer of special encryption using secret keys

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[25] http://www.DIGICASH.COM/ecash/intro/index.html
[26] http://www.digicash.com/index_e.html
[27] http://computer.org/internet/v1n6/w6chaum.htm

formed by and known only to your PC. The bank then deducts the amount from your account and signs the blinded blank coins, using an RSA digital signature. Then the PC removes the envelopes, using its secret keys, and stores the signed un-blinded coins on its hard disc. Because the blinding commutes with the signature, your PC can remove the blinding while leaving the signature on the coin number. When you pay a merchant with some of the coins, it forwards them to the bank and waits to hear back before accepting the payment. To ensure they haven't been spent before, the bank cheques its list of already spent coins. And since they have the bank's signature on them, the bank knows that it must honour the payment to the merchant. But the bank has no idea from which account the coins were withdrawn, and thus has no knowledge of who the payer was--since all the coins were blinded during withdrawal'.

Dr. Chaum invented blind signature, which was used to guarantee privacy in network-based e-money schemes. The technology is like a digital envelop that hides information kept inside secret to all the users, including the financial service provider, of the network other than the owner.

5.2.4. E-CASH CUSTOMERS, RETAILERS AND ISSUERS

The way to be an e-cash user was to have a transaction account at an electronic bank that issue e-money. There were many issuer banks including Deutsche Bank in Germany, Den Norske Bank in Norway and St. George Bank in Australia. The issuer banks provided e-cash purse software to customers and this software package included an account identity plus set-up password. The end user followed the purse's user manual in order to open an e-cash account and connect it to the transaction account at the bank. E-cash was a software-based product and without understanding how to use the software, no transaction is possible. The software was either downloaded on-line or sent by the issuer bank.

On the analysis of the software, even if it seemed to be a very ease one for average PC user, it might have been perceived difficult by average person. In this sense, the software may be blamed as part of the problem for lack of wide acceptance of the scheme that leaded to the failure of the first version. In this respect, simplicity requirement of e-money schemes has been underlined one more time.

As users, retailers were asked to have an e-cash software either directly downloadable from the network or provided by the issuer bank. This package included an account ID and set-up password. They also needed a bank account to be connected to their purse account, which was named above as safe for users. Retailers were advised to contact issuers in order to get

domestic requirements to open a merchant e-cash account in order to accept e-cash for the goods and services that they sell.

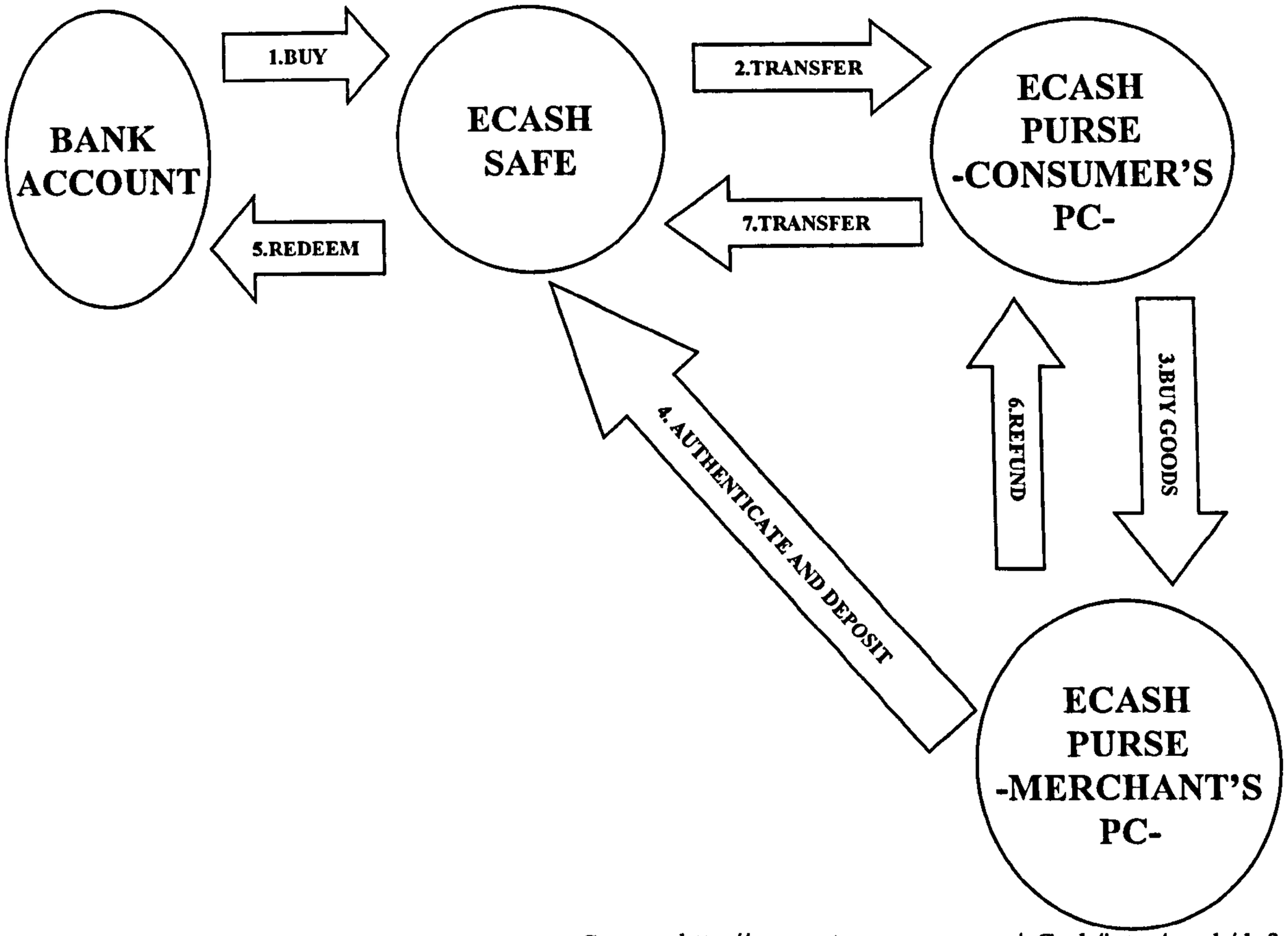
Digicash worked directly with issuers and helped banks (and only to banks) to develop national e-cash markets, integrate e-cash scheme into the banking system and localise the user and retailer software. The company developed partnership with banks around the world to issue e-cash in local currency. Digicash invited any banks issue e-cash and published a message to potential issuers on the Internet web-site in order to attract them.

5.2.5. E-CASH PROCESSING

St. George Bank of Australia explained how e-cash operated on its Web pages[28] for the Australian scheme: 'There are two components to e-cash: The first one is an e-cash Safe - this is analogous to a safe deposit room in a bank. Every user of e-cash has their own Safe in the Safe deposit room (resides on the e-cash server). The second one is an e-cash Purse that resides on the hard disk of account holder's PC. The Purse contains electronic coins. No actual money is involved in the system. Each coin consists of a long string of digits and each has a denomination or value. The Purse of coins is managed automatically by the e-cash software - it decides which coins to spend and keeps track of small change'.

[28] http://www.stgeorge.com.au/eCash/intro/work/default.htm

FIGURE 5.2.1: ECASH PROCESSING:



Source: http://www.stgeorge.com.au/eCash/intro/work/default.htm

The figure above exhibits the flow of money in the Digicash's e-cash scheme operated by St. George Bank in Australia:

1. Users buy e-cash by using funds in their conventional bank accounts through telephone banking, Internet banking or any other means. Issuer bank sends e-cash to the users e-cash safe account. The e-cash is stored in user's safe. From the point of view of central banking, as soon as money gets in the safe account for the user, it is out of the financial system and is not included in any monetary aggregates within recent definitions unless e-purse balances is added to the preferred aggregates.

2. Users keep their e-cash as long as they want in their safe account. They can also transfer e-cash from their Safe to their Purse. This process is conducted by e-cash software, which is provided by the bank. During the transfer, e-cash is converted into electronic coins that reside on the hard disk of user's PC as an encrypted data. The St. George bank plays an unobtrusive role in authenticating this money at the time of transaction in order to check whether e-cash is the one and only and issued by itself. This process guarantees the security of e-money scheme but needs too much computer-power for a widespread circulation to store so

much data for many users. On the other hand, it makes duplication of e-cash coins technically impossible within the system. Once e-cash is stored in user's PC, it is ready to be spent for the transactions on the Internet.

3. Users need to find a web-site displaying the e-cash logo selling goods and services before using e-cash. They use "buy me now" link on their purse software. Just after this command, merchant's software sends a payment request to user's Purse. Upon the confirmation of the payment request, e-cash is transferred from user's purse and is authenticated and deposited in the merchant's safe.

4. During the transaction, the merchant receives confirmation from the safe that the e-cash has been transferred into the merchant safe. This is an on-line real time confirmation and is needed for the security reasons. As soon as merchant's software confirmes the payment, it sends e-cash directly to the Safe in order to get an authentication that this e-cash was the one and only and was not spent before.

5. Merchants and personal users can redeem e-cash at any time and deposit the funds in their bank accounts. During this process, e-cash goes back to the financial system as conventional money.

6. Merchants can refund the consumer at any time. Refund might be needed for any possible cancellations of transactions. An important point here is that, refund is not through the same e-cash that was used for the transaction. Because once the transaction is completed, Safe destroys e-cash that was used in the transaction and in a case of refund, new e-cash that is issued by the banks with new string number for the merchant will be used.

7. Users can, at any time, transfer e-cash from their purse back to their safe. This option let users to control the amount of e-cash in their purse accounts. If they think that they do not need that amount of e-cash in their PC purse account, they transfer the surplus to their e-cash safe.

According to above explanation, e-cash has a direct link to a bank account but this connection arises from the nature of the e-cash scheme. Because it is a network-based product, it is expected to have all kind of network connections including a bank account. What makes e-cash a good example of e-money is that as soon as money left bank account for safe (1.BUY in Figure: 5.2.1), it was out of the banking system and was not included in any monetary aggregate.

E-cash software lets users keep e-cash from problems such as network collapse or PC breakdown. By using a secret random seed number chosen when the software downloaded, it

was possible to re-create the coins in PC and obtain back coins that were lost. Issuers could limit the amount of e-cash both at e-cash Safe and e-cash Purse.

E-cash Safe plays a critical role in above-mentioned scheme. First of all, e-cash Safe converts money into a digital form and creates a string of numbers to be used as medium of exchange. It also checks whether an e-cash created in advance was spent before or not. This guarantees that there is no e-cash in the system that is the same as another one. Consequently, Digicash scheme could be accepted as an electronic central bank distributing medium of exchange only on a network such as Internet.

5.2.6. FEATURES

Digicash used cryptographic encoding to protect the security of e-cash. It is the technology that typical Interbank payment systems such as APACS or SWIFT rely on for authenticating requests to move huge sums of money between banks. The company believed that e-cash technology incorporated a range of significant and unique features[29]:

'*1. Micro-payments and More*: Most other Internet payment systems do not accommodate micro-payments due to their high transaction costs, but e-cash overheads are so low that even payments for a couple of cents can be economically transacted, and in a matter of seconds. At the same time, e-cash can handle higher-value payments with equal ease.

2. Protection of Customer Privacy: Using e-cash, customers can shop on the Internet without compromising their security or privacy. Neither merchants nor issuers are in a position to know who has been shopping or what was purchased, ensuring that confidential information is never abused. Customers who require proof-of-payment are able to uniquely identify the recipient of their e-cash coins.

3. Impossible to Lose: The design of e-cash ensures that, even if a PC crashes, hard disk fails, or a power surge interrupts a transaction, e-cash balance is protected. A simple, intuitive procedure reissues remaining coins automatically and instantly.

4. Security through Encryption: The e-cash software uses public key cryptography with a key-length of at least 768 bits.

5. Fully Functioning Cash: Just like cash, e-cash can be freely transferred between individuals or merchants. This feature allows all e-cash users to act as merchants, with the ability to buy and sell their goods on the Internet'.

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[29] http://www.digicash.com/ecash/new_issuers/

There were there banks fully dedicated to the e-cash, one in Germany, one in Norway and the last one in Australia accepting e-cash as a potential product to attract more customers. Digicash expected that more banks around the world to issue e-cash in the near future. Digicash had no policy for international issuance of e-cash. The company preferred to assist banks to localise the purse program and left it to the bank's individual policies for their service. As a result, the issuer bank may or may not let e-cash to be used for international transactions.

Digicash's e-cash may be accepted as a good example of network-based e-money because of two reasons:

1. It was not an access product. Although it was needed to have a conventional bank account in order to get a safe; there was no connection to the conventional bank account at the time of transaction. As a result, e-cash was an 'offline' e-money product in an online environment.
2. As soon as money was downloaded from the conventional bank account to the safe account, it left the financial system and it was not included in any monetary aggregates. Safes presented a purchasing power to be used in any network transaction.

The company used advanced cryptography in e-money scheme. As a network-based e-money product, Digicash had a dependence on the developments on the Internet implementations such as e-commerce.

5.2.7. RECENT DEVELOPMENTS AND CONCLUSION

Digicash announced bankruptcy in November 1998. On December 1998, when the company was under 'Chapter 11', Interim CEO Scott Loftesness answered questions about developments on through e-mail and here are questions and answers:

Question: What does being under Chapter 11 really mean? Does it mean that there will be no more e-cash issued by partners around the world like St.George in Australia and Credit Suisse in Switzerland after the end of recent contracts?

Answer: Chapter 11 is an opportunity for a company to obtain protection from creditors while it pursues a re-organisation plan. In the case of Digicash, we expect to either sell the assets of the company to another company or to take in new financing which could enable the company to "re-start" its efforts. If either of these alternatives happen, I would expect that e-cash will continue to be marketed to banks around the world and, by them, to their consumer and merchant customers.

Question: Does it mean Digicash really decided not to invest more money to e-cash schemes so that there will be no more network-based e-money schemes after so many reports about it from central banks around the world like BIS and ECB in Europe and FED in America?

Answer: The reasons behind Digicash filing Chapter 11 are complex. Basically, the company failed to raise sufficient equity capital financing to continue operations. When the company ran out of money, Chapter 11 was filed. The failure was in no way associated with any reports from central banks around the world. In fact, central banks are quite comfortable with the Digicash's e-cash implementation as it enables seller/purchaser anonymity while still enabling banking authorities to monitor the flows of e-cash to/from consumer and merchant accounts.

Question. Does it mean Digicash accepted that there is no potential business case for network-based e-money?

Answer: No, it doesn't mean anything of the kind.

Question: Is it possible that another company will develop e-cash further by buying all the property rights from the Digicash?

Answer: As described above, yes -this is definitely a possibility..

In less than a year, major intellectual property that was belonging to Digicash has been sold to another company and e-cash came back to the market. In October 2000, the new company has been contacted through the Internet[30]. It was Ruloff Capital, that has purchased some of the assets of Digicash and the new owners incorporated eCash Technologies Inc in May 1999. eCash Technologies seems to be a new organisation, completely separate from Digicash and with a much broader focus. The new company argued that, Digicash was focused primarily on micro-payments. Digicash was the company that originally developed the e-cash software. When Digicash ran into financial problems, eCash purchased this special software and technology and now markets the software and derived products like person to person (P2P), debit, prepaid, business to business (B2B) and wireless payments, as well as gift certificates and customer loyalty programs. Germany's Deutsche Bank (which was one of the main supporters of Digicash) joined back into the program and now a full-fledged customer for new solutions. The new company has also signed a contract with Metavante, a transaction

[30] Rhonda Fels from the eCash Technologies has kindly answered the questions through the mail on October 9th 2000 and info desk provided extra information again through the mails.

processor. Metavante will offer eCash Technologies' products to 700 client banks in the U.S. They plan to announce soon a deal to open up the Asia market, as well as supplying the gift certificate product to a major online site. According to the current plans, several well-known retail sites will accept the gift certificate product.

In a recent questionnaire conducted by email[31], Rhonda Fels of eCash Technologies explained the current position of the product as follows:

Question. How eCash can enrich a solution for the Internet payments where banknotes and coins can not function as medium of exchange?

Answer: eCash is supportive of the government and bank regulated monetary systems. Rather than allowing individuals to create their own currency outside of a central monetary system (such as money used only for the web and gift systems), eCash is derived from bank controlled funds, and is guaranteed, controlled and redeemed by regulated financial institutions. Therefore eCash is an electronic/Internet extension of banknotes and coins, and not a replacement of them. eCash funds are generally exchanged between 2 parties, buyer and seller, before being returned to the financial system. Therefore governments and central banks can maintain closer control of Internet commerce through eCash then through other systems, where value can exchange hands several times before being accounted for by regulated institutions.

Question. How eCash can increase payment system efficiencies?

Answer: eCash is completely electronic, so has automated efficiencies of non-paper-based systems. eCash is also a streamlined payment and accounting system, with efficient sized payment messages. Many existing bank payments processing systems use older transaction processing technologies, which do not lend themselves to Internet-worked distributed real time payment systems. eCash easily interfaces with the legacy bank payment systems, but is an efficient user front end that allows payment flexibility with connection to bank back-end processes, funds and control.

Question. Can eCash create a full alternative to currency circulation with a capacity to cover all money demand for transaction purposes not only virtually but with the help of smart cards conventionally as well.

Answer: eCash technologies believes that the banking industry can use eCash products to completely address all payment transaction demands, because it is flexible and customisable. It provides a very simple basis for an electronic payment infrastructure, upon which financial

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[31] The questionnaire has been sent on the 9th October 2000 and the answers has been received 3 days later.

service providers can add unique products and services to enhance basic monetary transactions, such as advice, insurance, and risk management. eCash can be used with smart cards for stored value systems and it can be used with smart cards or other biometrics authentication systems for enhanced security.

Question. To what extend, such a potential may even be developed with the co-operations with financial industry including central banks and financial supervisory authorities?

Answer: Having a supervisory authority, central bank, or financial industry to co-operatively decide to set up eCash as the basic electronic payments infrastructure for one institution or for an entire countries' electronic currency could be realise huge efficiency, organisational and modernisation benefits for any individual institution or country that elects to use eCash as the basis for its' electronic payments infrastructure.

Question. What is the major difference between Digicash's and e-Cash's approach to network based e-money? Is there radical differences on the 'purse' application.

Answer: eCash Technologies has enhanced the basic software system, by incorporating recent advances in computing technologies for increased efficiency and scalability. eCash Technologies has also incorporated other recent advances for increased flexibility in the user interface and in administrative reporting. Finally there are some differences in the 'purse' application, which is now referred to differently according to the eCash product in question. Because of increased flexibility and unique branding enabled by the user interface, eCash can be used to extend various core banking products, which may behave differently from the consumer or user point of view. For example a debit product may behave differently than a credit or ATM cash machine or a stored value card. So the interface may appear differently and the method for withdrawing and depositing funds can be controlled by the financial institution that offers the product or service. eCash payment messages can also be more varied, (can be in denominations or a total amount) but still represent bank redeemable funds. Basically more flexibility has been added to the system to replicate more bank products.

Question. What happened to the other banks like St George in Australia? Is Deutsche Bank the only customer at the moment?

Answer: St. George Bank in Australia is still conducting its eCash pilot, and is in discussions with eCash Technologies to determine next steps. Metavante has also signed up to offer eCash products and services to many of its banking customers. eCash is in discussions with many other banks around the world. Since we are keeping the staff small at this point, we must prioritise our business dealings. Deutsche Bank and Metavante in the U.S., as well as

some other banks, financial service companies and online merchants that will be announced soon take top priority right now, but we are/will be talking to the banks that were in the original Digicash pilot. Interestingly, a former executive at Mark Twain bank, which participated in the earlier pilot with DC, has moved to EverBank, and we've been in serious discussions with him about Everbank using our software. One thing at a time; that's our motto right now.

Question. In your opinion, what was the major mistake on the original Digicash proposal? Why did the company fail? Can it be the lack of demand for a network-based e-money? or was it because of very complicated software?

Answer: We have great respect for the innovative approach pioneered by Digicash. Obviously, since eCash purchased some the assets (including patents) from the company after it failed, we see it as having great validity. Still, our business model is markedly different from Digicash's. Ours is not focused solely on micro-payments, a market that Digicash focused on. Our product line includes Debit, P2P, B2P, mobile, prepaid, gift certificates and loyalty programs. We feel this broader vision is a more valid business model. A large part of the reason for the Digicash failure was a matter of unfortunate timing. Sometimes, being ahead of the market (as Digicash was) is not a benefit. The Internet was not widely used, nor was the need for electronic payment solutions widely recognised earlier in the decade. We believe that the major problem Digicash faced. The business model they followed did not help that situation.

eCash enriched the payment solutions within the product portfolio. Digicash' s original e-cash has been kept in as with the changed name: P2P for person to person. Other than that the new product Monneta[32] also offers debit services with unique ability to transform traditional funds into electronic payments that can be offered globally with PCs and PDAs or mobile phones. A Monneta virtual card for prepaid services was described as a cash equivalent electronic payment method with a stored value. By adding gift certificate, loyalty and mobile options to the portfolio, the intention of the company seems to be to address any kind of virtual payment demand that may emerge in the future. Other companies such as www.flooz.com have tried gift certificates as well.

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[32] http://www.digicash.com/Solutions/

5.3. OPERATING SYSTEMS AND WINDOWS FOR SMART CARDS

The reality of e-money may totally be dependent on an effective and efficient technology. The current discussions seem to get over questions about the capabilities of the technology that makes e-money a reality but the conflict arises from the different approaches from different system operators for the future of different e-money schemes. As money needs to be generally acceptable, so does e-money and for e-money to be generally acceptable, it has to be supplied in such a way that there should be no technical obstacle for the general and immediate acceptability. In other words, all e-money schemes in a certain economic area had better to be interoperable and compatibly to each other. No matter which operator provides the e-value, the retailers and consumers should be capable of accepting any e-money that has been offered to them. The borders of such an economic area may be defined as a group of economic entities dealing and transacting with each other like a country, like Euro Zone and like border towns using more than one currency in daily life. For example, any e-money scheme within European Union countries needs to be interoperable in all countries because e-money will be issued as Euro which will be acceptable in all member countries. As a result, interoperability becomes one of the most critical issues surrounding e-money.

On the other hand, as the technology seems to be in an emerging stage, there are different approaches to e-money proposals. A discussion of these systems seems to be necessary both to understand the current issues relating to e-money and to evaluate future developments.

Consequently, in this part, first of all, there will be a general overview of Microsoft, Java and Maosco proposals for alternative operating systems. An operating system for an e-money scheme may be explained as a software that will enable the electronic purse application in a smart card to support the card to function as money, including storing the monetary value, making payments from the card and taking payments to the card by transferring monetary value from one card to another or from card to a financial service account. Whereas, the operating system for the smart card microprocessor must handle such tasks as[33] data transmission over the bi-directional, serial terminal interface, loading, operating, and management of applications, execution control and instruction processing, protected access to data, memory management, file management and management and execution of cryptographic algorithms.

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[33] http://www.litronic.com/whitepaper/scoper.html

Unlike the personal computer operating systems such as Unix, DOS, and Windows, smart card operating systems do not feature user interfaces or the ability to access external peripherals or storage media. The capabilities of hardware may not be comparable to personal computers as the size of a smart card is typically between 3 and 24 Kbytes recently but future developments are expected. The lower limit weak cards are used by specialised applications and the upper limit strong cards are used by multi-application operating systems.

The importance of operating system for different proposals is that all the machinery including the cards, retail terminals, value-loading mechanisms such as PCs and/or ATMs and/or telephones and/or PDAs and/or game consoles need to be compatible with particular software or with all the software which enable the circulation of e-money. Like Windows operating system for PCs, a standard for smart card operating systems may contribute to widen the acceptance of e-money as it creates a standard and interoperable environment for all e-money schemes.

Windows for Smart Cards (WSCs) operating system will be searched in dept. There are two reasons to choose this particular system. The first one is that Microsoft is not a bank at least for now. The company's specialisation is computer software. As it is argued that e-money technology may decrease barriers to entry to financial service industry, Microsoft's plans to get involved into e-money business would be a test for this projection. Second reason is that, as Microsoft is a leading company in computer software with a comparative advantage to banks in this particular field, it may also have a comparative advantage to be the leading operating system among current proposals such as Java and Multos at least for multi-application smart cards. Whereas banks has a comparative advantage in payment technologies and know-how compared to Microsoft, the project may also contribute to the changes in traditional banking as the concentration and weight of traditional payment services from banks may loose its importance and force the banks to re-structure.

The last part of this section will include recommendations and implications of different operating systems for the future of e-money.

5.3.1. OPERATING SYSTEMS IN GENERAL AND JAVA CARD

There are three major current proposals for smart card operating systems with a capacity of universal acceptability. With the limit of current potential of smart cards, it may not technically be possible to place more than one operating system to a smart card. As a result, software system interoperability seems technically difficult for especially card-to-card

transactions at least for now. It may be argued that smart cards will follow a similar pattern to PCs so that in every one-to-two years the technical capabilities will double itself without any production cost (Moore's Law). This can create an opportunity for software interoperability but within current limits, smart cards are not able to support more than one operating system even card readers may operate with two or more operating languages.

The first operating system to be analysed is Java programming language-based. This system has the backing of Sun Microsystems and Visa International. Visa dedicated itself to Java and believes that it will be the future operating system for smart cards. Java technology is explained[34] as to run on a smart card or other small memory-constrained device. The Java wallet is defined as a Java application, which provides an open development framework, user interface, and secure services for Internet commerce transactions. The Java Wallet was said to run on Java Runtime Environment (JRE) available on a personal computer, workstation, or network computer. The underlying framework for Java Wallet includes an interface that can communicate with smart cards, including Java Card-enabled smart cards.

As the other two operating systems, Java's aim is to support smart cards, retailer machines to be used for these cards and all of their applications relating to smart card potential such as vending machines and point-of-sale terminals. The main components of Java software are explained by Java sources in depth as[35]: The Java Card Virtual Machine is built on top of a specific integrated circuit and native operating system implementation as main part of the operating language. The Java Virtual Machine layer hides the manufacturer's proprietary technology with a common language and system interface. The Java Card framework defines a set of Application Programming Interface (API) classes for developing Java Card applications and for providing system services to those applications. A specific industry or business can supply add-on libraries to provide a service or to refine the security and system model. Java Card applications are called applets. Multiple applets can reside on one card. Each applet is identified uniquely by its application identifier.

A Java Card is defined as a smart card that is capable of running Java programs and said to contain detailed information for building the Java Card Virtual Machine and application programming interface in smart cards. The minimum system requirement is 16 kilobytes of read-only memory (ROM), 8 kilobytes of EEPROM, and 256 bytes of random access memory

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[34] http://java.sun.com/products/javacard/faq.html
[35] http://www.javaworld.com/javaworld/jw-03-1998/jw-03-javadev.html

(RAM). These requirements makes Java as the most complicated operating system because current smart technology still relies on 8 kilobytes of read-only-memory. On the other hand, Java applications those were named as applets contributes to the security of Java cards as it separates every single application from other applications creating auto-exist firewalls. As a result, it may be argued that Java operating system may play a critical role as an operating system in the future especially after the technical capacity of smart cards reach to a certain point which is not expected to take more than a couple of years.

For the purpose of e-money analysis, technical details may not seem to be so relevant but software improvements of the past relating to computer industry may be accepted as a proof for fast and sudden developments in this area. As a result, e-money may need at least a partial understanding of smart card operating systems but any further details will not be searched as it is very technical and in general may not be needed for e-money dynamics.

In the following parts, Multos will be analysed. This particular operating system has a special place in this particular area as it is especially developed for e-money applications when Mondex initiated the beginning of the project and additionally it may be accepted as the most banking industry influenced operating system in the market.

5.3.2. MULTOS OPERATING SYSTEM

Maosco (Multi-Application Operating System Consortium) was formed as an industry wide consortium in May 1997 to drive the adoption of Multos as an industry standard operating system and to manage its on-going development. Up to that time, the smart card market has been developed on a proprietary basis. Systems typically enabled only one application per card which lead to consumers having to carry a number of different cards in their wallets for a number of different purposes, such as telephone cards, debit and credit cards, loyalty cards and access cards to buildings. Interoperability was not possible to form as all the cards to have an individual operating system. It was not only inconvenient for the consumer but, because each card had to be developed as a unique product, it was also extremely expensive for card issuers and application developers. Consequently, despite the obvious advantages of smart cards, their emergence has been restricted to a certain extent. During the development of Mondex scheme, it has become apparent that without a purse-oriented operating system, the critical mass for different applications including e-purse may not be sustained. As Java Card and WSCs was not available for that time, developers of Mondex decided to create a unique and e-money-oriented

operating system to support e-money schemes and other applications to enlarge the reach of smart card technology.

Maosco's mission was given as[36] to exploit the Multos specification to create an open industry standard, high security smart card multi-application operating system. Its role is threefold; to drive the adoption of Multos as an industry standard, to manage the ongoing development and maintenance of the specifications and to provide licensing and certification services.

Further companies are being invited to give the consortium interests in all major areas of the smart card business and the industries it serves, which makes the consortium an open platform. But, as different companies has different projections, there are more than one consortiums in the market and membership seems very volatile currently as there has been a consolidation going on. Maosco Ltd is said to be a 'not for-profits company'. The control of the Multos specification is shaped with the consortium members and it is the consortium members, as a group, who are responsible for the ongoing maintenance and development of the Multos specification. The membership to the consortium is not restricted but three criteria's were named to achieve maximum industry presentation[37]: The first one as global representation - Multos is to be a global not a regional standard. The second one as cross industry representation -with representatives of both supply and demand sides of the smart card industry and the final one as multiple industry representation -i.e. telecommunication companies, financial service providers, DTV companies, Internet and e-commerce companies, public sector and so on.

Multos may be defined[38] as 'an enabler for a number of different applications or products to be held on the smart card at the same time, separately and securely, and makes the applications platform independent, which means that for applications such as credit and debit cards, cardholders need a single card'. This may prove a huge convenience for the consumer, while allowing card issuers the opportunity to share the space on the chip and hence the cost of the cards with other service providers. With Multos, consumers, in conjunction with the card provider, will be able to construct a smart card, which is able to hold a number of different applications to suit their individual requirements or lifestyle. For example, an underground pass

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[36] http://www.multos.com/200/240.html
[37] http://www.multos.com/500.html
[38] http://www.multos.com/100/110.html

card may include e-money to pay for parking or for a newspaper, to function as a telephone card and as an emergency health application.

Multos runs on the micro controller on a smart card. The technical procedure has been explained[39] in depth. 'The Multos smart card checks the validity of the application it has been sent, allocates the program a protected and -through the use of special 'firewall' programs- an isolated area in its memory, and locks the new program into place. Every application on a Multos smart card has a firewall protected area to prevent it from interfering with any other application and operating system and to protect it from any other application's interference. Multos is compliant with the key industry standards and EMV and allows credit/debit, electronic cash and other applications to co-reside on the same chip card. (EMV is Europay, Mastercard and Visa specifications for credit and debit cards to be used on e-commerce in an internationally standard and interoperable manner). The security system allows multiple applications from many different industries, not just financial applications, to be carried together securely and independently on the same smart card.

Multos is now available on a non-proprietary 'open system' basis to enable it to be used as a standard across the various industries interested in using smart cards including travel, retail, medical, government, access control, telecommunications, entertainment and finance applications. They may be named as EMV compatible credit and debit cards, electronic purses, airline ticketing, bus or rail season tickets, electronic traveller's cheques, loyalty programs, medical, Government/Citizens cards, driving licences, emergency health information, social security access control, telecommunications, calling cards with a programmable list of contacts and telephone numbers, entertainment applications such as electronic ticketing and electronic purse for theme parks, GSM standard for digital telecommunications, Internet both for access or payment.

Maosco Ltd. argued three key unique features for Multos operating system[40]: Firstly, rather than keeping Multos as a proprietary specification, Mondex International as the inventor of the operating system has chosen to donate the Multos specifications to the industry with the objective of creating an open, de facto industry standard. Secondly, security is a fundamental business requirement and should be designed into the product from the start - not added as a

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[39] http://www.multos.com/100/120.html
[40] http://www.multos.com/500.html

layer at the end. Finally, the ability to load and delete applications securely, whilst cards remain in the field is a feature which is completely unique to Multos.

These arguments do not hold for only Multos at the moment because all the operating systems argue that they have the same unique features. Consequently, above-mentioned features may be interpreted as the basic requirements that any operating system should sustain in general terms. Maosco Ltd. is clearly aware of the fact that[41] 'any card issuer who is going to invest seriously in smart cards as part of their delivery infrastructure is going to require and demand multiple sources of interoperable supply. The products are going to have to be interoperable - that is guaranteed to provide the same functionality, security and compatibility'.

Multos mentioned all the benefits of this particular operating systems for all the parties including both the financial industry and to many others -telecommunications, Internet, public services, satellite/cable and pay-per-view TV, transit, ticketing and retail industry and to benefit consumers in these industries world wide. Some of the benefits may be listed to demonstrate the efficiency and ease of use of an operating system[42]:

Card Issuers can choose among silicon providers and migrate their products from one generation of chip to the next without having to re-write applications. The security features enable applications to be downloaded over 'insecure' networks such as the Internet or public telephone systems by using firewalls. Upgrades would be faster, cheaper and less disruptive to the customer relationship arising from the standardisation. Multos operating system plans to allow issuers to share the cost of silicon with non-competitive application suppliers - for banks with travel companies, medical agencies with government issuers or transit authorities with telecommunication companies -enabling new areas of co-operation and co-branding to be developed. These additional offerings would also help to create a critical mass for smart card applications and increase the awareness of the smart card potential in public and private sector.

Application developers who have previously been restricted to the development of one-off bespoke applications could have the capability to offer their developments as standard products after the reality of an interoperable operating system. Like PCs, smart cards would have a common platform to operate without being hardware dependent.

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[41] http://www.multos.com/500.html
[42] http://www.multos.com/300/330.html

Silicon and card manufacturers may benefit from the greatly increased size of the smart card market arising from Multos technology that allows manufacturers to offer any one of their products to the complete range of application developers and smart card users.

Retailers may have more choices for offering cards to their customers and reducing costs. The operating system enables retailers to offer new services beyond loyalty programs such as electronic shopping lists or coupons with the new option of co-branding, sharing costs and offering customers more services on the retailer's own card. The standard operating system will allow all the economic units to adjust to a common platform for trade and exchanges with a potential to increase the acceptability of e-money and increase its role as a medium of exchange.

Customers (end-users) benefit from fewer cards to carry and to bring preferred products and services onto a single or small number of smart cards. Multos offers the important benefit of immediate on-line programming, allowing the consumer to choose which applications to hold on the card and enabling deletion of non-relevant applications. Multos will create an environment that cardholders need not to wait for a customised card to be physically delivered as they can create their own card on-line using a bank ATM, a public phone or a PC on the Internet to program the services they want on to the card. This may take a little over one minute with the cardholder putting the card into a bank ATM, into one of the new card-based telephones or a smart card reader attached to a PC linked to the Internet. Once the card is connected with the computer system of the bank or service provider, the cardholder is given a menu of options, which will start the programming process. This flexibility would allow the emergence of lifestyle cards, such as university cards carrying all the applications required for life on campus as the University of Exeter - building access, electronic purse, library card, student voting card, identity card etc. With a standard operating system, smart cards would have all their multi-application potential available to the customers.

Benefits to telecommunications companies include a secure and cost efficient way to move away from the 12 billion phone cards that have to be thrown away every year.

Although Multos exhibited these benefits arising from its own product, obviously, same benefits may be sustained by other operating systems as well. These benefits should better to be analysed as general benefits of a standard and interoperable operating system for smart card applications including e-money.

After analysing two operating systems namely Java Card and Multos, in the next section, WSCs from Microsoft will be searched in detail as it may play a critical role for e-money perspectives and future structure of financial service providers.

5.3.3. WINDOWS FOR SMART CARDS

WSCs will challenge Java Card from Sun Microsystems and Visa International, and Multos from Maosco, a consortium that includes MasterCard, American Express, Fujitsu, and other major corporations. All three Operating systems make it possible to put several application packages on an integrated circuit inside a smart card and to change those programs without any impact on other programs stored in the card. What makes WSCs so special is because Microsoft has a great influence on computer software with a well-established marketing structure throughout the world and has a comparative advantage against its competitors. Multos has a banking background and more dedicated to e-money arising from its Mondex connection but without analysing all the operating systems, it may not be possible to cover operating system developments around e-money including WSCs. The multifunction capability of smart cards lets these cards be used for site and network access, identification, and records storage and for cash transactions as e-money. Some of the potential functions of smart cards that were mentioned[43] by Microsoft include:

- A smart card can remember multiple passwords for a user, all protected by a single PIN. This results in a direct solution for users to remember many different passwords for many different network accesses.
- Users need not know the secret or password stored on the card, so that they can't write it down or share it with others. This potential solves the problem of password vulnerability.
- When the smart card is capable, symmetric cryptographic algorithms can be performed on cards so that the secret does not need to appear in the desktop computer, where it could be sniffed by a malicious program. This guarantees the security of card passwords in network environments.
- The smart card can hold the private key for a user PIN protected, so that it's portable. Additionally, these cards are temper-resistant creating storage for protecting private keys, account numbers, passwords and other forms of personal information. Smart cards may be used for authentication under a high level of security.

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[43] http://www.microsoft.com/windowsce/smartcard/resources/wp2.asp

- If the smart card is capable, it can perform the asymmetric algorithm on card, so that the private key never appears in the PC, where it could be sniffed by a malicious program.
- If the smart card is capable, it can generate the private key on the card so that it never has existed anywhere other than on the smart card in secured storage. This allows digital signatures to replace hand-written signatures.
- When on a smart card, the certificate and private key are portable from machine to machine creating convenience and allowing place-independent transactions to be performed.
- When on a smart card, the private key need never exist in the computer memory, where it could be vulnerable to sniffing by malicious programs.
- When on a smart card with an auto-disabling PIN, access to the private key is resistant to a 'guessing' attack.
- When on a smart card, the intended user has more control over when and where the private key is being used because they can carry the smart card with them.
- Smart cards can be initialised with a very strong password, which would be difficult for a human to remember. This increases the effective key space.

These potential are not directly related to particular operating systems. The reason they were investigated here is that with all these potential, smart cards may have a widespread acceptance as they create a combination of conventional and virtual way of life. Thus, software-based and card-based e-money potential may be integrated to a single platform by using smart cards to allow individuals to perform financial transactions on conventional methods and fast-developing virtual methods such as e-commerce. For this purpose, three multifunction operating systems are expected to battle to gain a foothold in market namely WSCs, Java Card and Multos.

Historically, WSCs is the youngest operating system project. It was announced in October 1998 with a potential launch as early as January 1999 but because of non-stop technical progress and fast-changing requirements of the market, it has been delayed quite a few times. The project was announced[44] as a standards-based platform that will provide secure storage for security, loyalty and e-purse solutions in the Microsoft Windows operating system. Obviously, Microsoft seems to be willing to play a full-scale role with all the infrastructure of its products already available in almost every PC around the world and relies strongly on the

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[44] http://www.microsoft.com/PressPass/press/1998/Oct98/smrtcdpr.htm

comparative advantage of Windows product that are widely used and became familiar to PC users and experts.

Typical solutions enabled via smart cards were named as secure network authentication; secure corporate transactions such as online banking, and debit and credit, e-cash and customer loyalty programs; and mentioned to take many advantages[45].

WSCs has no direct aim to be a pure alternative to central bank money because it is not an e-money scheme. Consequently, it may be misleading to investigate this product as to be a direct threat to the central banking. The importance of the product is, as mentioned earlier, is that:

1. Microsoft is not a financial service provider and the development of its operating system is not directly and only financial service oriented. However, as a non-financial institution, the company's plan may create an alternative payment system infrastructure, which may also be used for financial services. This potential comes from the continuous progress in smart card technology and continuous innovation on smart card applications. Even a smart card infrastructure with a purely standard or interoperable operating system may not have a direct aim to create an e-money scheme, once the critical mass is reached, it may be very easy to add an e-purse application for all smart cards to lead direct issuance of e-money.
2. Microsoft's comparative advantage in PC software and international expertise on marketing and on sustaining a non-stop progress in computer software may be an additional cost-cutting alternative to banking-based payment alternatives. As surveyed in chapter 6, the future access for money is expected to be PCs by the innovators and operators and PCs may not be understood better by banks and similar financial service providers than Microsoft, which may not have a comparative advantage in financial service products but could get an advantage to create a payment infrastructure by using its power in PC software and by using smart cards in payment services including other multi-application potential.
3. For a few decades now, computing cost has been diminishing and it is generally expected that the cost of communication may follow a similar trend. With almost zero cost of

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[45] http://www.microsoft.com/PressPass/press/1998/Oct98/smrtcdpr.htm: **Multi-partition file system** to physically separate data files so that multiple applications can safely run on a single card. Java manages this by using applets and Multos by using firewalls. **Access Control Rules** to tightly control who has access to all the files on the card, as well as files off the card. Security seems to be one of the most critical issue for all operating systems. **Pluggable cyptographic algorithms** to allow developers and customers to specify and design their own levels of cryptographic support. This option seems to address especially public key infrastructure potential by using public key cryptography and security. **Support for existing smart card standards** to sustain currently agreed standards

computing and communication, it may not be easy to charge financial service customers for simple transactions relating to payments such as account-to-account transfers. If Microsoft supports WSCs as an alternative payment infrastructure which may be open to different e-money scheme operators, then, the role of banks may deteriorate as new financial service provider start-ups find a ready-to-use payment infrastructure that they can use by just integrating to PC-based and Windows compatible smart cards. Because of their multi-application potential, such a system may provide e-money with a ready-to-use PC network hugely supported by recent trends in Internet and WAP potential with an enormously increasing number and ability to add other payment alternatives such as credit and debit cards for macro-payments.

4. Even central bankers started to question the future of central banks after the current technological developments. Deputy Governor of the BOE Mervyn King argued in a recent latter published in Financial Times that[46] 'There would be no unique role for base money, and hence the central bank monopoly of its issue would have no value. Central banks would lose their ability to implement monetary policy. The successors to Bill Gates would have put the successors to Alan Greenspan out of business'. Without being even a bank, Microsoft, representing the technological improvements of the last two decades, seems to convince even central bankers that money, most probably in an electronic form, may be managed without central banks. This approach may confirm a requirement for a close attention to WSCs.
5. Regulators may find it difficult to understand how to react to a potentially new framework for the financial service supply by using internationally compatible and borderless service coverage as conventionally banking regulation relies on banking industry and financial service providers mainly dominated by banks. It may be a new concept to supervise a computer software company as a financial service provider or an electronic network to be shared by many financial service start-ups to enjoy the potential of smart cards creating a combined software and card-based environment for e-money issuance.

In the light of these considerations, it may be useful to investigate the WSCs operating system in further depth.

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for smart cards by the industry in order not the create a competition which may result in the disruption of given standards.

[46] http://www.ft.com/hippocampus/q147c2e.htm. Financial Times, 'Personal View', August 31, 1999.

Microsoft assumes that smart cards will have a similar development pattern to personal computers: Once a common operating system, similar to IBM compatibility in the PC market, is created there will be a boom in demand for especially multi-application smart cards including e-purse to store money. As a result, Microsoft's WSCs has been designed[47] to provide a standard-based platform that enables secure storage for smart cards used for a variety of purposes, such as secure network authentication, secure corporate transactions, e-cash and customer loyalty programs. This approach would create a natural environment for e-money potential because as smart cards have a wide customer base, it may be easier to convince them to add e-purse applications to their existing cards than convincing them to carry an e-purse card only. WSCs is defined as an 8-bit multi-application operating system for smart cards for now. It is designed to be a low-cost, easy to program platform that runs many existing Microsoft technologies. It has been designed to meet four key criteria:

1. To enable smart cards to be a secure extension to the PC environment, in terms of development tools and connectivity. This criterion may create the broadest base for money distribution channel that is available in the current market conditions. All the computers carrying a PC/SC logo will be interoperable for smart card applications.
2. To work with software development tools that has a broad base of developer familiarity and support. This is the comparative advantage of Microsoft in the software industry and e-money scheme operators may customise the operating system to add and subtract different functions in addition to e-purse limited only to the memory of the embedded chip.
3. To offer card issuers the ability to choose the components they want from a variety of suppliers. It is this opportunity that new entrance to financial service industry may be easier and cheaper compared to a current fixed investment level for conventional financial services.
4. To deliver smart cards at a more attractive price, therefore encouraging new applications and uses. Cards are expected to cost between $2 and $4 each for simple cards and $6 and $8 for cards with more advanced security features, compared to the $15 or so it costs for existing cards. The cost mentioned here may drop dramatically in the future or advanced cards may be offered for the same level of cost creating an opportunity not to increase cost for increased security with advanced cards. There may be a correlation between the cost and security level and financial applications may require highest level of security. But, as cost

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[47] http://www.microsoft.com/PressPass/features/1998/10-27smartcard.htm

of card decreases, the reach of applications increase as well to help sustain economies of scale.

Above four criteria were regarded as necessary for any smart card platform or initiative to succeed in accelerating the acceptance of smart cards to support a critical mass to sustain the economies of scale.

Microsoft expects WSCs to become the popular smart card choice for three reasons[48]:

1. Because it is based on the Personal Computer /Smart Card (PC/SC) interface standard. Other operating systems are available for both card and network-based solutions as well.
2. It is ISO 7816-compatible. Other operating systems maintain the same requirement as well, as this is a standard for smart card industry.
3. It is very tightly integrated with the Microsoft Windows NT, Windows CE and Windows 2000 operating systems and Microsoft Internet Explorer browser software. This is the major difference of WSCs from other operating systems, as Microsoft seems to be committed to its operating system by using all its software expertise for smart cards infrastructure.

As it is mentioned earlier, Microsoft has no immediate intention to operate an e-money scheme. On the contrary, Microsoft's initial focus is on three broad market categories[49]:

1. Corporate information technology (secure logon).
2. Medical applications to improve the quality of service and decrease the time spent for admitting and processing patients.
3. Travel and Entertainment including Loyalty Applications. As credit cards emerged from this particular sector, it may be one of the major parts of early smart card applications.

On the other hand, WSCs promises to create operating systems resulting in benefits known as the four P's[50]: enhanced protection, improved productivity, increased profit and facilitated promotions for all related parties to smart card applications. Microsoft argues that applications are the driving force behind the new smart card market and the choice of applications will be the strategic decision for implementers and adopters including e-money scheme operators. According to the company, the most promising applications include[51]: (i) Prepayment for services like prepaid phone cards. (ii) Credit, debit and e-purse cards.(iii) Loyalty cards for discounts. (iv) Access control to buildings, computers or other secure areas.

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[48] http://www.microsoft.com/PressPass/press/1999/May99/AtmelPR.htm
[49] http://www.microsoft.com/PressPass/press/1999/May99/PilotPR.htm
[50] http://www.microsoft.com/windowsce/smartcard/start/intro.asp
[51] http://www.microsoft.com/windowsce/smartcard/start/background.asp

All these applications broadens the reach of smart cards for widespread issuance of e-money by just adding e-purse applications to the cards that are already in the circulation. Any application that increases the number of smart card capable for e-purse application would increase potential customer base resulting in a critical mass for economies of scale. Consequently, WSCs may help not only to create a common platform for different e-money schemes but also widens the number of potential customers to a level, which is attractive enough for local, national and international rollouts for e-money schemes.

5.3.4. EVALUATION OF OPERATING SYSTEMS

Three different operating systems that were analysed above have been trying to dominate smart card operating systems for the future by creating a common platform for different applications including e-purse. They all aim to be the best both now and in the future. The competition among them may either exploit aggressive e-money rollouts or may delay it because of unclear future perspectives. Here is a comparison:

TABLE 5.3.1. MULTI-APPLICATION OPERATING SYSTEMS

WINDOWS FOR SMART CARDS	MULTOS	JAVA CARD
Last to start	First to start	Second to start
Most flexible	Formal Security	Most Functions
Cross Industry	Financial Industry	3-4 key Industries
Single Company	Consortium	Company + Consortium
Windows Development Environment	Mondex tie-in	Java-based technology.

Source: European Card Review, May-June 1999, Page 4.

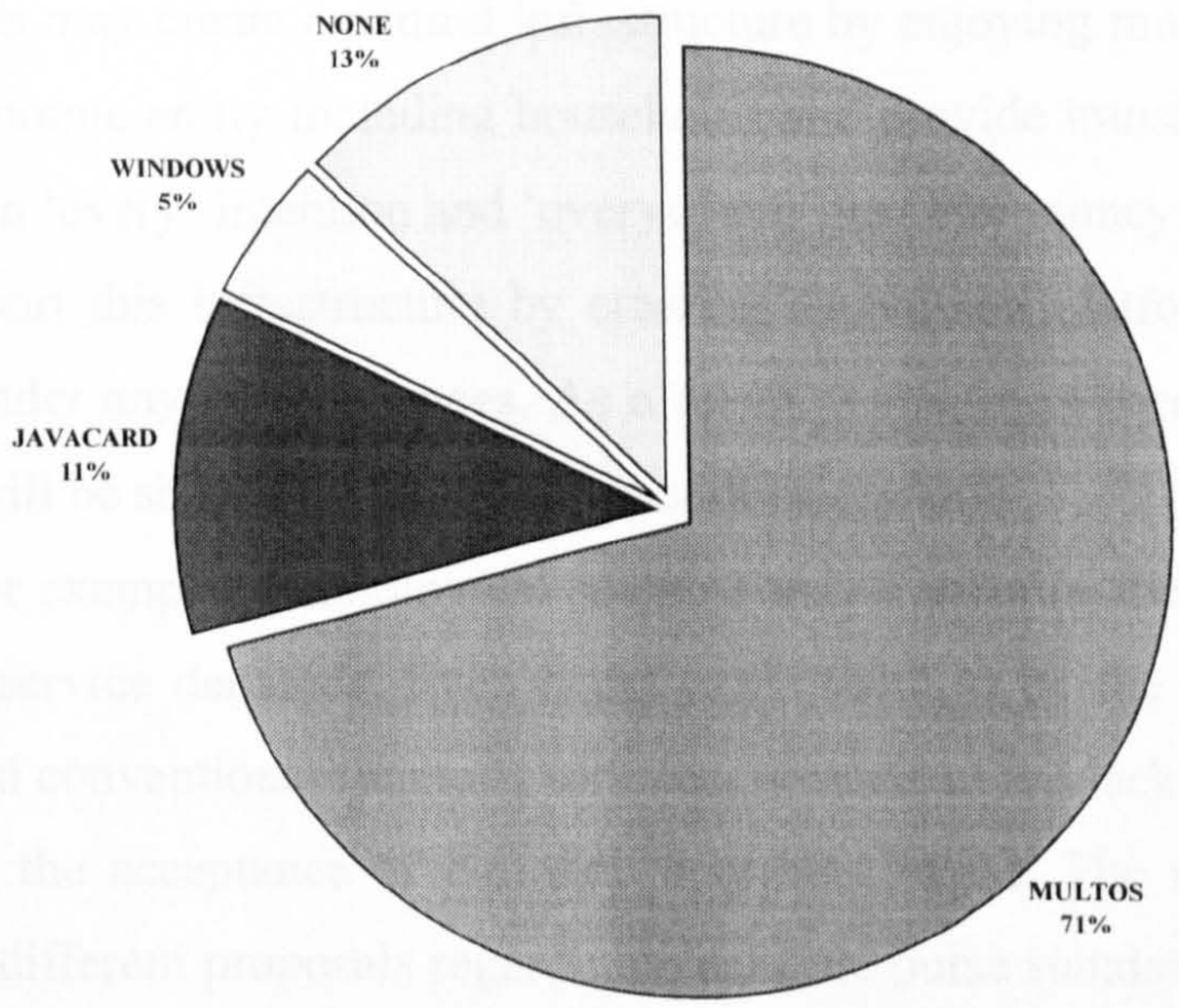
The table gives a summary of each operating system including their characteristics. WSCs seems to be the most flexible one as it gives issuers a wide range of options to customise applications on their own priorities compared to Multos, that gives security a top-priority as it targets financial industry whereas WSCs targets cross industries such as authentication and secure access. On the other hand, Java Card seems to enjoy Java language's advantages with most functions creating a demand for even more advanced cards targeting certain industries such as banking and leisure and entertainment.

The structure of organisations changes among the operating systems as well. Microsoft seems to prefer to act alone on the design of WSCs by just consulting its potential customer base.

The last distinction arises from operating platforms as WSCs operate in a Windows development environment totally integrated to Microsoft's software expertise whereas Java Card operates under a Java language-based technology. Mondex, on the other hand, was designed as an independent operating system mainly prioritising financial application requirements for Mondex e-money scheme.

A current survey question on the Internet by Faulkner & Gray's Card Technology asked the participants this question[52]: Below chart exhibits these results:

CHART 5.3.1: THE FUTURE OF OPERATING SYSTEMS



The results seem to favour Multos but it may be very difficult to conclude that the competition is over. As of October 12, 1999, there were 598 responses and 424 of them favoured Multos whereas 77 of them argued that in 'several years' there would not be a dominant operating system. 68 of the participants voted in favour of Java Card whereas only 29 participant voted for WSCs. Because of the consolidation process, it may be possible to observe

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[52] http://www.cardtech.faulknergray.com/survey2.htm- *Which software-operating platform will become the standard for multi-application cards? Select One:*
A) Multos: It's available today, highly secure, and it was developed with smart cards in mind.
B) Java Card: The Java programming language has many supporters among software developers, and Java Card has established a foothold in the GSM phone market.
C) Windows for Smart Cards: Microsoft knows software, has virtually unlimited resources and, well, it's Microsoft.
D) No single operating platform will dominate the smart card market for the next several years.

hard fluctuations arising from continuous technological process. A possible crackdown, for example, may change above picture suddenly in disfavour of cracked systems.

5.3.5. ADDITIONAL REMARKS ON OPERATING SYSTEMS

The relationship between e-money and multi-application operating systems may be constructed by the definition of money, which is generally and immediately accepted medium of exchange. The current stage of e-money may be summarised as a discovery process to find the best way to create an efficient infrastructure in order to create first of all a critical mass and then, support it to profit from economies of scale. The aim of this section was to find out how smart cards may create a natural infrastructure by enjoying multi-application potential to reach every economic entity including households and provide transactions using e-money, which is accepted in 'every' intention and 'everywhere' just like money. Operating system's importance is to support this infrastructure by creating a common platform for all e-money schemes to operate under any circumstances. As a result, it may be expected that the future of operating systems will be shaped by many different developments.

For example, technological progress may determine the reach of smart card solutions to financial service demands. Even smart cards seem to be the best available gateway between virtual and conventional financial services, because of the lack of consensus on interoperability solutions, the acceptance of e-money may be delayed. The reason for such a delay may be found on different proposals regarding electronic purse standardisation. For example, European Committee for Banking Standards have been publishing so many guidance relating to electronic purse and finally, The Interoperable Financial Sector Electronic Purse Standard for European Banking was announced in June 1999. Standardised transactions included balance inquiry, currency exchange, log inquiry, load of purchasing power, incremental purchase and purchase cancellation.

It is not only European Committee for Banking Standards that is trying to create a common platform for e-money operations, payment card operators want to impose their own solutions as well. For example, Visa International published the details of Open Platform as a solution to create a common platform for its own e-purse: Visa Cash. But it only supports Java-based solutions even it is promised to adapt other operating systems when they are finalised including WSCs. Visa defines The Open Platform[53] as a comprehensive system architecture

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[53] http://www.visa.com/av/news/PRmisc042999.vhtml

that enables the development of globally interoperable smart card systems. Visa argues that Open Platform enables smart card issuers to choose between operating systems and application developers while providing a core security and card management technology.

Proton World, on the other hand, supports a variety of technologies and specifications to deliver open, interoperable and global smart card solutions with an aim to support and implement the Common Electronic Purse Specifications (CEPS). The CEPS is designed to permit convenient interoperability between electronic purse schemes world-wide. The CEPS were published at the end of March 99 after reviewed by independent laboratories and is supported by Europay International, Visa International, Proton World and German and Spanish Banks associations. Unfortunately, Mondex is not CEPS compatible at least for the moment resulting in an interoperability problem for two different approaches to e-money.

All the above-analysed alliances may have a different influence on the future of operating systems because all those different 'common platforms' need a different technology resulting in different software. Either operating systems or e-purse operators may need to adapt to the other as a result of interoperability requirement.

Other than technological problems relating to operating systems, the operating systems should be interoperable among themselves as well, which may only be supported by more advanced smart cards in the future. It may be expected that there may not be so many operating systems at the same time, as mobile phone technology seems to prove the advantage of having an international standard for a new product. Some of the operating systems may be eliminated in the future through competition. This risk may slow decision-makings of operators in order not to choose the operating system, which is not reliable.

One other point is that recently, operating systems seems to be planned through card-based e-money schemes. It may be expected that, software-based e-money schemes may also find smart card solutions to issue e-money. National or international currencies may not be the only form of purchasing power that are downloaded to smart cards but it may also be e-gold and/or Beenz (the Internet value earnable on the Internet only as a currency) for example. Once there is a reliable infrastructure to circulate purchasing power on smart cards with interoperability, it may be possible to circulate any kind of purchasing power.

5.4. CONCLUDING REMARKS FOR CASE STUDIES AND OPERATING SYSTEMS

This chapter considered Mondex as an example of card-based e-money proposals, Digicash as a network-based e-money scheme and operating systems for smart cards as to play a critical role for the future of e-money. The numbers of e-money projects are not limited to these two examples. From Avant in Finland, which was originally the one and only central bank e-money scheme, to e-gold; there have been many others that have been developed and even so often another new project comes on to the market. They may change from Ithaca Hours as a local exchange trading system to an electronic gift certificate such as Flooz, or an electronic mail of value such as Paypal. Some projects try to fill the gap of alternative payment systems as credit cards look for an age limit of 18 and offer virtual wallets on the Internet to enable underage to be able to spend.

It may be argued that all the exaggeration of the past few years for national rollouts for testing projects or increased international co-operation were not realised. It may also be argued that e-money may not be realised in the couple of years. Both arguments may have supportive and discouraging aspects. But, e-money is still under increased interest among central bankers, academicians and practitioners and the discussions probably accelerate year by year to the implications. The above two case studies were believed to cover almost all the potential e-money proposals in a way. Especially the analysis on operating system completed the picture because it may be expected for the future that all the e-money forms will in one way or another be similar to the cases that were investigated here as they almost cover all the potential aspects of e-money.

6. SURVEYS ON ELECTRONIC MONEY[54]

In this chapter, three sets of data will be analysed. The first data set was collected in 1999 and will be analysed in the next section and the second data set was collected in 2000 and will be analysed in the following section. Both surveys have an aim to collect empirical data about the current stage of e-money schemes and investigate future trends that may help central bankers, regulators and practitioners shaping their approach to e-money and its implications for financial service industry including monetary policy and financial regulation. The final data set from the third survey was collected in Miami in 2000 with an aim to compare the results to earlier findings from the European surveys. The comparison will target whether there is a difference on the perception of e-money among European and the American innovators and operators to create a base for the alternative reactions of the ECB and the FED to the emergence of e-money.

E-money has captured the attention of central banks, financial regulators, law enforcement agencies, financial practitioners and academics alike. All the three surveys have a clear assumption: The future stage of e-money might most probably be shaped by the discoveries that have been and would be made by the innovators and the operators, who will further manipulate and exploit the technical potential of those innovations with financial applications. As a result, any e-money analysis might be incomplete unless covering the opinions and perception of innovators and operators. This assumption also covers the two basic motives behind e-money reality, namely endlessly decreasing cost of telecommunication and ever increasing computing power including smart cards. It is clear that innovators and operators are at the forefront of e-money development, conceiving and offering new ideas and products to investors and the market at large. Therefore, their views on the potential of e-money and its impact are uniquely interesting for policy makers. Of course, innovators and operators cannot exactly predict how the future of e-money will turn out, but they do have a lot of special

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[54] Partial analysis of these surveys have been presented in conferences and published as discussion papers. The analysis of the first survey was presented as "Capie, F.H. – Gormez, Y. – Stojanovic, A.: Electronic Money: The Perception of Operators and Innovators" at the 8th Symposium on Finance, Banking, and Insurance, Universität Karlsruhe (TH), Germany, December 15–17, 1999" and the analysis of the second survey was presented as "Capie, F.H. – Gormez, Y.: A Survey on Electronic Money Trends in 2000" at the Third Berlin Internet Economics Workshop, Berlecon Research, Berlin, Germany, May 26–27, 2000. A collected version of both surveys has been combined and published as "Gormez Y.; Capie F.H.; 'Surveys on Electronic Money', Bank of Finland Discussion Papers, 07\2000, Helsinki, June 2000". The final survey has totally been sponsored by the Bank of Finland during a research scholarship and the analysis is accepted for the future publication list as

knowledge on the possibilities of their products and ideas make available for the society as a whole.

E-money has been treated as a phenomenon through the chapter. Consequently, it was assumed that the survey approach would be the best way to collect data in order to gain insights into the future of this presumed phenomenon, as meaningful time series data being almost totally unavailable because of the infancy of e-money. As a result, the chapter is mainly exploratory.

It is hardly surprising anymore to hear about new trials in new countries or cities (involving the same or different e-money schemes). Although there is no generally-agreed business case for any particular e-money scheme, operators and innovators have been trying to establish national and international standards for e-money products, using a wide variety of approaches (from account-based payment solutions to totally anonymous token-based payments). They have invested large sums of money, time and effort. A survey of current or planned e-money products in 68 countries/territories has recently been made available to the public by the BIS, (2000).

As an emerging technology, e-money seems to have been moving very fast. A few years ago, expectations as to network-based e-money tended to be exaggerated. The early proposals were impressive, in line with popular expectations regarding Internet and network-based virtual life. In the following years, smart card-based solutions to e-money applications became very popular, and nearly all credit companies began to invest in electronic purse technology, parallel to independent start-ups. There were even forecasts of person-to-person transactions via electronic wallets that would be distributed to all cardholders. Recently, mobile applications have favoured network and card-based e-money schemes in connection with WAP applications, which is another type of card-based solution, since WAP is written on smart cards. In this rapidly and continuously changing environment, the survey approach seems to provide the best means of collecting data on the implications and possibilities of e-money.

6.1. E-MONEY: THE PERCEPTION OF INNOVATORS AND OPERATORS

The first data set will be analysed in this section. The data was collected in 1999 during 12th International Advanced Card Exhibition and Conference (Smart99cards), which was held

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"Gormez Y.; Capie F.H.; 'Prospects for Electronic Money: A US - European Comparative Survey', Bank of Finland Discussion Papers".

in Olympia 2 in London on 23 – 25 March 1999. The exhibitions brought the innovators and operators together in a presentation of their products and visions of e-money applications. Consequently, the scope of the survey is limited to the perceptions of innovators and operators regarding e-money; the views of other interest groups are excluded from the study.

The purpose of the survey was to collect empirical data on the current status of e-money schemes and to investigate future trends, interesting to central bankers, regulators and practitioners who are shaping their approach to e-money and its implications for the financial services industry, including the monetary policy and financial regulation aspects. The study is not intended to provide detailed information on any particular e-money scheme nor on the advantages or disadvantages of particular proposals. Nor is this an analysis of a particular country's vision of the e-money phenomenon. The aim was to collect data that may help to understand the possibilities and limitations of e-money in general, so as to assist policy makers to decide on policies that may have direct or indirect consequences for the development of e-money. The questionnaire for the survey is presented in the appendix 6.1.6.

6.1.1. INTRODUCTION AND AIMS OF THE SURVEY

It is generally assumed that e-money, as a developing technology, has many implications for the overall structure of financial industry and on the conduct of monetary policy and monetary policy instruments in particular. In order to investigate the assumption further and collect empirical information about the impacts of this developing technology, innovators and operators, who develop it for daily use in financial transactions, have been questioned.

One aim of the first survey was to provide empirical insights into what e-money innovators and e-money scheme operators driving the innovation and technological developments think about the issues surrounding e-money.

The second aim was to scrutinise some of the issues of concern to the parties that take part in e-money implementation, analysis and discussions. The broader aim was to gather information from industry experts and use it to gain insights that will help decision-makers and other discussants from both academia and the practical world to understand e-money and its potential and limitations.

Consequently, detailed analyses of particular products or schemes are beyond the scope of the study. The data collection was not designed for this purpose, which would be better

served by a case study. Moreover, it is not the aim here to compare different e-money schemes or to clarify differences in various concepts of e-money.

Consequently, the scope of the survey was limited to collecting empirical data on e-money developments from the innovators and scheme operators point of view only, excluding academics, bankers, central bankers, financial industry experts, consultants and the like. Individual analysis of a particular product or scheme was also out of the scope of the survey. The procedure to collect data was not designed to do so, as this would be done better by case studies. There is also no intention to compare different e-money schemes or to clarify differences to the concept of e-money from different sides.

6.1.2. THE SURVEY SAMPLE

With the above mentioned aims and limits, a questionnaire was prepared and a survey was conducted at the Smart99cards Exhibition and Conference. Open systems and multi-applications were key concepts at the exhibition, not only for card manufacturers but also for system operators and users. Almost all e-money scheme operators – some with similar and some with widely differing approaches to e-money applications – including Mondex International Ltd, Europay International, Proton World International SA and Visa International participated in the exhibition. Projects involving person-to-person applications were presented along with projects with account-based solutions. There were companies that were attempting to unite several e-money applications in a single and compatible platform and companies with operating system proposals for potential e-money software. Most of the major innovators in the world behind e-money technology including Ascom, Bull Smart Cards and Terminals, Gemplus Ltd, Keycorb Ltd, Lucent Technologies, Philips Semiconductors, Schlumberger Cards and Siemens Semiconductors contributed to the exhibition. The topics ranged from biometrics solutions to advanced cryptography. The majority of represented companies were interested in certain aspects of smart card technology, but the main players were also concerned with defining their approaches to current problems and sharing their visions with interested parties. The total number of exhibitors was just over 120.

As a result, it can be argued that the survey sample, which included almost all relevant exhibitors, was representative and had good-to-excellent coverage on emerging e-money technologies, since all the main players were there long enough to provide the appropriate environment for a survey.

6.1.3. METHODOLOGY AND DATA COLLECTION

The questionnaire was distributed to the individual exhibit stands on the second and third days of the exhibition. The distribution process included an interview of the exhibitor concerning its products and services. Those exhibitors with products and services unrelated to e-money (eg companies involved in the manufacturing process but not in financial applications) were not given a questionnaire. Potential respondents were informed of the aims of the survey, including general information about the research project. In all, 105 questionnaires were distributed and 51 were later collected, so that the return rate was 49 %. (Due to the hectic circumstances, many exhibitors lost their questionnaires and were given second copies. In calculating the rate of return, lost questionnaires were excluded from the total count so as to avoid double counting). There were some exhibitors who refused to complete questionnaires while other non-responses were mostly due to a lack of available staff or requisite expertise (as most of them explained it) .

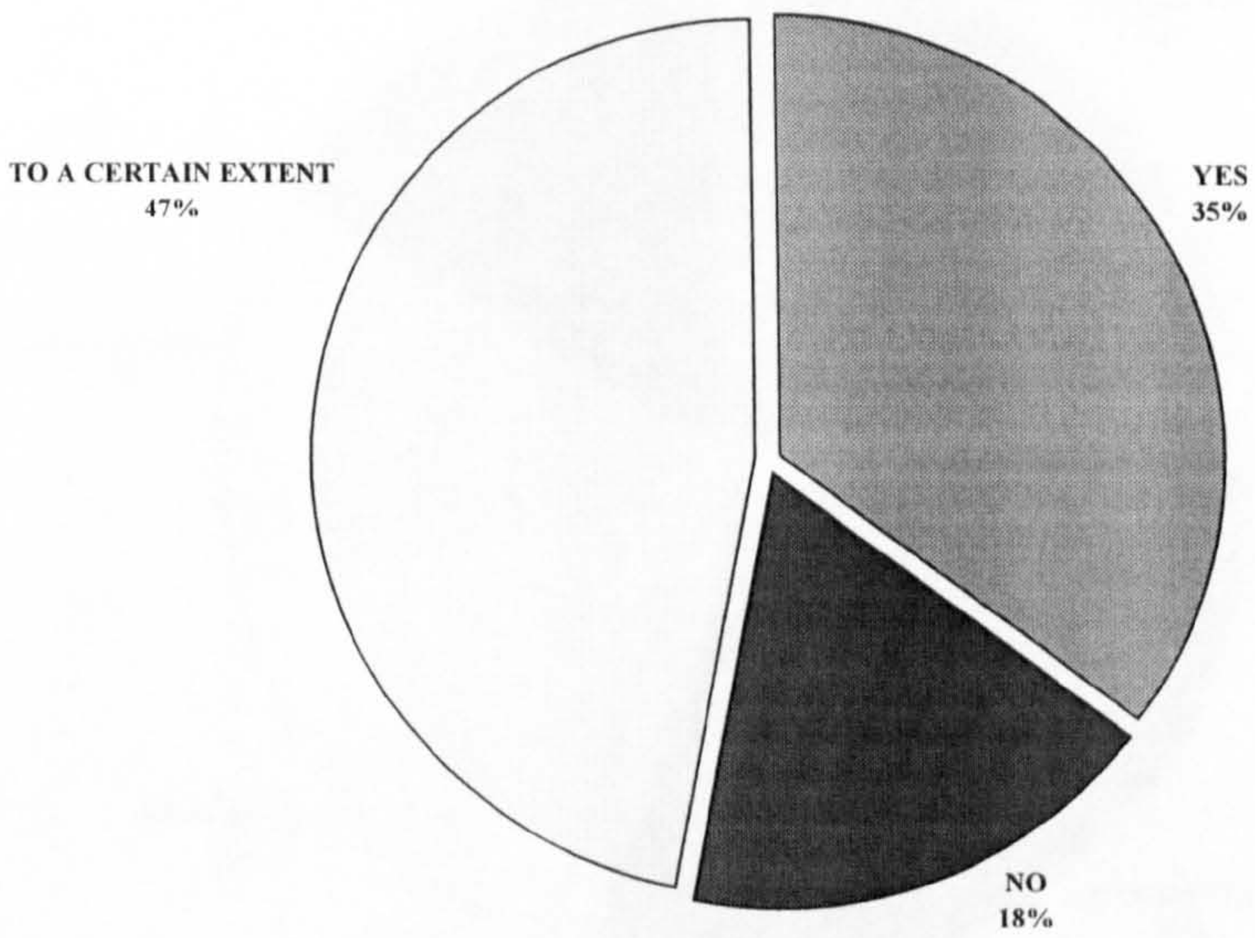
Collection of the questionnaires took place on the second and third days of the exhibition. Longer interviews were conducted with e-money operators and influential innovators (eg the major smart card providers) on an individual basis in order to gain additional insights into current and future projects. The exhibition also enabled visitors to view the latest developments such as mobile phones that can read smart cards and execute financial transactions on a real-time basis. (These mobile phones are like card readers with dual bands and are capable of executing financial transactions). Another exhibit was on the integration of smart card readers and PCs, which enables interoperability of conventional and virtual payment systems. When mature, all PCs may be able to execute financial transactions with guaranteed security.

6.1.4. SURVEY RESULTS

The questionnaire comprised eleven questions, each with a section for comments. Central to the questionnaire were central banking-related issues, like the outlook for regulation. The implications of regulatory proposals on innovation and competition were also investigated. The technological limits and obstacles as well as the possibilities for e-money innovation – like the future base for e-money access – were also included in the questionnaire. Finally, queries were also made on future trends in light of these obstacles and possibilities, as e.g. the implications of e-money products for the banking industry.

The first question on the questionnaire was "Do you think that electronic cash has a potential to replace central bank money?". The aim of the question was to ascertain whether e-money technology is perceived as sufficiently mature to replace currency (banknotes and coins) in circulation produced and managed by central banks and treasuries, since this would have implications for both the privatisation of seigniorage revenues and for the conduct of monetary policy. Further, the views expressed on e-money can be defended only if the technology has the potential to provide a permanent replacement for banknotes and coins. Otherwise, e-money may warrant analysis merely as another complementary innovation in advanced payment systems, which have been developing rapidly, especially since 1980, due to advances in credit and debit card applications. The responses are summarised in the chart 6.1.1.

CHART 6.1.1: CAN E-MONEY REPLACE CENTRAL BANK MONEY?

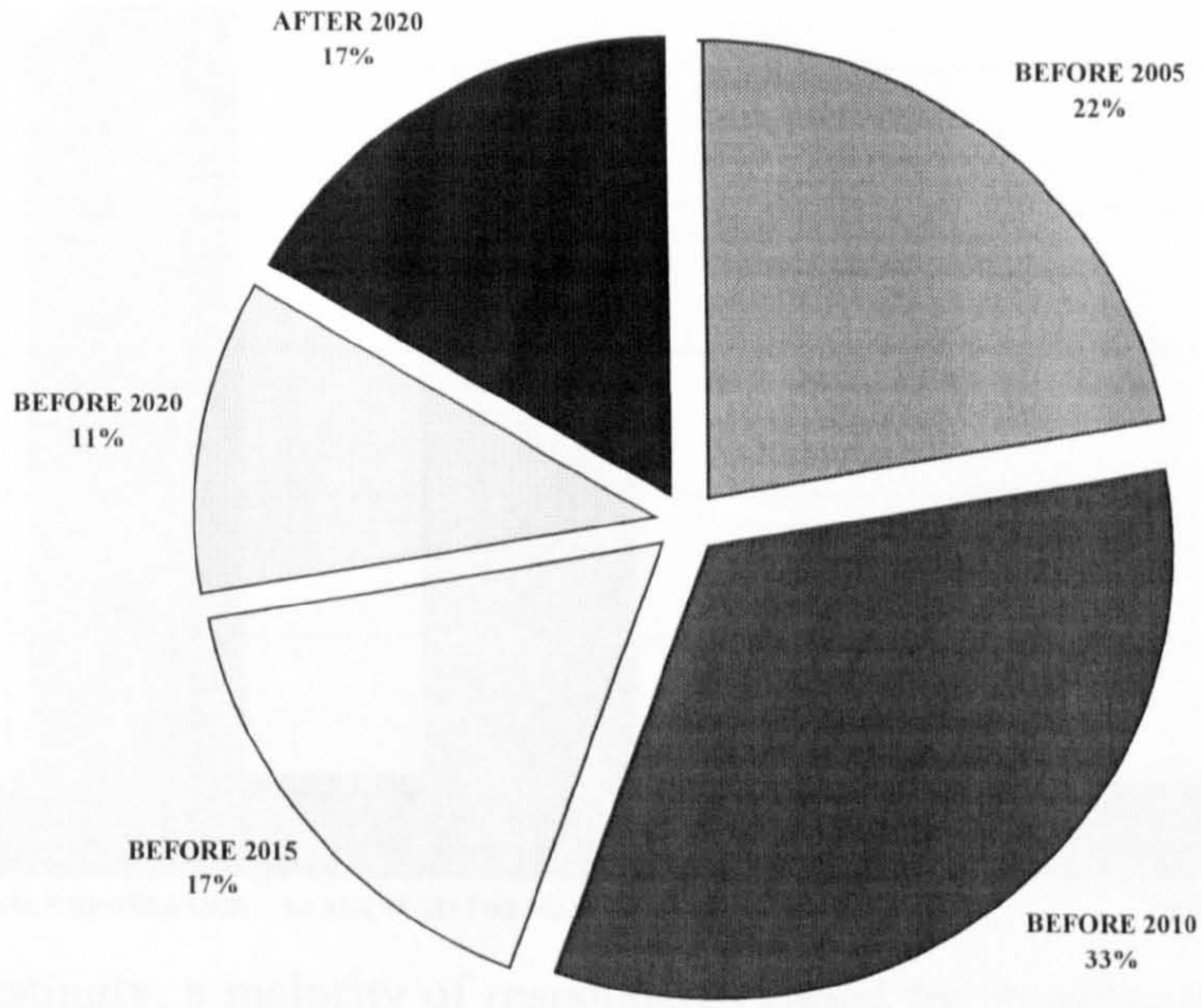


It seems quite clear that the majority of the respondents believed in the possibility of e-money replacing currency in circulation. Only 18 % felt that e-money could not replace central bank money, whereas 82 % felt that it could do so, albeit 47 % to only a certain extent. Even excluding the "To a certain extent" option, believers in the potential of e-money technology to eliminate banknotes and coins surpassed non-believers by 17 %. There were no "Don't know" responses. It seems that the sample selection for the questionnaire was appropriate for collecting data on e-money, as all the respondents confirmed that they were sufficiently familiar with e-money to give reasoned responses to the questions. There were comments on issues of concern to elderly people and children and on issues such as marketing e-money concept in order to create a critical mass of users. These are serious matters among those

concerned with e-money. Some argue that even with the appropriate technology for replacing central bank money, there could be social barriers to a complete changeover.

In connection with the first question, it was asked "If yes, when?". 35 % of those who said "Yes" to the first question gave their responses. The aim here was to ascertain the expected time needed for e-money technologies to replace banknotes and coins and to determine whether central banks and regulators should take time to analyse e-money products or should try to decide now on their roles and functions. The responses should provide insight on the time-frame for policy action. The results are shown in chart 6.1.2.

CHART 6.1.2: IF E-CASH CAN REPLACE CB MONEY, WHEN?



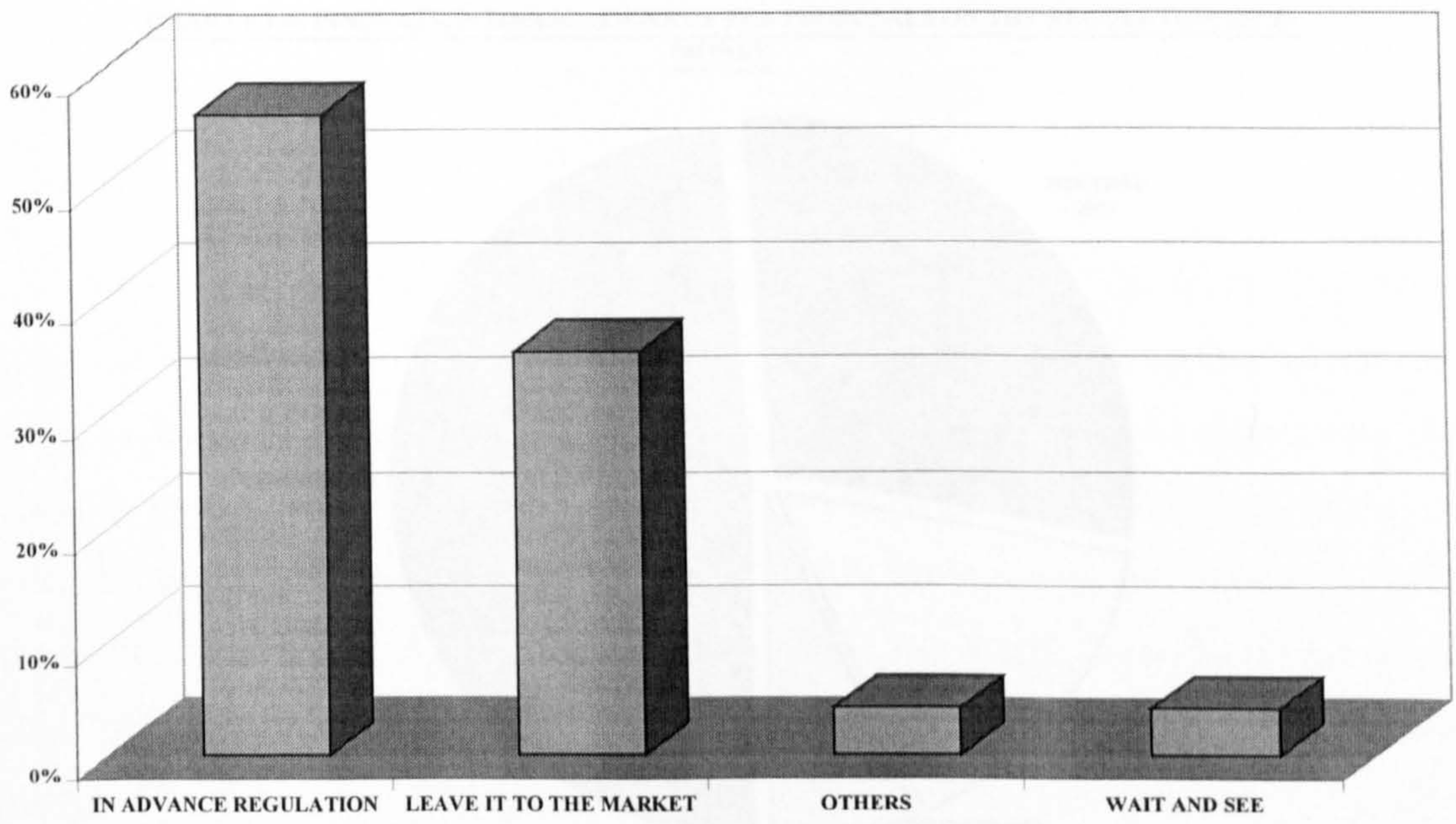
Note that more than half of the respondents who felt that e-money has the potential to replace central bank (CB) money also felt that this will take place before 2010. The chart also shows that those respondents who anticipated the total replacement of currency in circulation by e-money believed this would happen sooner rather than later. Only 17 % indicated that replacement of CB money would be realised after 2020.

According to the results, policy makers concerned with e-money, including central banks and regulatory bodies, should decide soon on appropriate policies in order not to lag behind the curve of technological progress. Time may be a critical factor for the effectiveness of a policy measure. One important aspect of the elimination of banknotes and coins is that this is a once-and-for-all matter since, once the technology is capable of circulating money electronically, the circulation could continue to be electronically based even in the event that

the denomination of the currency is changed. Moreover, central banks' control over money increased in the early 19th century, and over a period of many years financial markets became accustomed to this notion. Keeping this in mind, even a 20-year period for the elimination of currency may not be regarded as a "long time".

The next question regarding central banking issues concerned the desired reaction of central banks to e-money developments. The aim was to determine innovators' and operators' demands on the regulatory authorities in general and on central banks in particular as regards the regulation of e-money. Chart 6.1.3 illustrates the results.

CHART 6.1.3: WHAT SHOULD BE THE REACTION OF CENTRAL BANKS TO E-CASH?

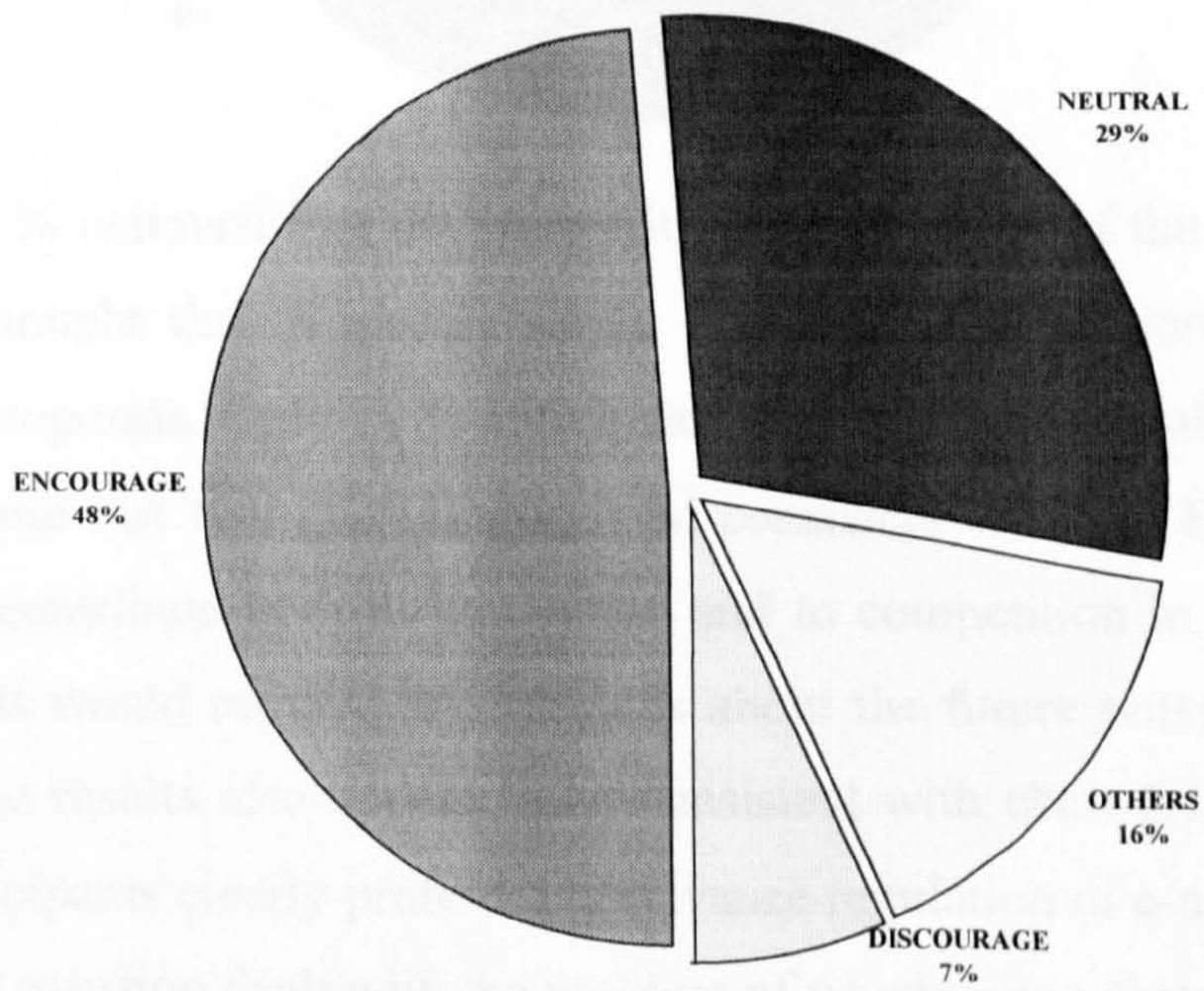


Interestingly, a majority of respondents called for in-advance regulation of e-money by central banks, whereas a "wait-and-see" policy was mentioned only as often as "other" proposals, i.e. "getting involved in the discussions" and "analysis of e-money products". The clear preference for regulation of e-money may be explained by uncertainty about the future of e-money products and the fact that innovators and operators may be expecting central bank regulation as an alternative to common standards, which would be necessary for world-wide success of a particular scheme. Because so many different proposals for e-money schemes have been developed and because there are already more than three different operating systems for using smart cards in a launch of e-money, the questionnaire result may also be taken as a call for centralised regulation that would guide future e-money developments. As there seems to be a lot of different proposals for different e-money schemes and as there already are three different operating systems (Multos, Java and WSCs) for future e-money launches, the result

may also be taken as a demand for centralised regulation to guide the future of e-money developments. Any kind of incentive (incl. central bank regulation) that sets standards for launches would eliminate the risk of investing in a non-dominant technology.

There were two other questions concerning regulatory issues. The aim was to ascertain the reaction of innovators and regulators to the ECB regulatory proposals (ECB, 1998) on innovation and competition. As it is generally believed that there is a negative correlation between regulation and innovation, the intention was to determine whether innovators and operators regarded regulation as a barrier to further innovation and whether it was regarded as anti-competitive. Chart 6.1.4 summarises the implications for innovation.

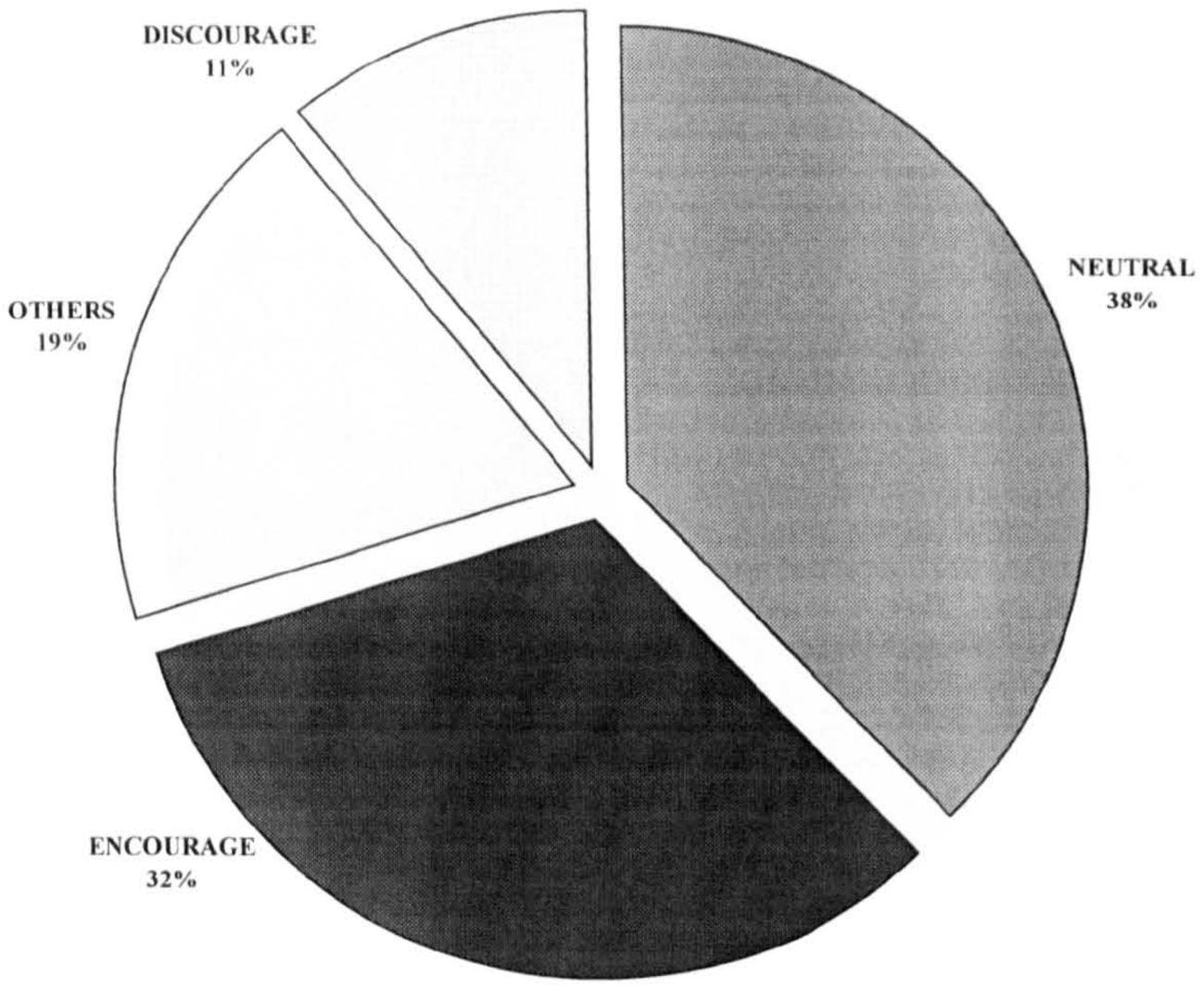
CHART 6.1.4: INNOVATION IMPLICATIONS OF ECB PROPOSALS ON THE REGULATION OF E-MONEY



As the chart displays, almost half of innovators and operators favour regulation, as they do not regard it as a barrier for innovation incentives. At the same time, 29 % expressed a neutral affect of ECB proposals for innovation and only 7 % believed that proposals discourage innovation. Those who were not familiar with the ECB proposals marked 'Others' option among the answers, which equal to 10 %.

The results of ECB's regulatory proposals for competition implications are shown on Chart 6.1.5 below.

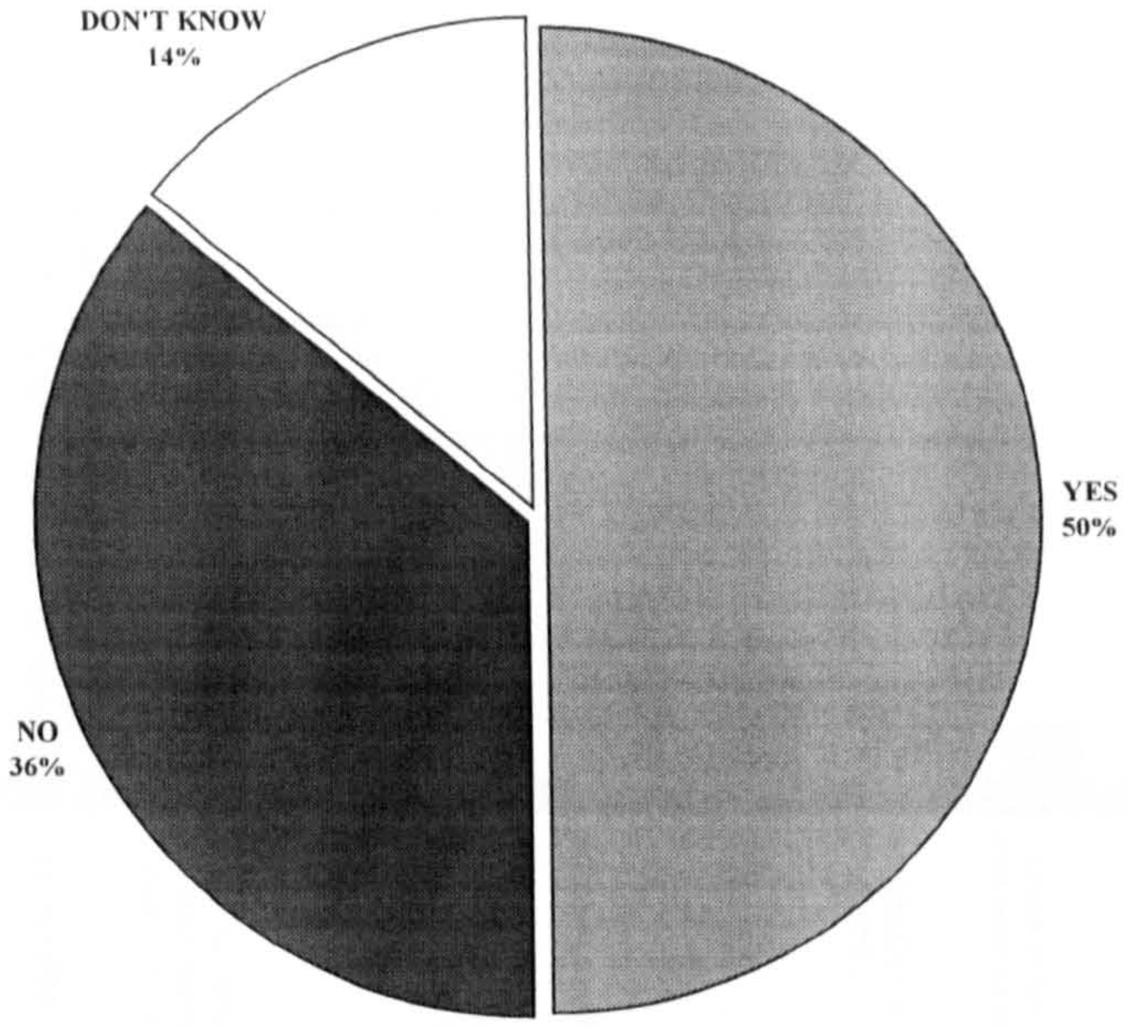
CHART 6.1.5: COMPETITION IMPLICATIONS OF ECB PROPOSALS ON THE REGULATION OF E-MONEY



Here, 38 % believed that the competition implications of the ECB proposals would be neutral, 32 % thought that proposals would encourage competition, and 19 % indicated no opinion on the proposals. Only 11 % anticipated that regulation would discourage competition. Responses to these last two questions seemed consistent with the ECB view that in-advance regulation may contribute both to innovation and to competition in connection with e-money products, since it would remove uncertainties about the future potential of e-money products (ECB 1998). The results also appear to be consistent with chart 6.1.3, as it indicated that the majority of participants clearly preferred in-advance regulation of e-money.

The next question dealt with the problem of whether non-financial institutions should be allowed to issue e-money. The aim of this particular question was to find out whether e-money may also be issued by, for example, telecom companies, and if yes, whether they should be allowed by central banks and regulatory bodies. The results are exhibited in the next chart:

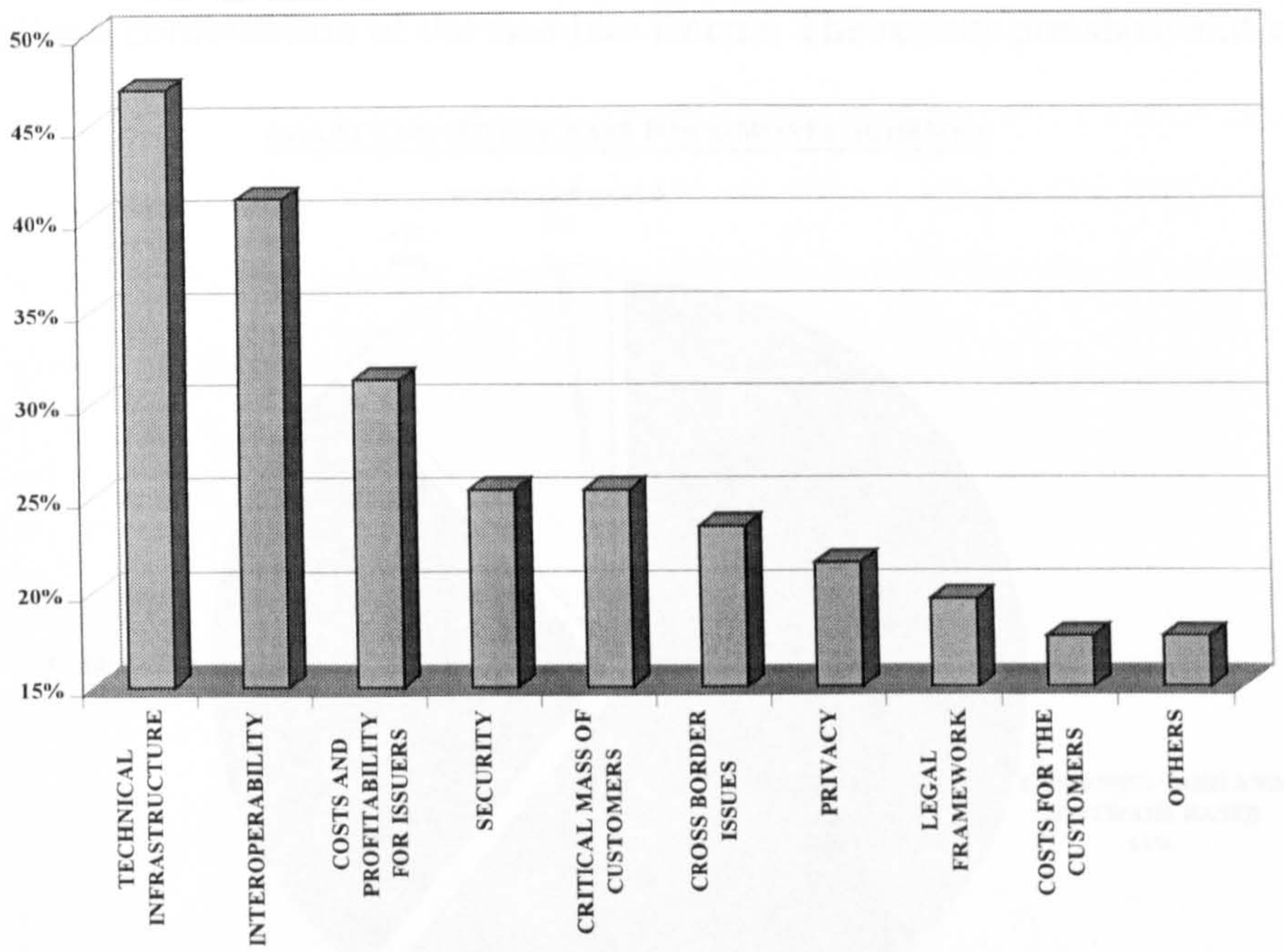
CHART 6.1.6: SHOULD NON-BANK INSTITUTIONS BE ALLOWED TO ISSUE E-MONEY?



As the chart shows, the majority was in favour of allowing non-financial institutions to issue e-money; only 36 % opposed the idea. Although the ECB proposals on regulation of e-money were favoured in respect of innovation and competition, the tendency to eliminate non-banks seems not to be supported by innovators and operators. They apparently prefer regulation as guidance rather than as a set of restrictive rules.

The next question was about obstacles to wide acceptance of e-cash as a replacement for central bank money. The aim of the question was to determine the kinds of problems that have so far limited, and would in the future limit, potential technical solutions from turning into practical total solutions. Chart 6.1.7 shows the results.

CHART 6.1.7: MAIN OBSTACLES FOR E-CASH TO REPLACE CB MONEY

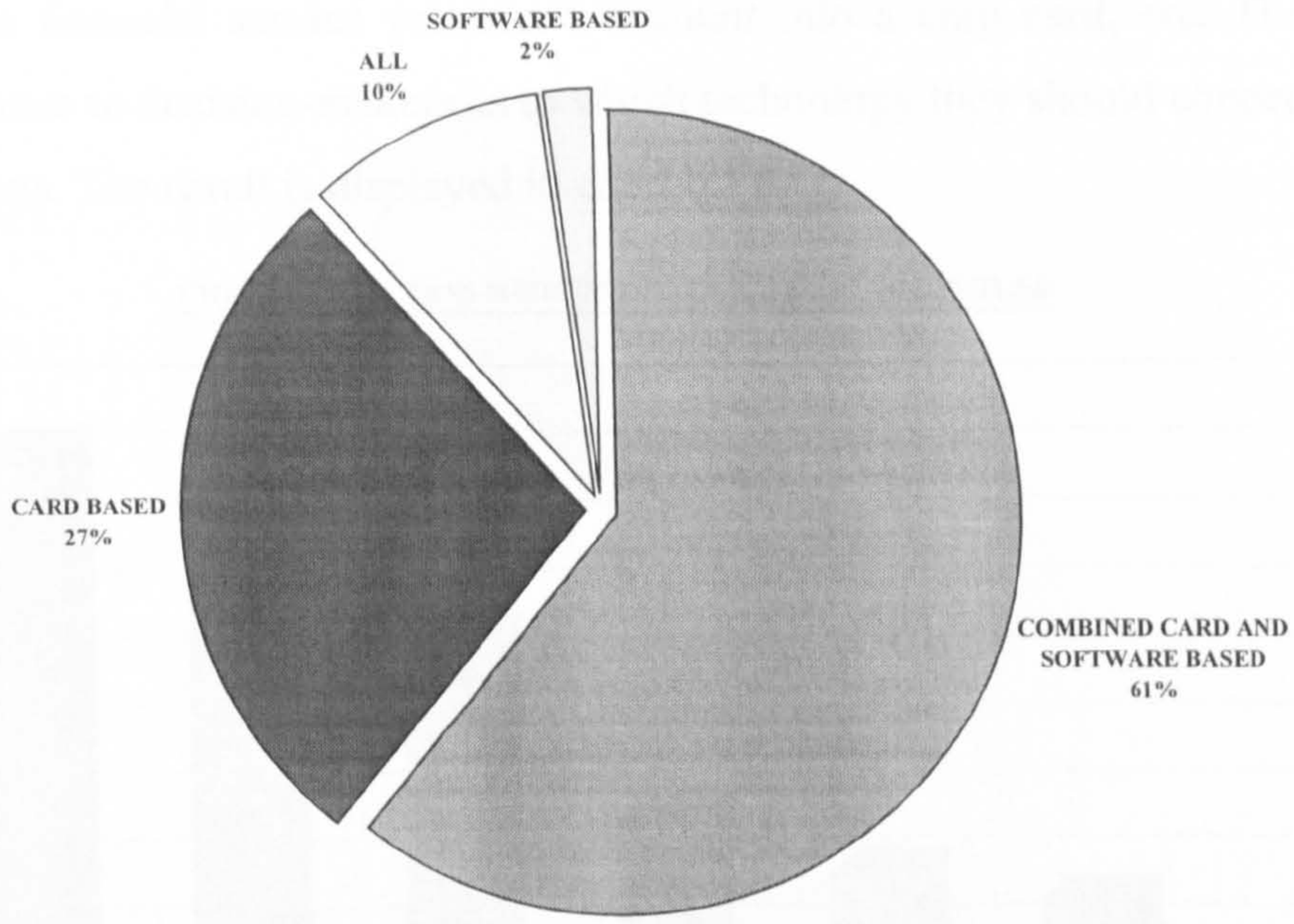


The required technical infrastructure, including retailer readers, customer cards and software, was mentioned as the leading obstacle for e-money to replace CB money by almost half of the respondents. Interoperability of different e-money schemes was the second most frequently mentioned obstacle, and most of respondents mentioned the success of GSM technology in mobile phones in that it enabled a common world-wide platform for mobile systems. Interoperability is also a big issue for alternative operating systems. Issuers' costs and profitability was the third obstacle, and it may be argued that because there is as yet no proven business case for e-money, the innovators and operators still see profitability as an obstacle. Interestingly, not many of the respondents mentioned security and privacy as major obstacles (25 % and 22 % respectively). Whereas it is not unreasonable that security would not be rated high in importance because of confidence in secure solutions, privacy seems to be somewhat undervalued. The legal framework was also given low priority, which may be another indication in favour of the regulatory approach to e-money issues. It may be argued that innovators and operators look for some kind of guidance in resolving their conflicts and rely on regulation as a common ground. Because, on one hand, they favour in-advance regulation (chart 6.1.3) and do not think ECB regulations impose a negative impact on innovation and competition (charts 6.1.4 and 6.1.5) while, on the other hand, they do not think that a legal framework is a serious obstacle to e-money schemes.

Another question concerning future prospects for e-money was about the future base for e-money schemes. There are three essentially different proposals for the base for e-money that

can be supported by an operating system: card-based like Mondex, software-based like Digicash and/or a combination of the two like Beenz. The results are shown in chart 6.1.8.

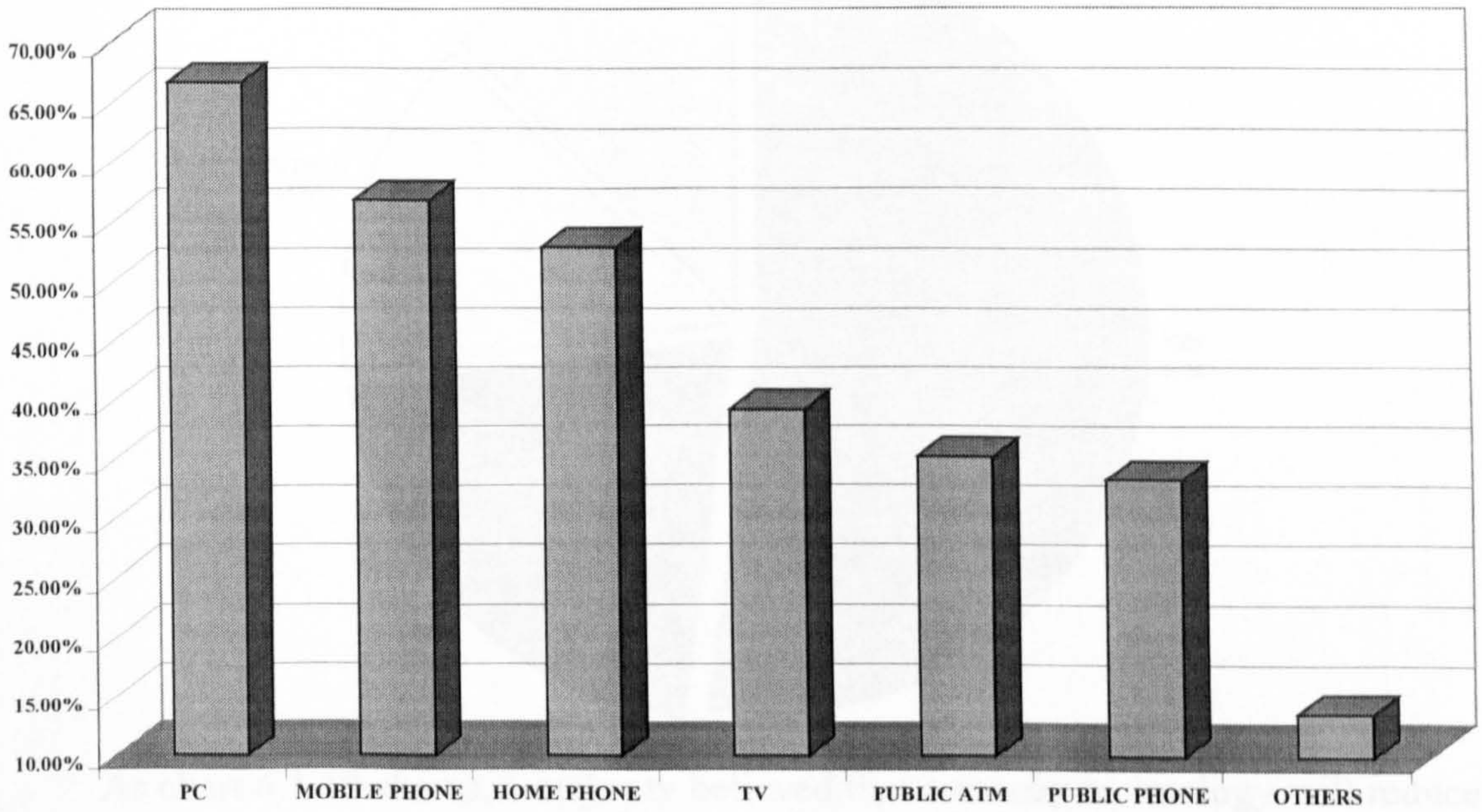
CHART 6.1.8: FUTURE BASE FOR E-MONEY SCHEMES



According to the results, 61 % felt that the future base for e-money schemes would be a combination of card- and software-based products that can be used both in conventional transactions and in e-commerce. This result seems consistent with current market trends since, in all card-based solutions, network connections have been adapted to e-money schemes and network-based proposals seem to entail commercial problems, at least as regards the earliest versions of e-money schemes. The card-based option was supported by 27 % and only 2 % favoured software-based products. One of the important aspects of the multi-application potential of chip cards is that they are suitable to develop the critical mass necessary to solve the chicken-egg problem for e-money schemes. As every card application could increase the number of cards in circulation, the purse application may be supported by the existence of an appropriate infrastructure. However, according to the survey results, the respondents expect that there will be a common solution for transaction requirements in conventional and virtual lives, ie for both traditional and electronic commerce. This result underlines the significance of smart cards, as they seem to be the only technical product that can support a card- and software-based solution due to their individual features and network adaptability. Of all respondents, 10 % thought that three different solutions might continue to exist side by side, which indeed seems a possibility since this would address the needs of different segments within the interactive groups via international, national and local electronic trading systems.

The next question is about another critical problem concerning e-money schemes, i.e. the future access medium. The aim of the question was to find potential distribution channels for e-money in financial transactions, including activities such as downloading purchasing power from a financial service provider's account into a chip card, etc. The results should provide guidance to decision-makers as to which technology they should concentrate on in their policy reactions. The result is displayed in chart 6.1.9.

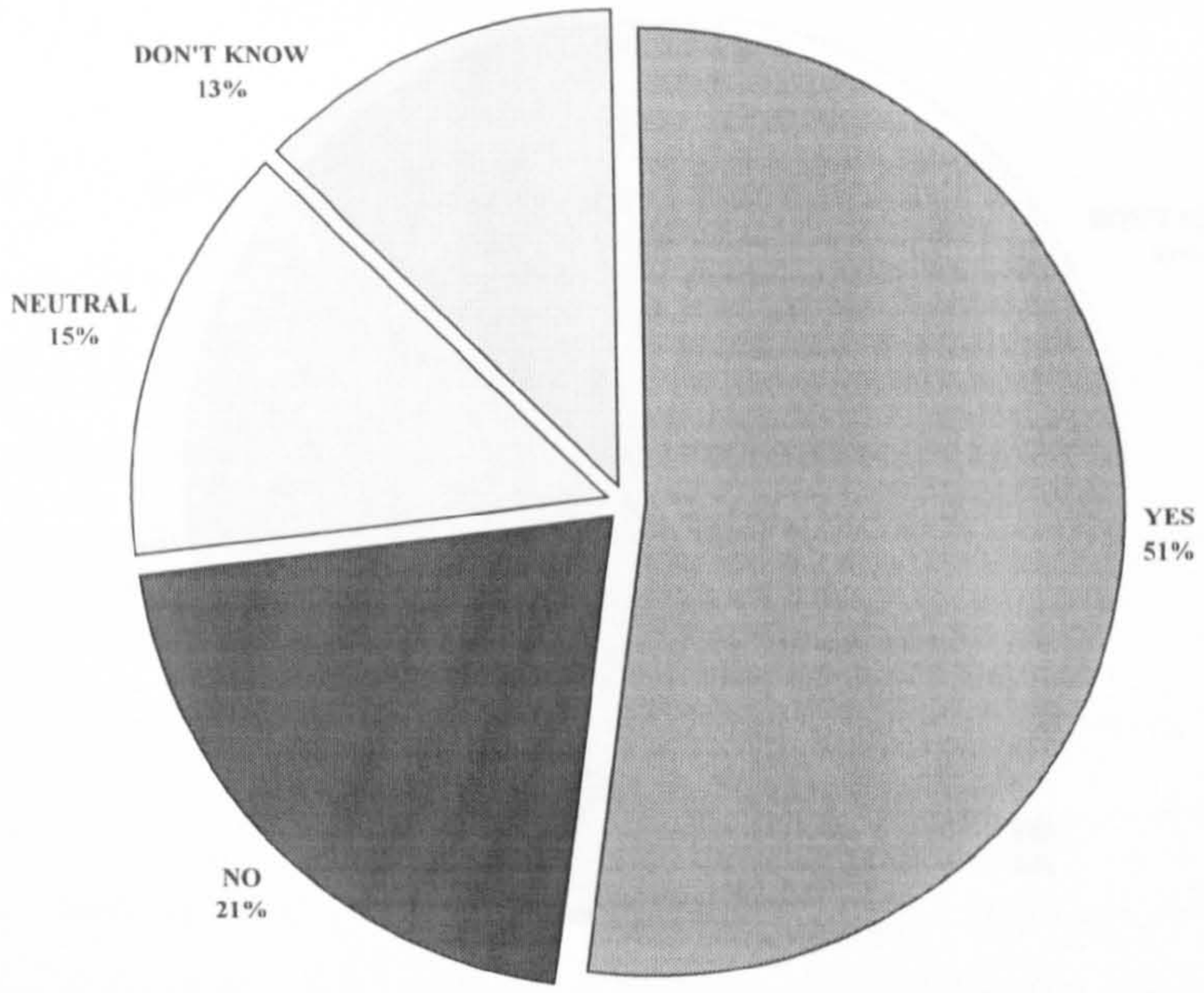
CHART 6.1.9: ACCESS MEDIUM FOR E-MONEY IN THE FUTURE



The PC was the favoured access medium for the future, and mobile phones ranked second. The third was the home phone, followed by TV, public ATM and public phone. The preference for the PC seemed consistent with the anticipated future base for e-money schemes, as it can be used for both card and software-based e-money schemes. TV is probably ranked high because it is anticipated that DTV technology will bring new opportunities in connection with e-commerce. These responses are important to central banks because the top four choices are not among the common cash access media in current banking practice. This may be an indication that the financial service industry could change profoundly from the traditional distribution of currency via bank branches, ATMs and retailer cash-backs to electronic circulation of monetary value via PCs, phones and DTVs, which would obviate the need for physical cash. Once money can be circulated electronically via the latter media, electronification of financial services as a whole may be accelerated, which would have broad implications, ranging across the monetary transmission mechanism to seigniorage and across free banking to competing currencies.

The purpose of the next question was to determine whether e-money technology could reduce barriers to entry to the financial service industry. These barriers affect provision of new financial services by financial institutions as well as provision of financial services by non-financial firms. The question is intended to cover both, with emphasis on the latter development, especially as regards payment services.

CHART 6.1.10: CAN E-MONEY DECREASE BARRIERS TO ENTRY TO THE BANKING INDUSTRY?

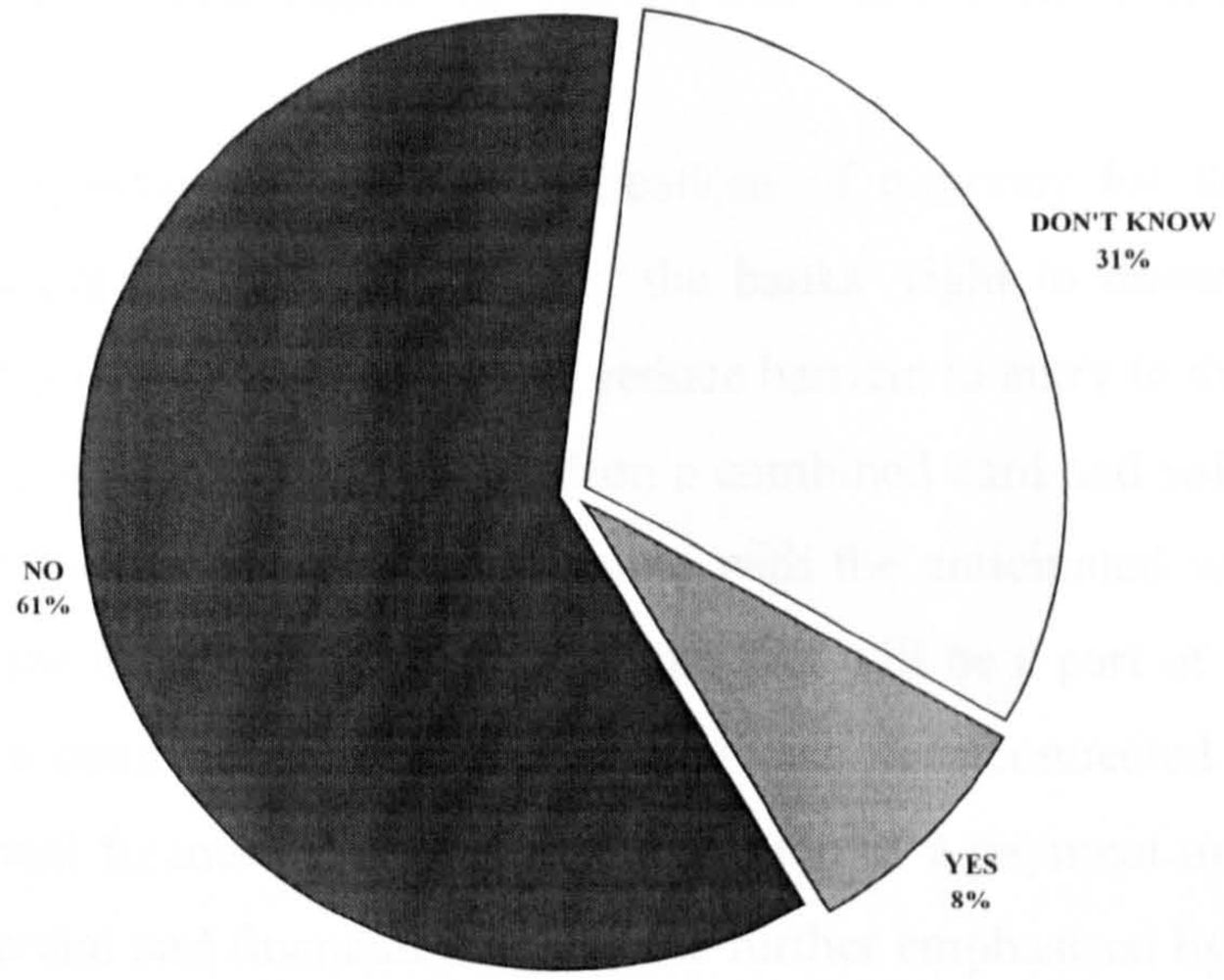


As chart 6.1.10 shows, a majority believed that e-money technology will reduce barriers to entry. Only 21 % thought it will not do so, while 15 % anticipated a neutral effect.. If the results are accurate, they may have implications not only for regulation of e-money but also for regulation of the whole financial system, as they raise questions about special treatment of banks vs other firms in the economy. The results confirm that e-money technology will increase competition in the financial services industry. The general feeling is that competition increases market efficiency. It may be necessary to evaluate financial services as to exactly who should be licensed to provide these services so as to ensure productivity, efficiency and stability.

The last question was about the privatisation of money. It may be argued that it is generally expected that the introduction of e-money will reduce handling costs of money as a medium of exchange, and if security can be ensured, then there may be a case for privatisation of money. It may also be argued that e-money developments have stimulated increased analysis of unregulated banking experiences around the world from a historical perspective, since it apparently enables a technical and informative infrastructure for issuing private money.

Privatisation of money in this context, in its simplest form, is defined as the process of eliminating the central bank monopoly on money and transferring the issuance, circulation and quality management of money to private hands, preferably on a competitive basis. The aim of the question was to investigate the exact stance of innovators and operators on the question of private money. Responses to the question are shown in chart 6.1.11.

CHART 6.1.11: SHOULD MONEY BE PRIVATISED?



With a majority, the innovators and operators opposed the privatisation of money. Note that "don't know" responses amounted to 31 %, i.e. almost a third of the respondents preferred to stay out of the discussion. But 8 % favoured the privatisation of money. This seemingly small percentage could be quite significant, in light of the fact that privatisation of money would constitute a big change from a status quo situation going back many years. It may be argued that the primacy of central bank money is no longer a truism and that central bank money is not unchallenged anymore.

6.1.5. CONCLUSIONS

The survey confirms that central banks and regulatory bodies have been on the right track in exploring the potential of e-money to replace their own monies. First two charts suggest that innovators and operators are of this opinion. Moreover, central banks are expected by innovators and operators to regulate e-money business in advance, probably in order to establish a well-defined regulatory environment for continuously changing business structures and proposals.

The pronounced demand for regulation may be explained by the fact that GSM seems to have been successful in providing a standard for mobile phones, as it has enabled the development of a critical mass and has solved the chicken-egg problem already during the initial launches. Innovators and operators did not regard the ECB proposals on e-money as an impediment to innovation in e-money technology nor to competition among different operators.

Concerning the privatisation of money, it may seem that the majority rejected the idea. However, the monopoly of central banks in issuing money as a medium of exchange did not go unchallenged.

Responses to questions about the implications of e-money for the banking industry indicated that innovators and operators contest the banks' right to monopolise the e-money business and feel that e-money technology will reduce barriers to entry to the banking industry.

Innovators and operators nearly agreed on a combined card and software base as the e-money infrastructure for the future. This is in line with the anticipated wider acceptance and use of e-money and the need for a payment medium that will be a part of the new, developing lifestyle, whereby e-commerce and PC banking are interconnected with conventional commerce and personal finance. The need for integration of a payment medium (eg e-money) with the new commercial and financial landscape is further emphasised by the favoured access media for e-money. It is not impossible to envisage a "network" of interoperable PCs, mobile and fixed-line phones, DTVs and ATMs that serve as a platform for retail payments, at customers' convenience. Provision of payment and settlement services is where financial institutions have the advantage over the new challengers but, at the same time, commoditisation of these services may lead to the demise of banks as the service providers.

The main obstacles to e-money replacing central bank money were seen as problems in technical infrastructure, interoperability, and costs and profitability for issuers. It is obvious that the innovators and operators gave priority to "technological and operational" issues, believing that the broader economic and social considerations will eventually fall into place. This may reflect a professional bias, but it may also indicate the confidence of innovators and operators in the realisation of secure and "privacy-protected" e-money.

6.1.6. SURVEY QUESTIONNAIRE 1999

A QUESTIONNAIRE ON ELECTRONIC MONEY DEVELOPMENTS

City University Business School; Department of Banking and Finance
Research Student: Yuksel Gormez (Y.Gormez@city.ac.uk)
Topic: ELECTRONIC MONEY, PAYMENT SYSTEMS AND MONETARY POLICY

QUESTIONS:

1. Do you think that electronic cash has a potential to replace central bank money?

A) Yes
B) No
C) To a certain extent
D) Don't know
Comment:_____

1a. If yes, when?

A) Before 2005
B) Before 2010
C) Before 2015
D) Before 2020
E) After 2020

2. What are the main obstacles for e-cash to replace the central bank's money (or to be widely accepted)? (Tick all relevant answers)

A) Costs for the customers
B) Costs/profitability for the issuers
C) Security
D) Privacy
E) Interoperability
F) Legal framework
G) Technical infrastructure
H) Cross-border issues
I) Critical mass of customers
J) Others_____
Comment:_____

3. What should be the reaction of central banks to e-cash?

A) In advance regulation for guidance
B) Wait and See
C) Leave it to the Market
D) Other: _____

4. What do you think about the European Central Bank proposals on the regulation of e-money?

A) Encourage Innovations
B) Discourage Innovations
C) Neutral effect on Innovations
D) Other_____
Comment:_____

5. What do you think about the European Central Bank proposals on the regulation of e-money?

A) Encourage Competition
B) Discourage Competition
C) Neutral effect on competition
D) Other_____
Comment:_____

6. What is the base for e-money schemes of the future?

A) Card based
B) Software based
C) Combined card and software based
D) All of the Above
E) Other_____
Comment:_____

7. What 'access' medium for e-money will be used the most in the future by the customers? (Tick all relevant answers)

A) Public telephone
B) Home telephone
C) Mobile telephone
D) Television
E) PC
F) Public 'ATM'
G) Other
Comment:_____

8. Should institutions other than banks be allowed to issue e-money?

A) Yes
B) No
C) Don't Know
D) Other
Comment:_____

9. Do you think e-money schemes can decrease barriers to entry to the banking industry?

A) Yes
B) No
C) Neutral
D) Don't Know
Comment:_____

10. Should money be privatised?

A) Yes
B) No
C) Don't know
Comment:_____

6.2. ELECTRONIC MONEY TRENDS IN 2000

In this section, the second survey, which was conducted about a year later in 2000, at the 13th International Advanced Card Exhibition and Conference (Smartcard2000), which was held in Olympia 2 in London on 8–10 February 2000, the same venue where the first survey was conducted, will be analysed. As the previous year's survey provided a very useful set of data, the same venue was used a year later in order to extend the understanding of current trends in e-money developments with additional questions. It was not intended to collect up to date data in order to see what might have changed in the interim since it was considered more useful to extend the coverage of the surveys as extensively as possible using a different set of questions. The relationships between the results of the two surveys will be discussed in the last section of this division.

6.2.1. INTRODUCTION AND AIMS OF THE SURVEY

The aims of this survey were first to deepen empirical insights into what e-money innovators and scheme operators driving the innovation and technological development think about the issues concerning e-money (e.g. the preferred operating system for card-based solutions) and technical issues surrounding the current stage of e-money technology.

The second aim was to discover the current expectations of innovators and operators concerning the possibilities and impacts of e-money for the future of the financial service industry and financial service providers. Questions in this section are intended to show how e-money may influence e.g. the dominance of banks in the provision of financial services.

The third aim of the survey was to investigate future capabilities of e-money technology regarding the future of central banking as well as innovators' and operators' expectations about the possibilities for e-money and the implications of those possibilities for the future of central banking.

The overall aim was the same as that of the first survey, i.e. to gather information from industry experts and use this information to gain insights that will aid decision-makers and discussants (both academics and practitioners) in understanding e-money and its potential and limits. An important limitation of both surveys is that they are concept- rather than product-oriented. They do not analyse any particular proposals or schemes or compare them in terms of advantages and disadvantages. E-money is taken here as an emerging phenomenon, and it is assumed that anyone with an interest in the financial industry will need to understand its pros and cons. Instead of relying on case studies of different proposals and making comparisons, it

was felt that a collection of broader data would most effectively provide advance insights for shaping policies to address the overall implications of alternative proposals.

Consequently, the scope of the survey was again limited to collecting empirical data on e-money developments from the innovators and scheme operators point of view only, excluding academics, bankers, central bankers, financial industry experts, consultants and the like. Individual analysis of a particular product or scheme was also out of the scope of the survey. The procedure to collect data was not designed to do so, as this would be done better by case studies. There is also no intention to compare different e-money schemes or to clarify differences to the concept of e-money from different sides. The survey has been concept oriented instead of being product oriented.

6.2.2. THE SURVEY SAMPLE

With the above-mentioned aims and limits, a questionnaire was prepared and a survey was conducted at the Smartcard2000 Exhibition and Conference. The exhibition was defined as[55] "the catalyst of high level debate where bold ideas will be both discussed and unveiled". The coverage included areas such as information technology, telecommunications, payments, identification and security, transport and access control, health, e-commerce, loyalty, gaming, multimedia and personalisation card management. As in the previous year, almost all international e-money scheme operators representing either account-based or other scheme proposals participated in the exhibition including Mondex International Ltd, Europay International, Proton World International SA and Visa International. Operating systems were also represented at the exhibition, although by only one of more than three specialist firms namely Multos. Innovators from around the world involved in e-money technology, including smart card producers, semiconductor providers, security and payment system experts and card system designers, participated in the exhibition, many of whom had participated in the first survey. Ascom, Gemplus Ltd, Hitachi Europe Ltd, Oberthur Card Systems, Philips Semiconductors Gratkor, Keycorb Ltd, Racal Security and Payments, Fortress U&T Ltd and Schlumberger Systems were the major participant innovators. The total number of exhibitors was just over 90, which meant that the coverage of the second survey was not as wide as that of the first survey.

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[55] Smartcard2000 Show Guide

Because the survey results from the previous year proved encouraging, it seemed natural to extend the data collection and analysis of e-money into year 2000. The exhibitions again included many products relating to e-money applications, including electronic wallets, personal computers designed to function like point-of-sale terminals and e-money transfer terminals, secure mobile phones that use bio-metric technology to guarantee the security of potential mobile e-money applications, reloadable smart cards that can extend the reach of e-money in retail applications and smart card keys that can expand the scope of applications in payments. Innovators and operators exhibited their latest products, which may reshape the future of e-money technologies, and the exhibition was useful in presenting the current level of technology and suggesting current and future applications that will exploit the vast potential of e-money technology.

As the survey results from the last year proved the sample as reliable, there has been no hesitation to extend data collection and expend potential of e-money analysis to year 2000. The venue had many products relating to e-money applications including electronic wallets, personal computers designed to function like point-of-sale terminals and e-money transferring terminals, secure mobile phones that use bio-metric technology to guarantee the security of potential mobile e-money applications, re-loadable smart cards that may extent the reach of e-money on retails applications and smart card keys that may enrich the alternative applications in payments. A visual image of the current level of technology has been quite helpful in understanding the future of e-money. One particular example was to execute a person-to-person transaction using an electronic wallet, which was the basic technology that eliminates the requirement of a financial service provider during a transaction and thus differentiates e-money from other electronic payment instruments.

6.2.3. METHODOLOGY AND DATA COLLECTION

The methodology and data collection for the second survey were quite similar to those for the first survey. The questionnaire was distributed on the first and second day of the exhibition on a stand-by-stand basis, but this time the interviews required more time to discuss particular products and their relevance to e-money. In particular, e-money that is compatible with mobile phones was given extra time and attention because of its vast potential to create an alternative mobile, and hence flexible, distribution channel for e-money schemes. Moreover, almost all the participants were informed of the aims of the data collection, including basic information about the research project. For this survey, 107 questionnaires were distributed,

which was slightly more than for the first survey (105), and 70 were returned. The return rate (65 %), was considerably higher than that for the first survey (49%). This may be a result of expertise gained a year earlier on the conduct of surveys and measures taken to increase the rate of return. Lost questionnaires and refusals to respond (mostly due to a lack of available staff and/or expertise, as most of them put it) were not included in the distribution count and the rate of return was calculated so as to avoid double counting. This time, collection of the questionnaires took place during the first, second and third days of the exhibition.

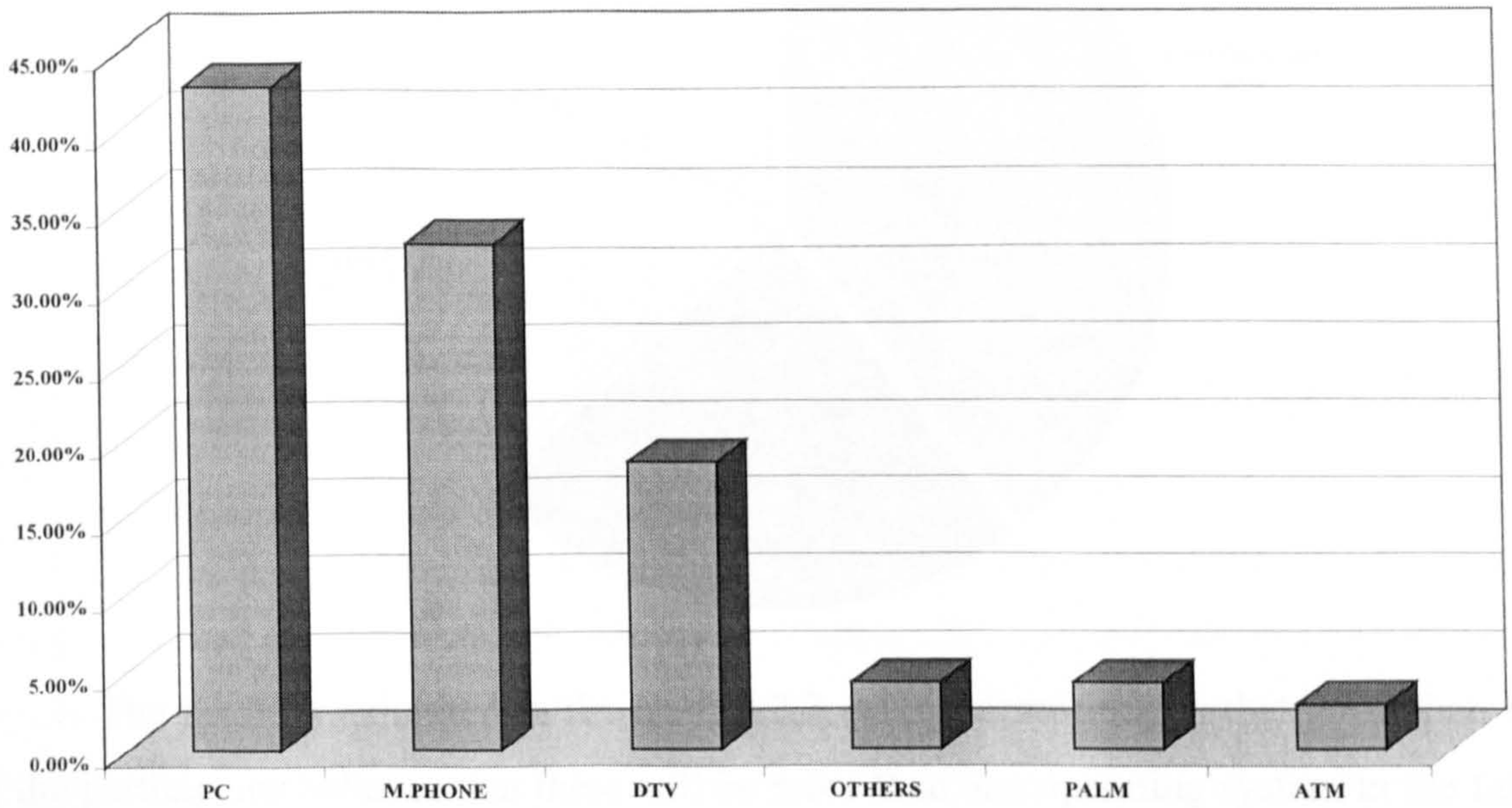
Extra time was given to some participants in order to help them to understand the questionnaire, especially when they asked questions about the research project in general. One observation may be worth mentioning. It seems that it is not only the operators that try to manipulate and exploit the potential of e-money and e-money applications. Innovators as well seem to be quite confident to extend their product ranges to enrich e-money applications, both conventional applications, such as transportation applications of card-based e-money schemes, and PC-based solutions for the management of network-based e-money. Innovators seem to work together with different e-money scheme operators in order to provide different application tools required for different applications by different e-money scheme operators. Some of the innovators argued that sometimes it is the innovators that guide operators on the full potential of the technology in order to help operators to extend their coverage on e-money schemes, especially relating to multi-applications. This may help to create a synergy that will speed up of the adjustment of the financial industry to potential of e-money technology.

6.2.4. SURVEY RESULTS

The questionnaire for this survey included thirteen questions compared to eleven in the first survey, most of which included a comment section. One theme of the questionnaire was the technical issues concerning e-money technology such as critical access media, the operating system that is most likely to dominate future applications, the most favoured technology for successful e-money implementation, and possible reasons for the failure of some e-money trials. Another theme was financial services industry-related problems such as the future medium of exchange for e-commerce, the potential impact of e-money on the industry, non-bank firms that may gain competitive advantage vs banks, potential issuers of e-money, and the banks' position in the industry. The final theme was the future of central banks and central bank money in light of the potential of e-money technology and the implications for central banking and national currencies.

The first question on the questionnaire was "Which medium of access technology is most likely to dominate the future e-money developments?". The aim of the question was to try to find leading indicators about the future trends in technology especially those supportive to e-money. The result of the responses is illustrated in chart 6.2.1.

CHART 6.2.1: WHICH MEDIUM OF ACCESS TECHNOLOGY IS MOST LIKELY TO DOMINATE THE FUTURE E-MONEY DEVELOPMENTS?

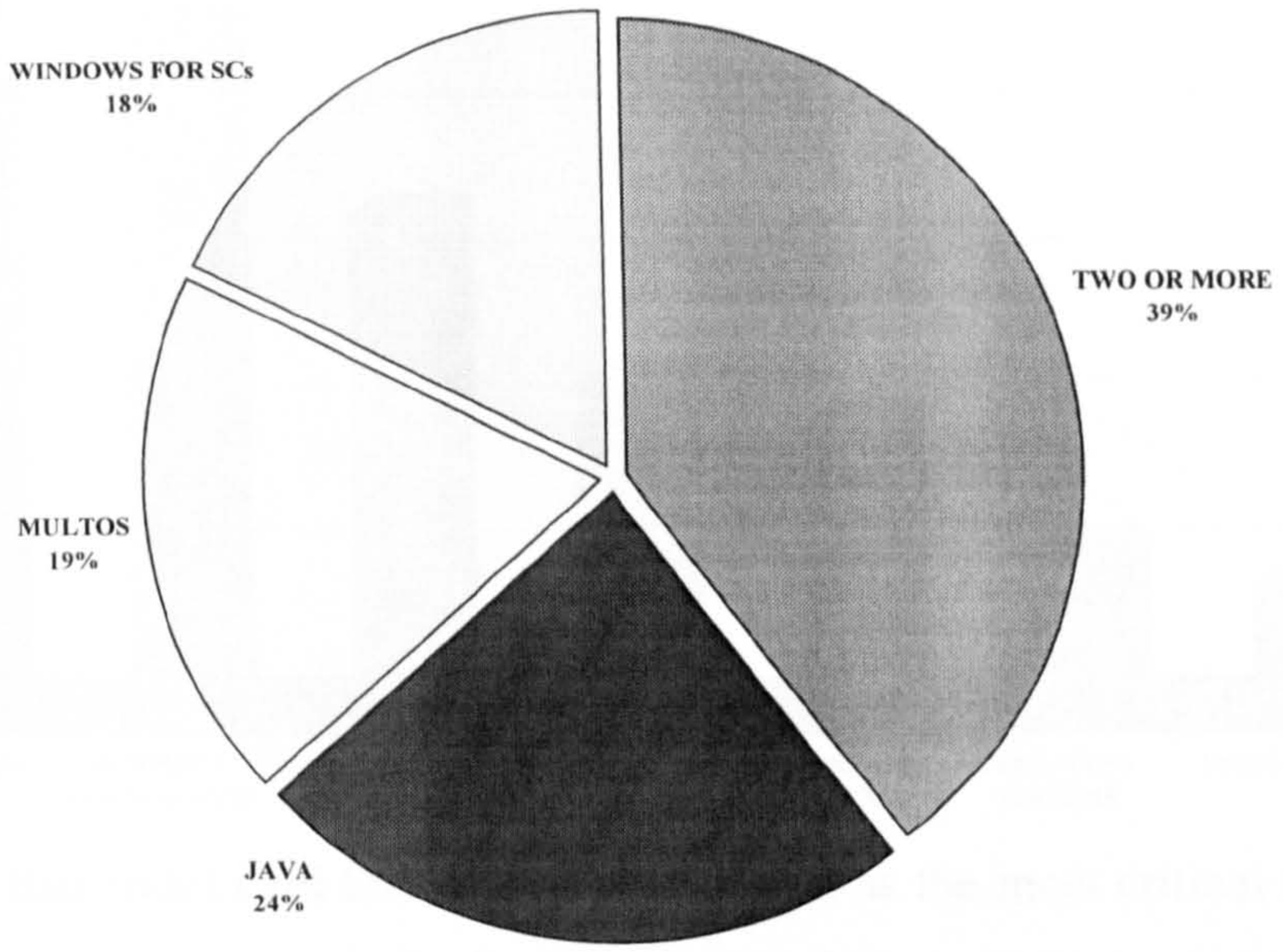


It seems clear that the majority of the respondents believe personal computers will be the dominant access medium for e-money, as almost half of the respondents chose it as the potential dominant technology. This result accords with the results from the first survey, as shown in chart 6.1.9. The mobile phone maintained its place as second choice. It may thus be argued that the PC is expected to play a dominant role in the future of e-money. DTV and hand-held devices followed the PC and mobile phone on the list. Alternative proposals from respondents included "any tool that guarantees security", "mobile phone combined with palm" and "point-of-sale terminals". The emerging picture is that the PC and the mobile phone are well positioned to dominate the future, whereas DTV, palm and ATMs are likely to play a supportive role.

The second question addressed a technical issue relating to operating systems for network-based e-money solutions: "Which operating system may dominate the future of e-money technologies?" The aim of the question was to investigate whether a particular operating system will play the critical role in shaping the future of e-money or there will be more than one operating system. Because, with more than one operating system, interoperability is a primary concern of end-users and hence is critical to the immediate acceptance of e-money for

final settlement of transactions. Whereas chart 5.3.1 provided an external opinion limited to the Internet users, the aim here is to get innovators and operators opinion on the subject matter.

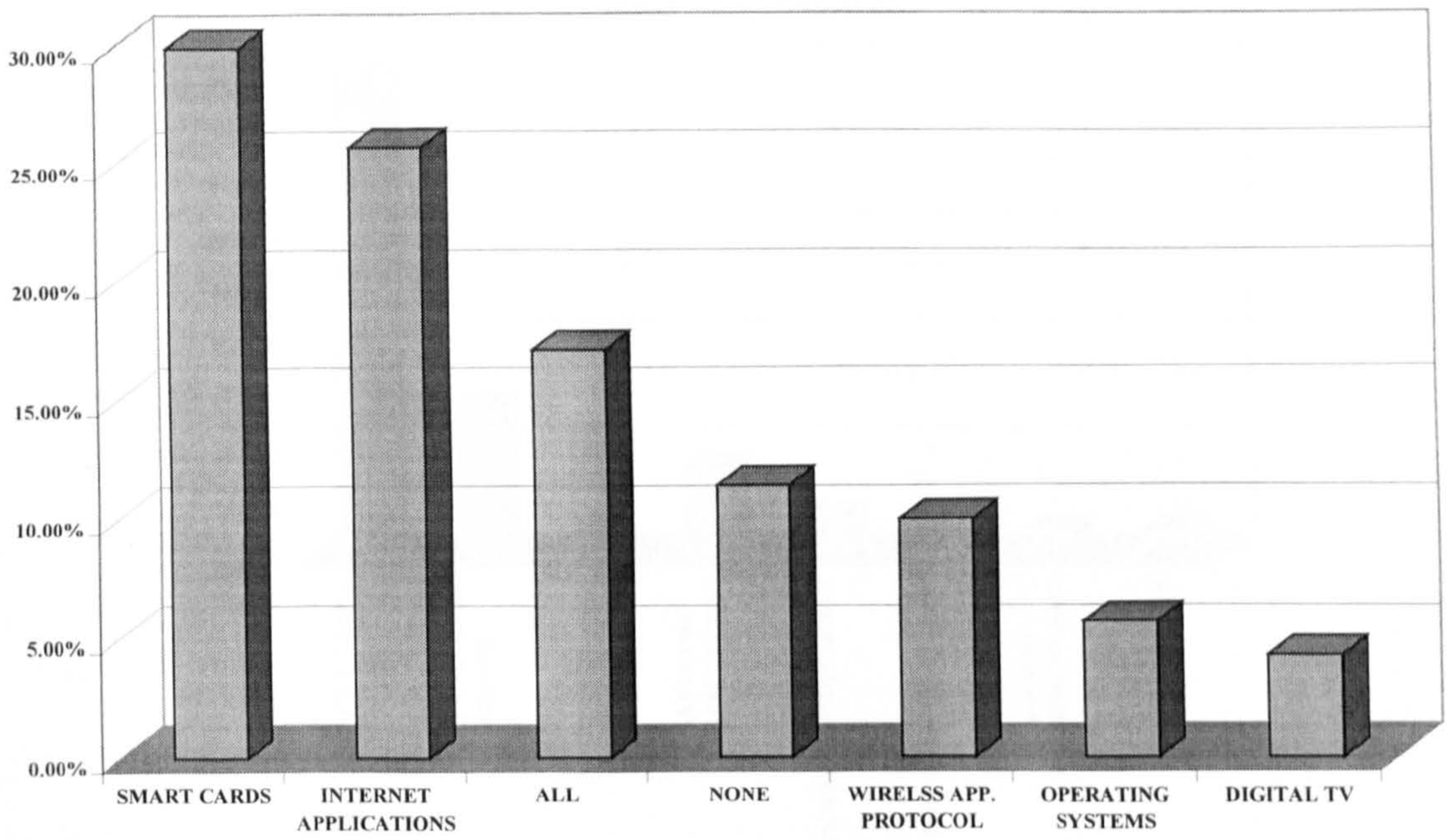
CHART 6.2.2: WHICH OPERATING SYSTEM MAY DOMINATE THE FUTURE OF E-MONEY TECHNOLOGIES?



The result is exhibited in the chart 6.2.2, which demonstrates that more than one-third of the participants believes that there will be more than one operating system in the future. The result underlines the importance of interoperability among different e-money schemes for the acceptability of e-money, whenever it becomes available. It may be useful to note that, once there is more than one operating system, all potential e-money access media – such as PCs, DTVs, palms, ATMs, PDAs etc - will need to be adaptable to different operating systems, which will require open and pre-agreed distribution for adjustment requirements. Otherwise, it would be difficult to maintain the reliability of circulation of e-money schemes, as households, firms and other economic entities will have to be induced to change their habits of using notes and coins. The finding here is contradictory to Chart 5.3.1 which exhibits an Internet survey on operating system and names Multos as the most favoured operating system. Obviously, it was an 'Internet-only' survey and the samples are quite different.

The next question relating to technical issues surrounding e-money was about the most critical technology for the future success of e-money applications. The aim was to get innovators' and operators' views on the technology that will play the critical role in shaping a successful e-money rollout. This was expected to enable decision-makers and other e-money discussants to focus on the proper technology in order to judge alternative proposals in terms of impacts and potential for the future. The next chart illustrates the result:

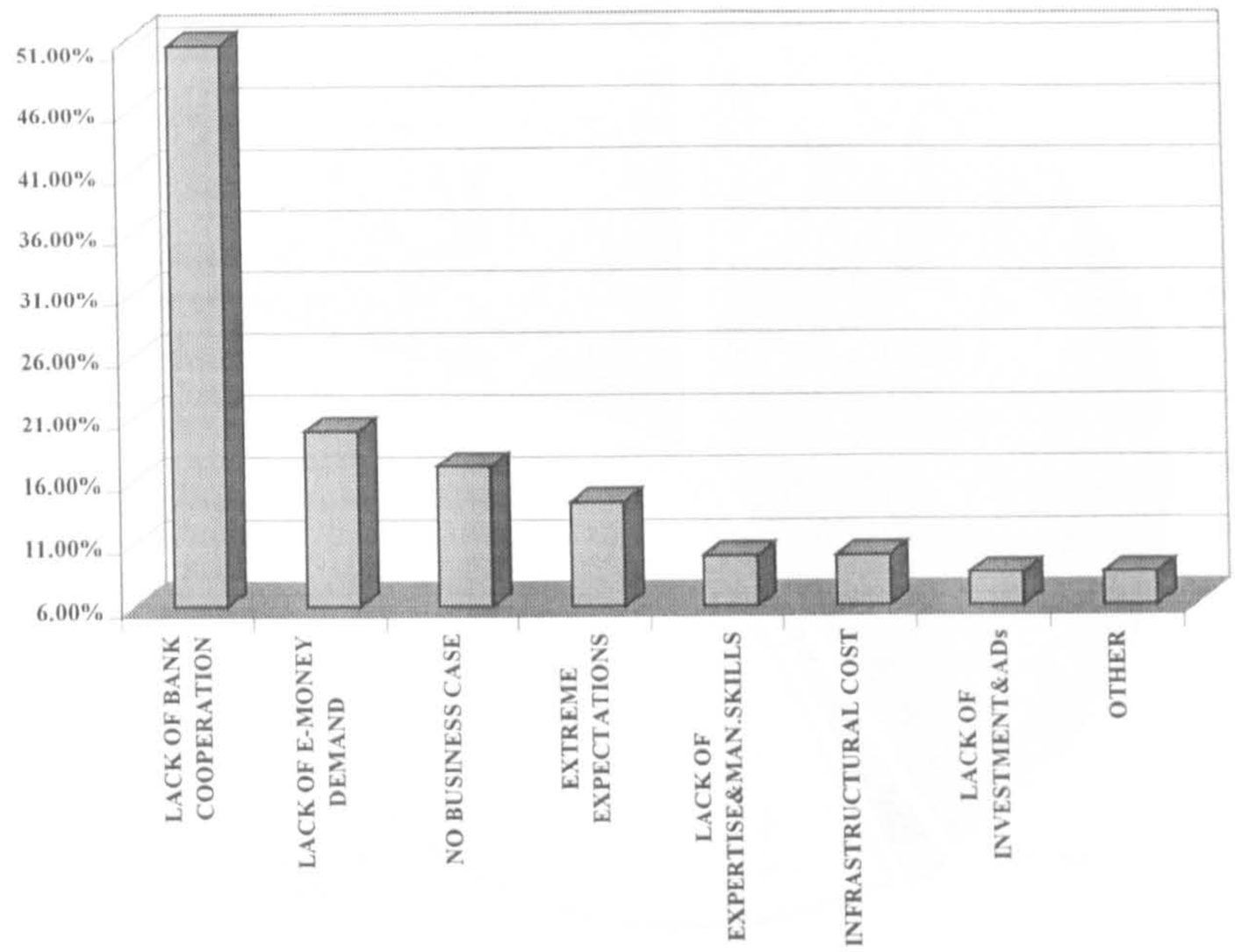
CHART 6.2.3: WHAT IS THE MOST CRITICAL TECHNOLOGY FOR THE FUTURE (SUCCESS) OF E-MONEY?



One sees that smart card technology was chosen as the most critical technology for the future success of e-money proposals. Internet applications ranked second and some 16 % of respondents did not rank the technologies, arguing that all the listed technologies are equally important. "Security", "service" "user acceptance", "speed of the applications", "consumer take-up" and "standardisation" were other important matters listed separately by respondents. Overall, innovators and operators confirmed the latest idea, which is to treat smart cards as the connector between virtual and conventional lives that will open the gate to common solutions to similar problems in two different dimensions of modern life.

The last question on technical issues concerning e-money schemes was "What may be the reasons for the failure of alternative e-money proposals like Digicash?". The intent was to collect empirical evidence on the reasons that some e-money schemes (at least their first versions) failed and thus aid financial authorities in evaluating the chances of success of future trials. Digicash, which was a very popular concept earlier in the history of Internet, played a critical role in spreading the understanding of e-money and related technologies. As analysed in section 5.2, Digicash played a critical role on the understanding of e-money technology and became a great success during the initial launch for a trial but the company was not able to promote e-money idea above a certain limit and sold all project to another company, including the "blind signature", which is a critical technology for creating anonymous network-based e-cash. The results were exhibited in the next following chart.

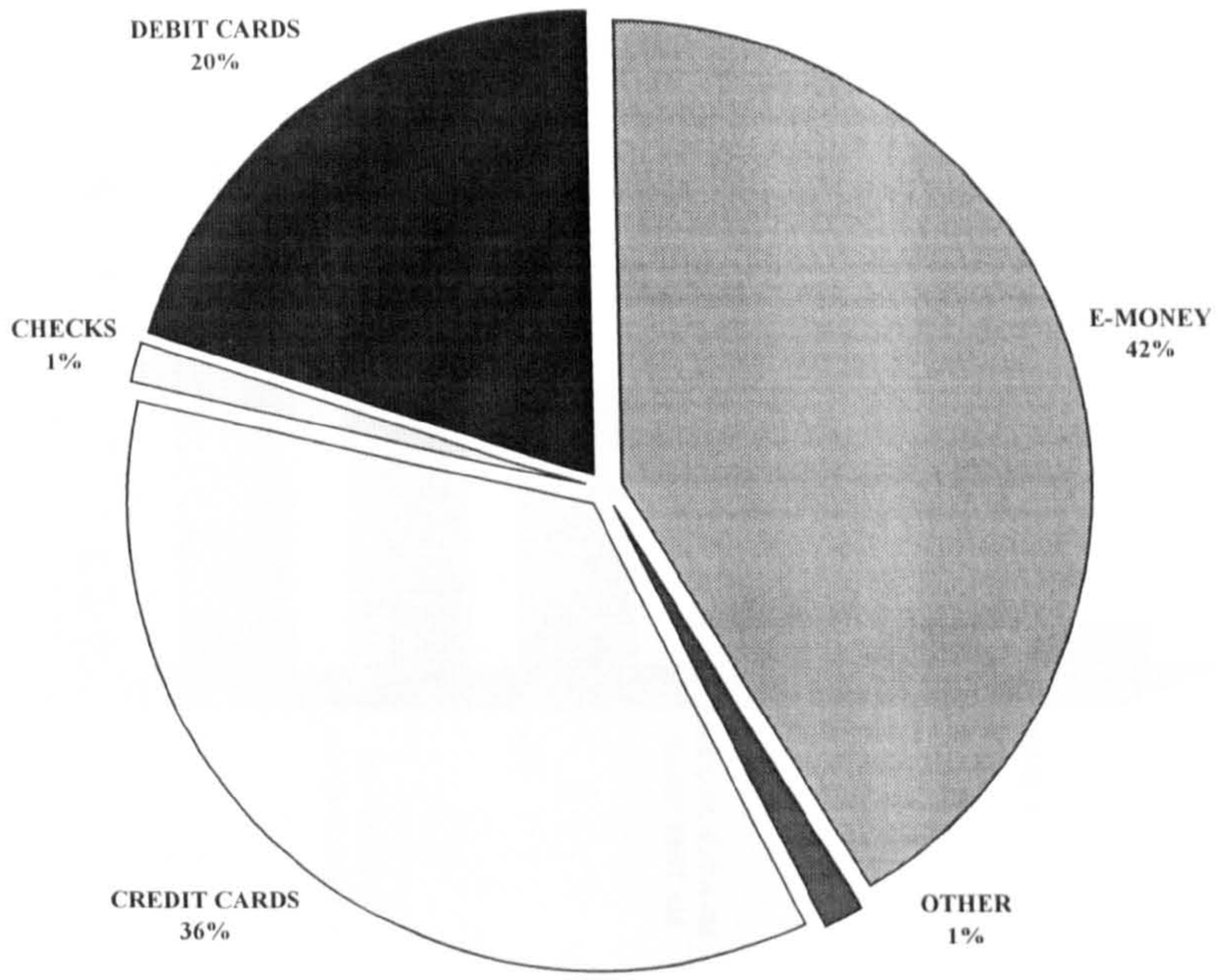
CHART 6.2.4: WHAT MAY BE THE REASONS FOR THE FAILURE OF ALTERNATIVE E-MONEY PROPOSALS LIKE DIGICASH?



Note that nearly half of the respondents blamed the lack of cooperation between banks and e-money innovators. This result may reflect the current influence of banks in payment systems and the belief that banks still have a sustainable comparative advantage in payment solutions, at least in the near future. The second-ranked reason for failure was lack of demand for e-money, at least during the trials of the first versions. This may reflect the immature stage of the Internet and e-commerce in previous years. Internet penetration was relatively low and the volume of e-commerce was insignificant compared to conventional commerce. The third-ranked reason was lack of a business case for e-money. Again, the result underlines the importance of carefully designed e-money proposals and good timing. The next reason given was exaggerated expectations, which may suggest that future proposals should not create unsustainable and unrealisable expectations for e-money schemes. Other reasons given were "lack of time to market", "lack of government regulation", and "unfriendly consumer interface" combined with "not the right acceptance" and "poor marketing of the product".

After the four questions related to technical issues, the second part of the questionnaire examined the future of the financial industry and the impact and implications of e-money technology on the industry in general and on banks in particular. The first question in this part, "Which payment instrument is best suited for "retail" e-commerce transactions?", was aimed at determining whether current payment alternatives can eliminate the demand for e-money arising from e-commerce, especially retail e-commerce as opposed to business-to-business e-commerce. The results are illustrated in the following chart.

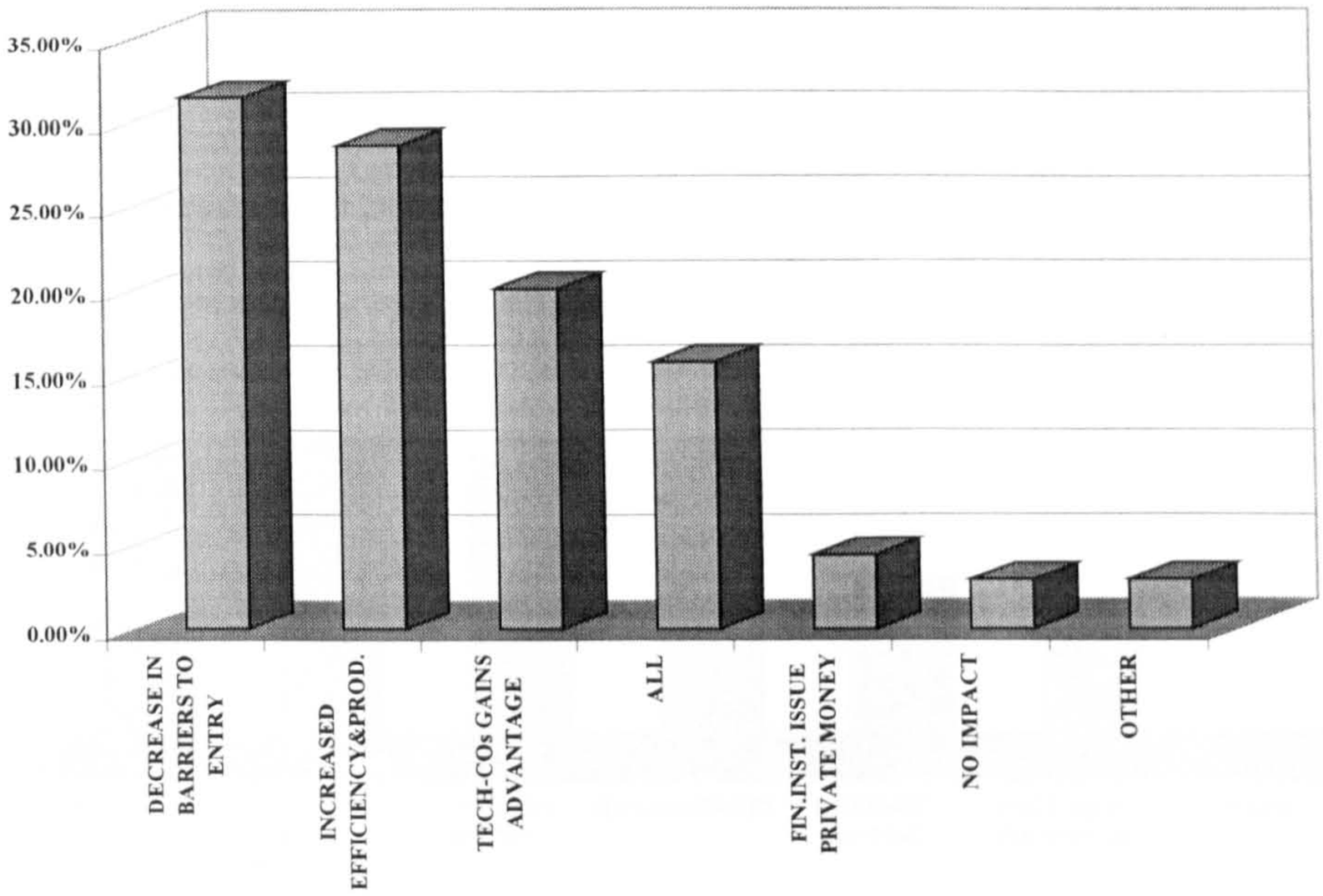
CHART 6.2.5: WHICH PAYMENT INSTRUMENT IS BEST SUITED FOR 'RETAIL' E-COMMERCE TRANSACTIONS?



According to the results, e-money will be a "demanded or required" medium of exchange in one way or another and expectations regarding the demand for e-money resulting from e-commerce transactions are characterised as non-illusionary but real. More than 40 % of the respondents believed that e-money is the best instrument for retail e-commerce. Even credit and debit cards, with their historical advantage in consumer awareness and understanding, were outranked by e-money. They ranked second and third as payment instruments for retail e-commerce. This result may indicate a potential pickup in the maturation of e-money schemes in the near future due to rapid growth in value and volume of e-commerce. It may also reduce the reliance on credit and debit cards as e-commerce payment instruments, since even operators and innovators seem not to be relying on them. It may be worth emphasising that e-money products can support credit and debit payments whereas the opposite does not hold. For example, with multi-application smart cards, it is possible to integrate purse, debit and credit functions.

For the next question, "What may be the impact of e-money on the future of financial services industry?", the aim was to clarify the impact of e-money on financial institutions. There are opposing expectations regarding this issue, ranging from no serious impact at all (ie just another innovation related to payment media) to a serious development similar to the initial use of money in primitive societies. The results are exhibited in the next chart:

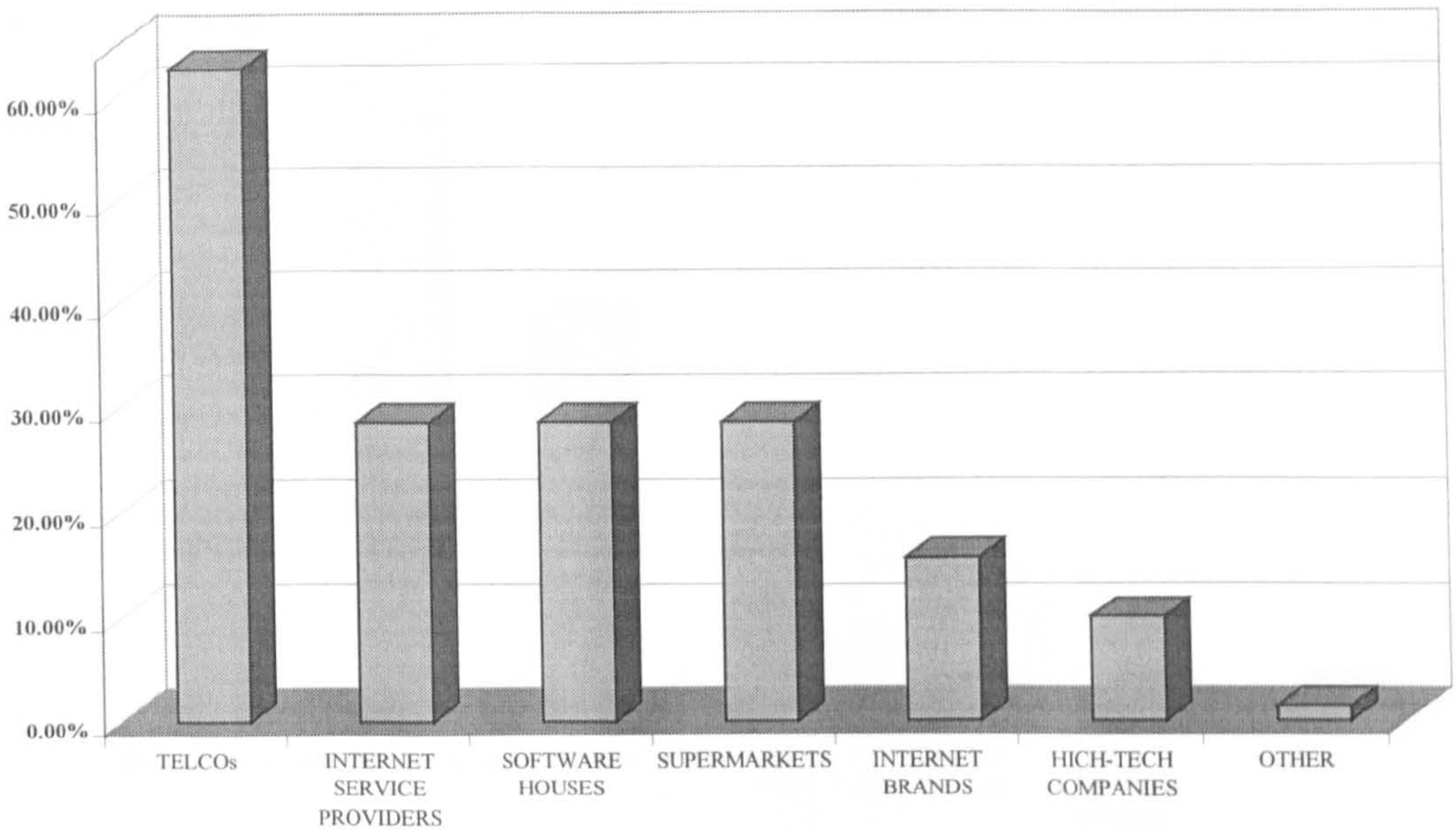
CHART 6.2.6: WHAT MAY BE THE IMPACT OF E-MONEY ON THE FUTURE OF FINANCIAL SERVICES INDUSTRY?



As the chart shows, more than 30 % of the respondents felt that e-money will reduce barriers to entry to the financial service industry by reducing operating and managerial costs and increasing competition. This result was consistent with the first survey, as seen in chart 6.1.10. Respondents also believed that e-money will increase the efficiency and productivity of financial service providers. About 20 % believed that telecommunication companies would gain comparative advantage in financial service provision. On the other hand, some 15 % of respondents were neutral as to the impacts, reporting them as equally possible. Almost 5 % also believed that e-money will allow financial institutions to issue their own private money. Other views expressed included "reduction of freight and operating cost", "decline in user loyalty", and "increased income with .com companies".

The next question, "Which institutions are best placed to compete with banks in providing e-money schemes?", was aimed at discovering which institutions are expected to compete best with banks for e-money. The importance of this issue is that traditionally central banks have relied mainly on banks to both collect data and provide liquidity to the financial system. If e-money can change the structure of financial sector, then central banks may need to include non-bank institutions in their price stability operations. The monetary transmission mechanism may be influenced or even changed because of non-bank involvement in financial services. The results follow in the next chart.

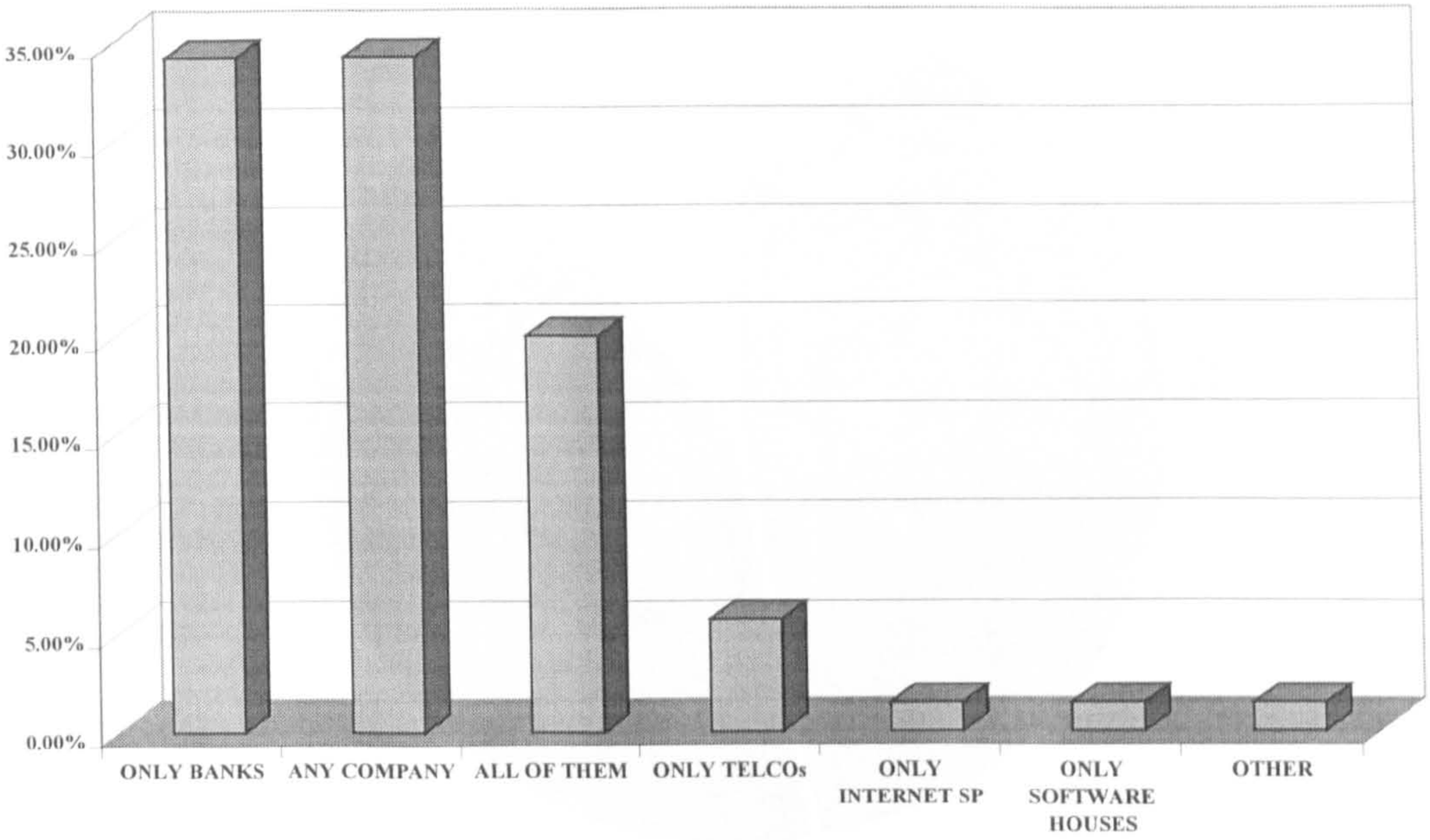
CHART 6.2.7: WHICH INSTITUTIONS ARE BEST PLACED TO COMPETE WITH BANKS IN PROVIDING E-MONEY SCHEMES?



The results point to telecommunication companies, as the majority of respondents cited them as the banks' main competitors. This result may lead to future mergers and acquisitions between banks and telecom companies or banks may try to take over telecom companies or vice versa. The result also underlines the expertise of telecom companies in communication channels, which is expected to dominate retail payment systems in the future, both with wires and recently wireless. Internet service providers, software houses, supermarkets and retail chains followed telecom companies with almost equal percentages. Interestingly, most of these companies have already started to co-operate with banks in one way or another. Internet brands that have gained a certain amount of consumer awareness and confidence and high-tech companies that also support financial service providers with solutions to financial applications were also preferred by some of the respondents. One respondent mentioned "insurance companies and pension funds" while another argued that "banks will not promote e-money".

Another question related to the future impact of e-money on the financial service industry concerned potential issuers of e-money: "Who should be allowed to issue e-money?" The aim was to determine whether banks are still favoured as payment system experts or whether other institutions are also becoming acceptable as e-money issuers. This may have implications for the integrity of financial systems and for monetary stability, which is generally viewed to have primacy in modern financial systems. The results are shown chart 6.2.8.

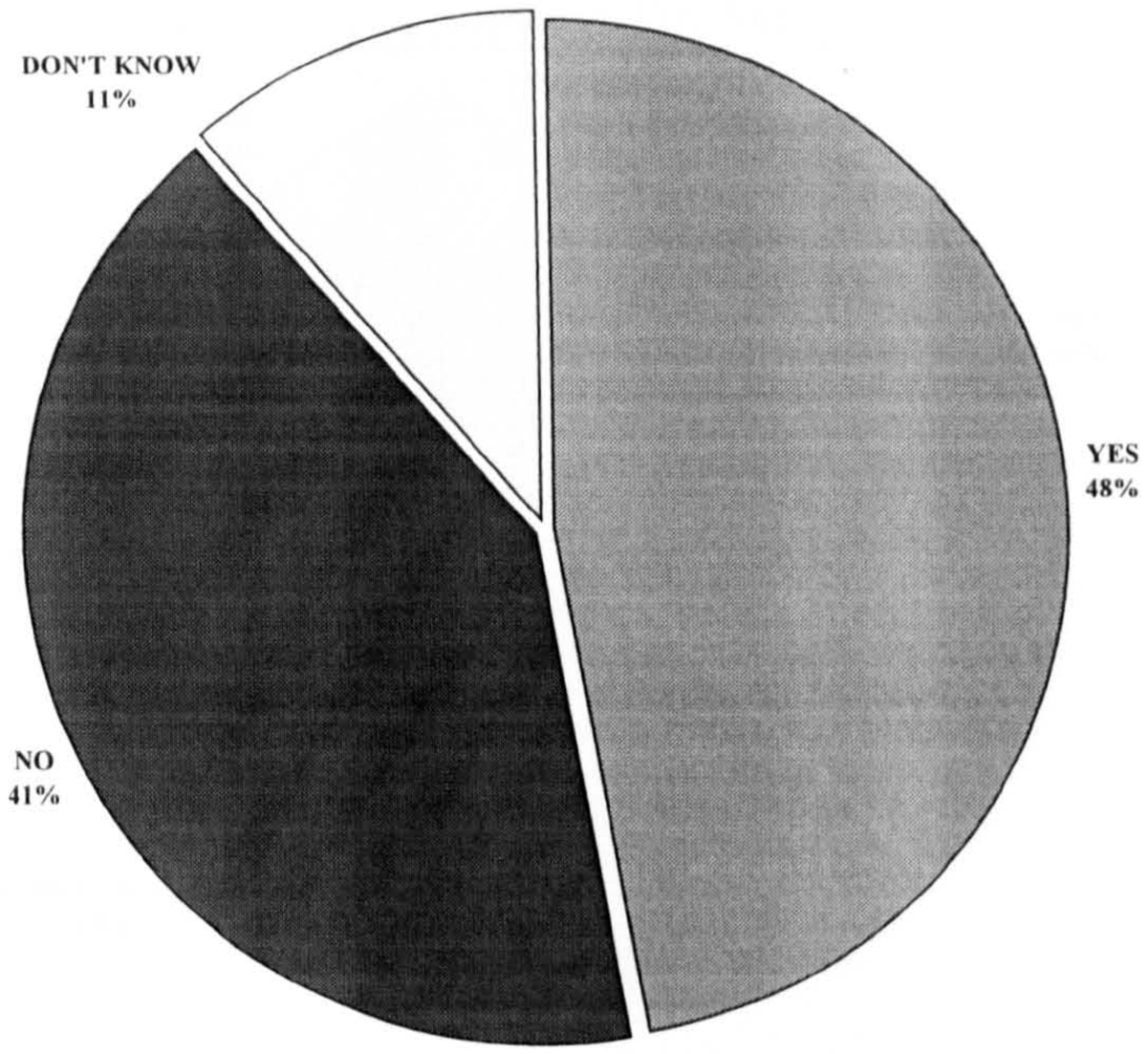
CHART 6.2.8: WHO SHOULD BE ALLOWED TO ISSUE E-MONEY?



The respondents seemed neutral as to issuers of e-money, as they equally favoured the options "only banks" and "any firms capable of handling e-money technology". Who is the issuer does not seem to be a major concern to innovators and operators, as banks are not clear favourites over other companies. Moreover, the third choice clearly indicated that respondents want all types of firms, including banks, telecom companies, Internet service providers and software houses, to be able to issue e-money.

The last direct question concerning financial service-related issues was on whether banks would remain as the main players in the financial services industry. Banks are the main players in almost all well-developed and stable financial systems, and they play a key role in the monetary transmission mechanism. As a result, it is important for central bankers and others concerned with financial stability (which is necessary for a well-functioning market economy) to understand all the technologies that may influence banks' prospects. The aim of the question, as a result of this importance was to obtain information that will guide central banks in how they should react to the emergence of e-money technologies in light of their impact on the future of banks within the financial industry. The results are shown in chart 6.2.9.

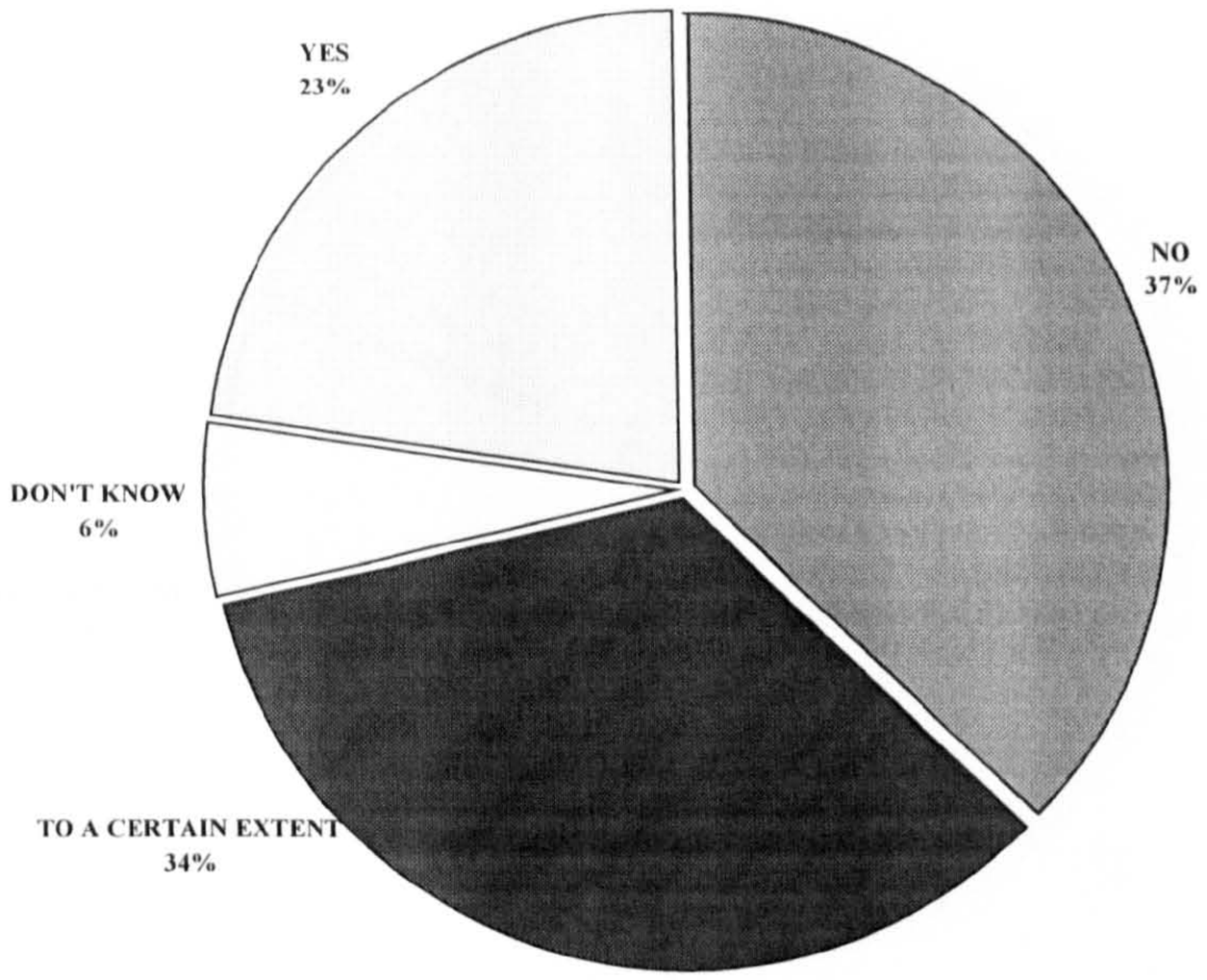
CHART 6.2.9: WILL BANKS REMAIN AS THE MAIN PLAYERS IN THE FINANCIAL SERVICES INDUSTRY?



Note that less than a majority of respondents believe that banks will be able to sustain their main role in the financial industry whereas more than 40 % believe that banks may not be the main players in the future. The result can be interpreted as being supportive of functional rather than institutional regulation of financial services.

The last group of questions addressed implications of e-money for central banks and conventional money. The first question was on the impact of e-money on the power of central banks as sole providers of monetary base. The results are illustrated in the next chart.

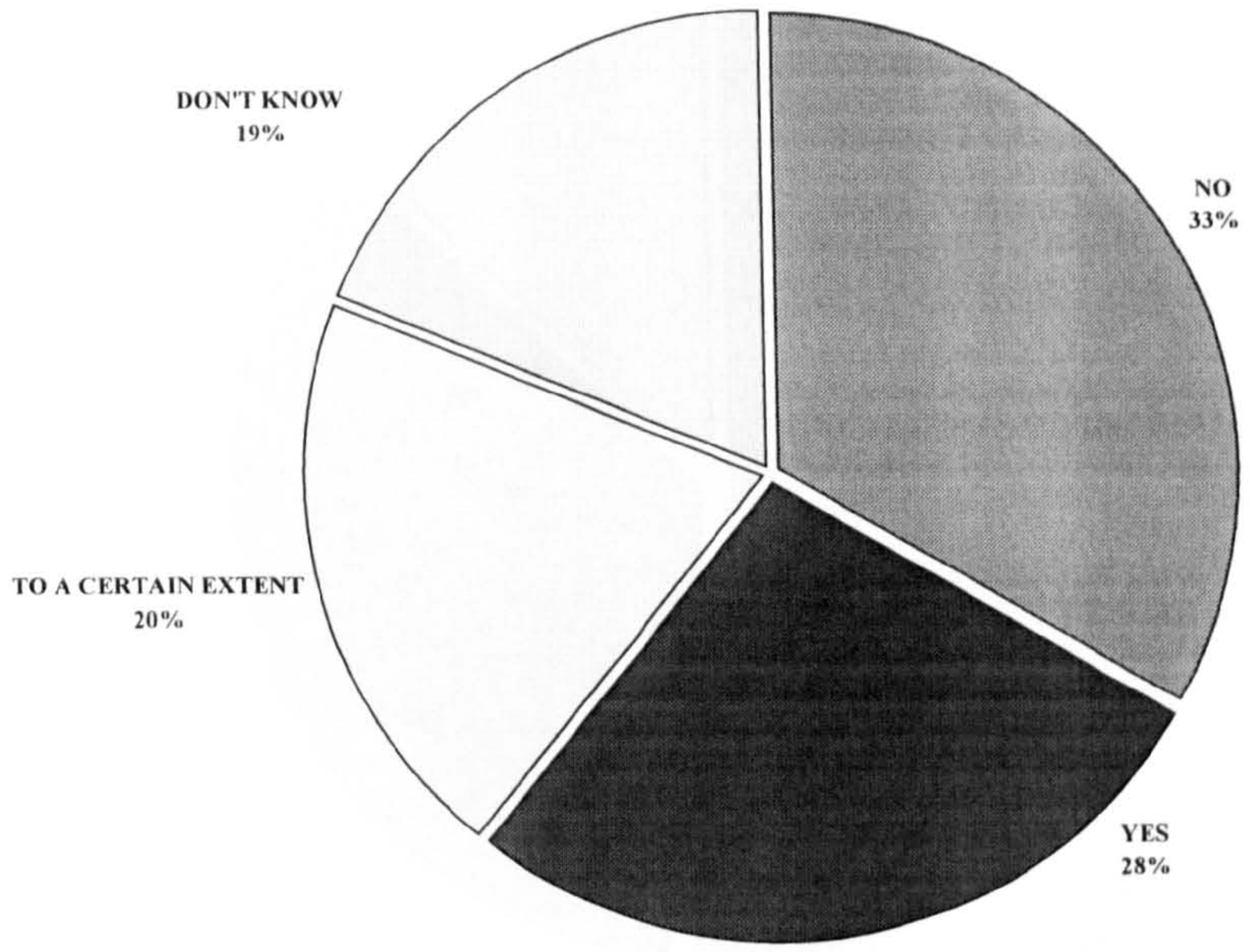
CHART 6.2.10: CAN E-MONEY TECHNOLOGIES ELIMINATE THE POWER OF CENTRAL BANKS AS THE SOLE PROVIDERS OF MONETARY BASE IN THE FUTURE (BY OFFERING ALTERNATIVE MONIES ISSUED BY OTHER INSTITUTIONS)?



As the chart shows, the majority of respondents believed that e-money technology will eliminate the power of central banks (by offering alternative monies issued by other institutions) as sole providers of monetary base, though 34 % qualified this to a certain extent. If one accepts that operators and innovators will shape the future of e-money technology, then this result could have implications for central banks as sole providers of monetary base. It might raise issues like that of a monetary policy regime without monetary base or an interest rate transmission mechanism in a competitive currency area.

The next question was on whether e-money would lead to a new free banking era. It also contained the main aspects of free banking, i.e. the absence of central bank involvement in the financial system and competing currencies issued by different institutions. The aim of the question was to obtain empirical evidence on expectations as to the re-emergence of a free banking era based on the fruits of technological improvements in computation. The results are exhibited in the following chart.

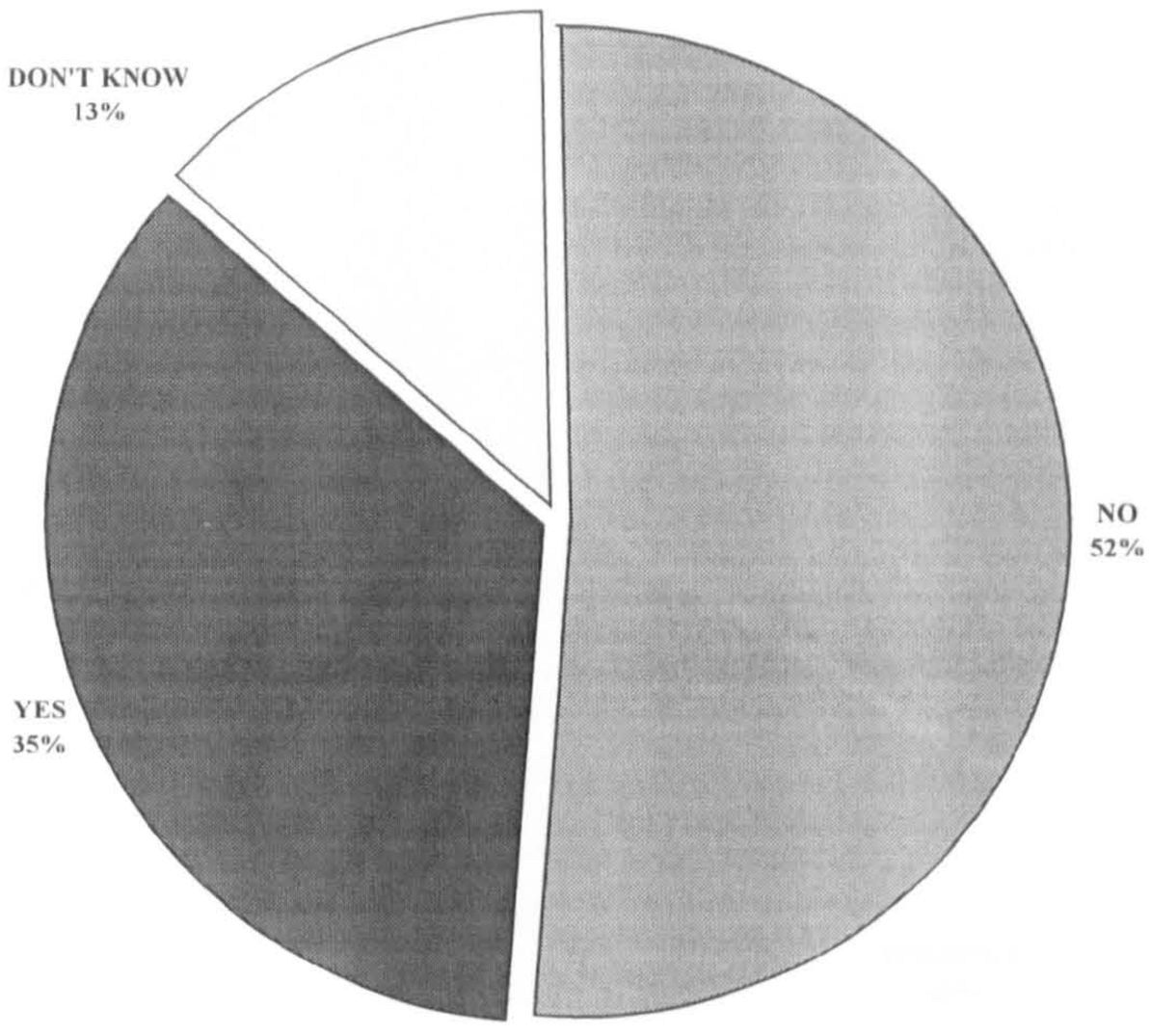
CHART 6.2.11: CAN E-MONEY TECHNOLOGIES LEAD TO A "FREE BANKING' ERA (A SYSTEM OF COMPETING CURRENCIES ISSUED BY VARIOUS INSTITUTIONS AND WITHOUT A CENTRAL BANK)



The results indicate that almost half of the respondents expected that e-money technology would lead to a new free banking era, although 20 % qualified this only to an extent. Those who did not believe that e-money would lead to a new free banking era amounted to about 33 % and those that choose the "don't know" option amounted to some 19 %, which was the highest for any question in the second survey.

The next question was part of the third group of questions, which investigated central banking and money implications of e-money. The question addressed whether there is a potential for a world currency with the advent of the technology. Some academicians and practitioners expect that computers and mobile networks will create a global economy without borders that will require a world currency or at least a world medium of exchange for this network. The results are shown in the following chart.

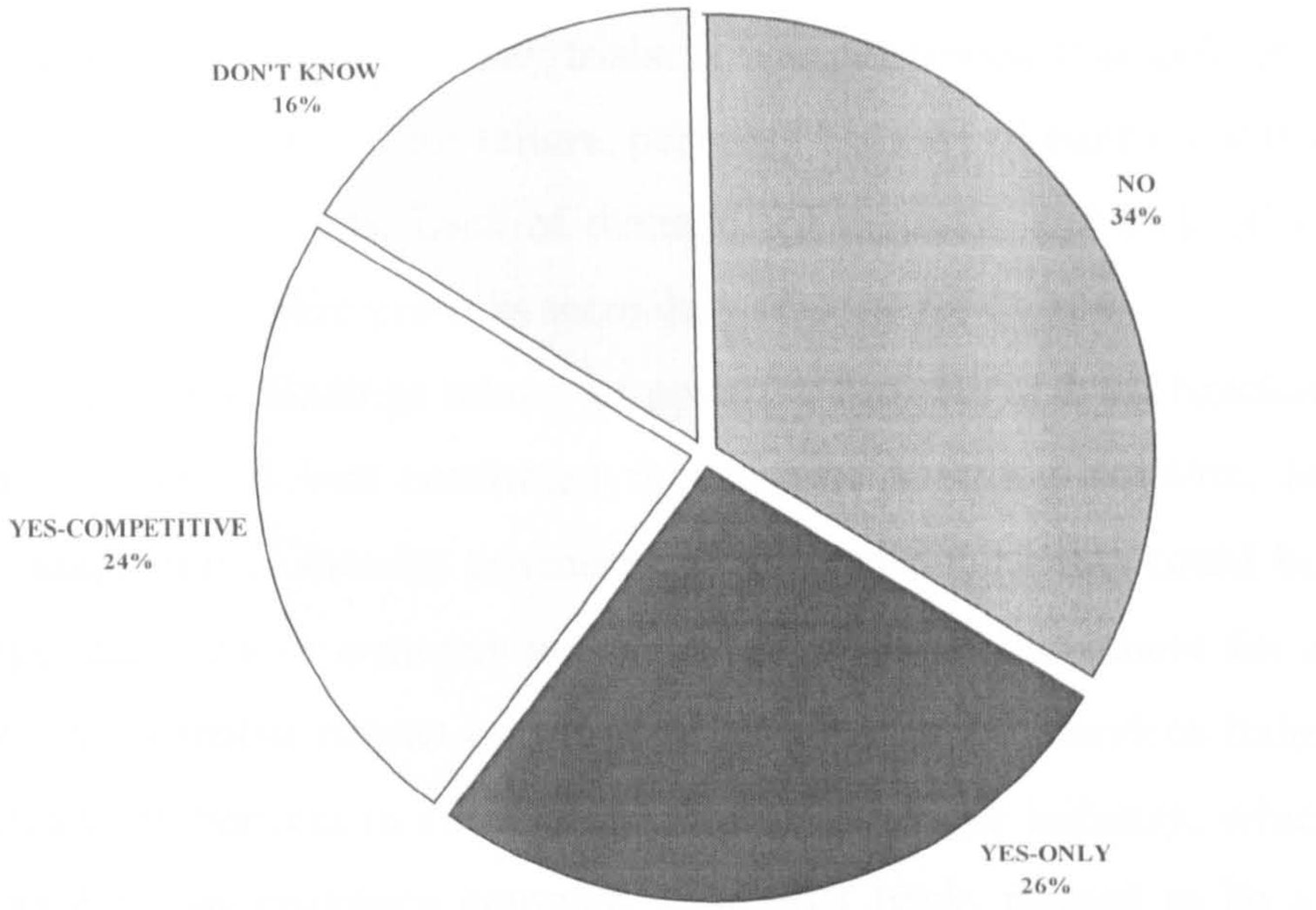
CHART 6.2.12: CAN E-MONEY CREATE A 'WORLD CURRENCY' BY ELIMINATING MOST OF THE CURRENTLY AVAILABLE NATIONAL CURRENCIES ALL AROUND THE WORLD?



A slight majority rejected the idea of a world currency and about 13 % chose the "don't know" option. One respondent argued that he did not anticipate a world currency because "the world industry is not only around computers". On the other hand, more than a third of the respondents accepted the concept of a world currency, a proportion that may have implications for future e-money proposals and regulation. If 35 % of the innovators and operators are convinced of the efficacy of a world currency that could be supported by e-money technology, national currencies, especially those with unstable values, may be under threat. Further, national approaches (including national regulation) of e-money with a global potential may not adequately address all issues concerning e-money.

The last question of the survey investigated the issuance of e-money by asking respondents whether central banks should issue e-money for their own account and hence compete with private banks and/or other institutions. The aim here was to gain insight into expectations regarding the best way to issue e-money in the future and to help central banks prepare for e-money-based monetary and financial systems. The results are shown in chart 6.2.13.

CHART 6.2.13: SHOULD CENTRAL BANKS ISSUE E-MONEY FOR THEIR OWN ACCOUNT, THUS COMPETING WITH PRIVATE BANKS AND/OR OTHER INSTITUTIONS?



As the chart shows, only 26 % believed that e-money should be issued exclusively by central banks. On the other hand, more than a third of the respondents clearly expressed their concerns about central bank involvement in the issuance of e-money, as they believed that "central banks should not compete with financial services providers". Moreover, almost a quarter of the respondents favoured competitive issuance of e-money, i.e. that central banks should compete with private issuers in e-money schemes. As a general conclusion, it seems that innovators and operators do not favour direct involvement of central banks in e-money issuance. In other words, central banks seem not to be welcomed in direct involvement for e-money issuance.

6.2.5. CONCLUSIONS AND RECOMMENDATIONS

The second survey shed some light on current problems with e-money technology. It is evident that e-money innovators and operators feel that future access products for e-money applications will be dominated by PCs, followed by mobile telephones and digital television.

Regarding the choice of operating system, the respondents believed that, rather than a single operating system, the e-money environment will be shaped by two or even more operating systems (most likely interoperable, as common sense would dictate). Smart cards will be the most critical technology for the future success of proposed e-money schemes, which is not at odds with current trends, as smart cards seem to serve as a bridge between the virtual and conventional life styles, including financial applications. Internet applications followed smart

cards as the second most important technology, ahead of WAP, operating systems and digital television. The final conclusion regarding technical issues concerns the general reasons for failure of some of the current e-money trials. It was confirmed that lack of co-operation with banks might be the main reason for failure, probably because of banks' comparative advantage, especially in payment systems. Lack of demand for e-money and lack of a business case, at least during trial periods were given as secondary reasons for failure.

Second group of findings relates to potential impacts and implications of e-money for the financial industry. It was confirmed that despite a strong position, historically proven success and adaptation to Internet payments, credit and debit cards could be driven out by e-money. Respondents chose e-money as the future payment instrument for retail e-commerce transactions. The potential impact of e-money on the financial services industry was expected to be a reduction in barriers to entry to the financial service industry, which may already be confirmed, as Egg, an insurance company's Internet bank, proved to be a potential success within less than two years in the UK. Increased efficiency and productivity for financial services and a weakening of bank's comparative advantage, especially vs telecommunication companies, were underlined as secondary impacts of e-money on the financial services industry. Telecommunication companies were rated as the most competitive vs banks, but Internet service providers, software houses and supermarkets were also mentioned as potential competitors of banks in providing e-money schemes. Regarding the issuance of e-money, banks and other companies were almost equally favoured, i.e. banks were not ascribed top-favourite status. It seems that banks have begun to loose their favoured status among innovators and operators as regards the provision of financial services, at least for the issuance of e-money in the future. Moreover, less than a majority saw banks as the main players in the financial service industry. Of the respondents, 41 % clearly stated that banks would not be the main players in the future.

The final set of conclusions is based on responses to questions on the impact and implications of e-money on conventional money and the current position of central banks. The first result confirmed that central banks might lose their power, at least to an extent, as sole providers of monetary base. The re-emergence of a free banking era triggered by e-money was expected by 48 % of the respondents, although 20 % qualified this somewhat. Regarding the creation of a world currency, 35 % of respondents felt this was likely, which can be regarded as a strongly supportive result. A total of 52 % clearly rejected the idea. The final finding from the survey was that respondents expressed opposition to central banks' monopoly of e-money

issuance, as only 26 % supported the idea while 34 % rejected it. Some 24 % of respondents supported competitive (incl. central banks) issuance of e-money.

There are some general observations regarding the survey results that might be worth mentioning: Innovators and operators argued that the technology and expertise for the launch of a successful e-money scheme could already be considered to be in place. However, they also mentioned the importance of perceptions of the general public concerning technology, which they cited as one of the main causes of delays in full implementation of e-money technology. The innovators in particular expressed a real concern about unsuccessful launches. They argued that each unsuccessful trial postpones a full-scale launch of national roll-outs by many years, even an international roll-out, especially in Europe that is enjoying the benefits of the Euro.

6.2.6. COMPARATIVE ANALYSIS OF THE SURVEYS

In preparing the second questionnaire, it was not intended to compare the results of the two surveys. However, certain complementary conclusions seemed to flow out of the two surveys, mostly because of overlapping questions. Caution is called for in such a comparison because of the year-long interim period at a time when the e-money phenomenon was changing rapidly. In the course of a year, there may be solid reasons for changes in basic attitudes to e-money. Even a single technological innovation may be capable of changing some of the basic presumptions. But because the questions in the two surveys were closely related, the venue was the same, and the respondents were largely the same, a comparison might be useful, given an appropriate degree of caution. To be sure, many of the questions were not related, as the second survey was designed to be complementary.

The first useful relationship to be cited is between chart 6.1.1, which indicates that e-money has the potential to replace central bank money and chart 6.2.10, which indicates that e-money technologies eliminate the power of the central bank as sole provider of monetary base. Both results underline the need for central banks to find and identify new means and instruments, especially so as to minimise their dependence on monetary aggregates in general and on narrow money in particular if they are to preserve their influence on financial markets and their ability to maintain price stability in the event that central bank money is replaced by e-money.

There seems to be a close relationship between charts 6.1.6 and 6.2.8. In the former, 50 % indicated that non-banks should be allowed to issue e-money and, in the latter, the respondents were about equally divided as between "only banks" vs "any company". Both of

these results suggest that if non-banks gain the right to issue e-money, central banks – which have traditionally relied on banks to maintain a stable relationship between the monetary policy transmission mechanism and the price level – may be forced to pay more attention to non-bank firms or to focus on monetary functions instead of monetary institutions in their efforts to maintain price stability.

Another noteworthy relationship holds between charts 6.1.9 and 6.2.1. In both charts, personal computers and mobile phones were given top priority as access media to e-money, followed by DTV. It can be argued that operators and innovators did not change their minds during the year as to the future of access products and e-money access. This finding is not at odds with the widespread expectation that network-based "virtual life" will be shaped by developments in three different technologies, ie personal computers, mobile phones and digital television. There are alternatives like refrigerators or electric cable appliances, but PC, DTV and the mobile phone seem to have a clear lead, at least for the time being.

Two different questions provided very similar results, as shown in charts 6.1.10 and 6.2.6. Both indicated that e-money will reduce barriers to entry to the financial industry. Even current trends may be seen to confirm these results, as many banks have begun to prefer either a merger with another bank or cooperation with different companies as means of maintaining a competitive edge. A current study on the implications of innovation in financial technology, especially in respect of money, argued that "it costs USD 1 million to set up a fully functioning Internet bank" (Gosling, 1999). Even though actual set-up costs may not constitute the only barrier to entry, they are clearly important, and they could well generate innovative financial applications that will open the door to the financial services industry.

Finally, charts 6.1.11, 6.2.11 and 6.2.13 seem to tell a story. The first chart indicates that money should not be privatised, albeit 8 % challenged the idea. In the second chart, 48 % of respondents indicated that e-money may lead to a free banking era and, in the third, 24 % defended co-issuance of e-money by central banks and private institutions while 34 % opposed central bank issuance of e-money. One might interpret this as an indication that during the year between surveys there was a trend toward a more liberal approach to currency issuance, including private money. The real challenge for e-money arises when it represents freely circulating intrinsic monetary value that is not the same as any national unit of account controlled by a known monetary authority with the intent to defend its value. The results of the surveys suggest that this challenge is seen to exist even at this stage of technology.

6.2.7: SURVEY QUESTIONNAIRE 2000

A QUESTIONNAIRE ON ELECTRONIC MONEY DEVELOPMENTS

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City University Business School; Department of Banking and Finance
Topic: ELECTRONIC MONEY, FINANCIAL SERVICES AND MONETARY POLICY

SURVEY QUESTIONS:

1. Which medium of access technology is most likely to dominate the future e-money developments?

A. Personal computer (PC)
B. Mobile telephone
C. Palm
D. Digital TV
E. Automated Teller Machine (ATM)
F. Other:_____

2. Which operating system may dominate the future of e-money technologies?

A. Multos.
B. Java.
C. Windows for Smartcards.
D. None of the above but_____
E. There will be two or more operating systems.

3. What is the most critical technology for the future (success) of e-money?

A. Smart Cards.
B. Internet Applications.
C. Wireless Application Protocols for mobile phones.
D. Digital TV.
E. Palm.
F. Operating Systems like Java, Multos, Windows for Smartcards
G. All of the above.
H. None of the above but_____

4. What may be the reasons for the failure of alternative e-money proposals like Digicash? (Please tick all the relevant answers)

A. Lack of demand for e-money.
B. Lack of business case for e-money.
C. Lack of coordination with banks and operators.
D. Lack of investment and advertisement.
E. Lack of expertise and management skills.
F. Exaggerated expectations.
G. Unsustainable cost of infrastructure to get critical mass.
H. Other:_____

5. Which payment instrument is best suited for 'retail' e-commerce transactions?

A. E-money.
B. Credit cards.
C. Debit cards
D. Checks.
E. E-gold.
F. Other:_____

6. What may be the impact of e-money on the future of financial services industry?

A. E-money will allow financial institutions to issue their own money.
B. It will only increase the efficiency and productivity of financial service providers.
C. It will decrease barriers to entry to the financial service industry by reducing operating and managerial cost and increase competition.
D. Technology companies will gain comparative advantage for financial services.
E. All of the above
F. It will have no impact
G. None of the above but other:_____

7. Which institutions are best placed to compete with banks in providing e-money schemes? (Please tick all the relevant answers)

A. Telecommunication companies like BT and Vodafone
B. High-tech companies like IBM.
C. Internet service providers like AOL.
D. E-commerce brand names like Amazon.com.
E. Software companies like Microsoft.
F. Supermarkets and retailer chains like Wal-Mart and M&S.
G. Other:_____

8. Who should be allowed to issue e-money?

A. Only Banks.
B. Only Telecommunication companies
C. Only Internet Service Providers
D. Only Software companies.
E. All of the above.
F. Any firms capable of handling e-money technologies.
G. Other_____

9. Will banks remain as the main players in the financial services industry?

A. Yes, they can supply financial services more efficiently than other firms.
B. No, other firms have been gaining comparative advantages especially in digital economy.
C. Don't know.
D. Comments_____

10. Can e-money technologies eliminate the power of central banks as the sole providers of monetary base in the future (by offering alternative monies issued by other institutions)?

A. Yes.
B. No.
C. To a certain extent.
D. Don't know Comment:_____

11. Can e-money technologies lead to a "free banking' era (A system of competing currencies issued by various institutions and without a Central Bank)

A. Yes.
B. No.
C. To a certain extent.
D. Don't know
E. Comment:_____

12. Can e-money create a 'world currency' by eliminating most of the currently available national currencies all around the world?

A. Yes
B. No
C. Don't know
D. Comment:_____

13. Should central banks issue e-money for their own account, thus competing with private banks and/or other institutions?

A. Yes, money should only be governed by central banks
B. Yes, all firms including central banks should compete with each other in e-money schemes.
C. No, central banks should not compete with financial services providers
D. Don't know
E. Other_____

6.3. PROSPECTS FOR E-MONEY: A US - EU COMPARATIVE SURVEY

This section extends an investigation of views on e-money operators and innovators on approaches to current issues surrounding e-money. This has been achieved through a survey of major e-money innovators and almost all international operators, who came together in Miami, the US, at the Cardtech\Securtech2000 Conference and Exhibition on e-money and related technologies. The aims of the section are to update forefront findings from European surveys on e-money related issues and to deepen the understanding of innovators' and operators' views, in order to stimulate further discussion, especially among central bankers, and to eliminate some of the existing ambiguities regarding the possibilities and implications of e-money.

6.3.1. INTRODUCTION AND AIMS OF THE SURVEY

There are two different perceptions (analysed in depth in the following part), which are essentially those of central banks as represented by the ECB and the FED. However, two basic motives behind e-money, i.e. decreasing cost of telecommunications and ever increasing calculation power, are almost irrelevant (or at least not directly relevant) to the main functions of central banking. As a result, it can be argued that the future of e-money is more dependent on the possibilities of innovation and implementation of the new products to real life payment problems as practical solutions through operators. This argument provides an opportunity to compare the e-money perceptions of innovators and operators in Europe (the EU area) and the United States. Two earlier European surveys provided a set of data that reflects e-money perception in the EU, and here the aim is mainly to collect a set of data reflecting the US perception to add to the combination of European questionnaires.

Aims of this survey include all those of the European surveys, including the provision of empirical insights into what innovators and operators driving e-money developments think about the issues of e-money regulation and implications of the advent of e-money for the banking industry and the investigation of the potential of e-money technology as regards the future of central banking and banknote and coin circulation. The overall aim is also and particularly to gather data from industry experts and use it to gain helpful insights in order to increase the understanding of differences in perceptions on e-money in Europe and in the US. The analysis compares earlier findings from two earlier surveys conducted in London. There were no major changes in the last survey compared to the two earlier ones, other than to combine the questions into a single questionnaire. By keeping the questions almost the same,

the aim was to develop a data set that could be compared to the European survey findings. It was expected that this will increase the understanding of the potential and the limitations associated with e-money among decision-makers and discussants, both academics and practitioners, and will help central bankers, regulators and practitioners formulate their approach to e-money and to understand its implications for the financial services industry, including monetary policy and financial regulation. It is important to underline that the aim was not to provide detailed information about a given e-money scheme nor the advantages and disadvantages of a particular proposal or the state of current e-money trials around the world.

Current trials have arguably not been able to provide a business case for e-money. Year 1998 figures for outstanding value in e-money schemes for the EU countries were made available by the ECB[56] (2000). The number of e-money cards increased from 46,077,000 to 77,282,000 between 1997 and 1998 while the number of e-money loading machines increased from 50,347 to 71,080 in the Eurozone.

Hove (2000) looked at the major electronic purse project in Europe and reached the conclusion that 'the initial expectations concerning EP adoption were unrealistic'. The Economist (February 19th - 25th 2000) earlier made a similar argument regarding the first versions of e-money trials as 'the reality has proved much less exciting: for electronic cash has flopped badly. Its' issuers either went bankrupt, dropped the product or moved into another business' but concluded that the second version or 'new generation of e-cash firms appears to be getting more things right than its predecessor did'. However, interest in e-money does not seem to be diminishing because of failures of the first generation e-money trials.

Although there is still no generally accepted and proven business case for a single e-money scheme, operators and innovators, in trying to create national and international standards for e-money products, have been investing significant amounts of money, time and effort. Their effort ranges from radical proposals such as commodity representative circulation of monetary value, which assumes digital and transferable circulation of precious metals like gold, silver, platinum etc (according to www.e-gold.com; there are 72,720 e-gold accounts world-wide as of September 2000) as medium of exchange, to 'gift certificates' that can be

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[56] BEF 1.35 billion for Belgium (compared to BEF 438.8 billion in notes and coin in circulation), DKK 18.5 million (DKK 34.5 billion) for Denmark; DEM 0.1 billion (DEM 242.6 billion) for Germany, ESP 1.71 billion (ESP 4.436 billion) for Spain, ITL 1309 billion (ITL 115,200 billion), for Italy, NLG 0.1 billion (NLG 38 billion) for the Netherlands, ATS 0.04 billion (ATS 145.5 billion) for Austria, PTE 04 billion (914.8 billion) for Portugal, and FIM 3 million (FIM 14.8 billion) for Finland.

addressed to a particular mail account only. Failures of different trials around the world did not seem to seriously dampen the interest on e-money proposals.

6.3.2. DIFFERENT E-MONEY PERCEPTIONS

Central banks around the world began to monitor the e-money phenomenon almost as soon as the first launches appeared in the financial industry, without waiting for a proven business case. However, there seems to be a clear distinction between the European (EU) and the US financial authority's perception on the proper approach to e-money. The first sign of this difference appeared in EMI (1994) which provided five scenarios for central bank action on e-money and evaluated them as follows:

1. No central bank intervention at all. This scenario was ignored in the light of central banks' responsibility for maintaining the integrity, stability and efficiency of payment systems and for conducting monetary policy.

2. No restriction on the issuing institution but with central banks exercising oversight. This scenario is rejected because the funds representing the value of the purchasing power contained in electronic purses needs to be considered as bank deposit money, which can only be held by credit institutions.

3. Central banks issue electronic purses themselves in competition with similar private sector schemes, using the existing banking infrastructure for the distribution of their electronic purses. This scenario was found to be inconsistent with the long term trends that led central banks to withdraw from competition with the banking sector and to concentrate on the oversight of payment systems and provision of Interbank services.

4. Central banks decide that the issue of electronic purses is exclusively a central bank activity and create a distribution infrastructure of their own. Under this scenario electronic purses could be given the status of legal tender. This scenario was not accepted as the best option by the report, which indicates that no EU central banks have a plan to issue purses because of the belief that the consequences of electronic purses may not be different than other cashless instruments. However, it was stated that central banks could at some point be obliged to issue prepaid cards themselves. It was stated that the Finnish central bank had decided to issue prepaid cards itself as a way of preventing the proliferation of non-compatible systems.

5. The issuance of electronic purses to be limited to credit institutions and not-fully-fledged credit institutions provided that (i) they provide only domestic payment systems, (ii)

they are subject to appropriate regulation, in particular with respect to liquidity requirements, and (iii) they are supervised by the institution that supervises credit institutions.

The last scenario was found by EMI (1994) to be the most appropriate one. A wait-and-see approach was heavily criticised due to the heavy investment in electronic purses and to the fact that after heavy investment, it would be very difficult in the future to modify developments later found to be inappropriate. EMI (1994) is a proposal that has had important implications for the regulation of e-money in particular and of innovative financial instruments in general. Because it did not cover software-based e-money, which did not exist when the report was written, indicating that regulation might better be cautious regarding innovative services and that it might be better to wait for at least a partially proven business case before totally shaping the coverage of regulation. Recently, a similar development seems to be recurring, as WAP for mobile networks have suddenly opened up a new avenue for e-money applications in addition to personal computers and DTV. The same problem may still exist in a similar way because when the technology behind e-money is not clearly agreed via the market mechanism, imposing regulation may be irrelevant and hence ineffective. For example, perhaps no one will be sure whether tomorrow's payment industry experts will come up with a voice-recognition-based payment solution.

Another expression of the European perception of e-money came three years later with the publication of the Opinion of the EMI Council on the issuance of e-money in the EMI Annual Report for 1997, but these opinions are mostly covered by the ECB (1998). Clearly, not all the European countries agreed with the report. It was mentioned in the ECB (1998) that 'a majority (excluding Denmark, Sweden, the United Kingdom and Luxembourg) adopted the opinions mentioned'. The report on e-money proposed further regulations relating to e-money, including software-based products. It defended a regulatory approach to e-money arising basically from concerns relating first to the need to preserve price stability and also to the need to preserve the unit of account function of currency. Setting out six different and mostly related arguments on the reasons behind the regulation of e-money, ECB regarded it as essential that e-money issuers should fulfil the following minimum requirements:

1. Prudential supervision of the issuers of e-money.

2. Solid and transparent legal arrangements enforceable under all relevant jurisdictions relating to the rights and obligations of customers, merchants, issuers and operators in an e-money scheme.

3. Technical security requiring adequate technical, organisational and procedural safeguards to prevent, contain and detect threats of counterfeit in particular.

4. Protection against criminal abuse such as money laundering required to be taken into account during the designing and implementing stage.

5. Monetary Statistics Reporting for the purposes of monetary policy to be supplied to the relevant central bank.

6. Redeemability as issuers proposed to be legally obliged to redeem e-money against central bank money at par at the request of the e-money holder. (Details were said to be specified).

7. Reserve requirements as a possibility for central banks to impose on all issuers of e-money.

Finally, the BIS (2000) gave another source of European perception on e-money, as the ECB stated that 'it is crucial that the development of the e-money should take place within a regulatory framework, which takes into account the public interests pursued by central banks'. The Eurosystem's view is that 'a clear and prudent regulatory framework for e-money will actually promote its acceptance by the general public and its development'.

Another dimension of the European perception for e-money comes from an EC directive, which is to be published in the Official Gazette. The directive allows non-banks to issue e-money under certain conditions. First of all, the total amount of financial liabilities related to outstanding e-money should normally not exceed EUR 5 million and should never exceed EUR 6 million. Additionally, the maximum reloadable amount is specified as EUR 150 per technical device. This normally implies a maximum of 33,333 cards, but it seems that the operator is to be allowed to choose a maximum reload limit of EUR 100, and the card number may be increased to 50,000 (or more by further reducing the reload amount). Secondly, the bearers of e-money are allowed to ask for redemption and that 'redeemability should always be understood to be at par value'.

Contrary to the above-mentioned European perception, the US perception on e-money seems quite different. The US Department of the Treasury (1996) mentioned the European perception and argued that 'limiting the issuance of electronic cash to banks could stifle competition and innovation'. The paper advised the US government to 'combine patience with aggressive fact-finding, study and co-ordination among government units both nationally and internationally' to meet its responsibilities.

Further, Greenspan (1997) clearly came out against early regulation of e-money, stating that in order to foster financial innovation, care should be taken not to impose rules that inhibit it. The Governor is especially concerned that there should be no attempt to impede unduly this newest innovation, e-money, or generally, increasingly broad electronic payments systems'.

Investigating the legal and regulatory framework across the world for e-money, Good (1997) proposed an international body to address the issue of dispute resolution in connection with e-money. The author argued that product standards and regulation are needed for e-money technology to be a serious alternative to central bank currency circulation and suggested that payment systems would be a challenge for policymakers, who must find a fine line between providing safety and stifling innovation. In a later paper, Good (1998) reached six conclusions on e-money issues for the future prospects for e-money systems in the US:

1. E-money systems will slowly be adopted by the US consumers as an additional payment method.

2. Those e-money systems that are most 'cash-like' will more likely be accepted for non-Internet purchases.

3. Technology acceptance is accelerating and this will speed the adoption.

4. Stored-value products that offer multiple applications, including incentives, are more likely to be accepted by the consumers.

5. Acceptance by European and Asian countries, as well as the developing countries, will push acceptance in the United States.

6. The market for e-money systems should be allowed to develop on its own without government intervention.

The last finding underlines the difference in the US approach to e-money issues relative to the European perception, and there are further indications of differences. Gramlich (1999), for example, valued 'obvious efficiency advantages in terms of ease of handling and record keeping for consumers, merchants, the banking system and the FED' arising from the advent of e-money. The author named the 'network problem' as the major hurdle for e-money product and concluded that because of the chicken-egg problem faced by innovative proposals like e-money with network problems, the government could possibly intervene to effect a solution but 'alternatives to stored-value products are cheap and safe enough that such intervention is both economically unwise and politically unlikely'.

This year; Greenspan (2000), again came out against a pivotal role for the public sector in setting the shape of payment systems for merchants and households. He advises that these be

left to the private sector and would limit the government's regulatory role to a focus on 'risk management systems', arguing that with complex financial systems, 'detailed rules and standards have become both more burdensome and less effective'. Greenspan mentioned one important role for the government in respect of payment system regulation, i.e. 'to help identify and, where appropriate, help remove barriers to innovation'.

Finally, the FED publicly declared recently (BIS, 2000) that, 'the introduction of e-money is not expected to have any effect on monetary policy implementation – neither reserve demand nor reserve supply is expected to be significantly affected. The situation will need to be monitored if and as e-money balances expand'.

The above comparison can be summarised as the in-advance regulatory approach to e-money in Europe versus wait-and-see approach advocated in the US.

6.3.3. THE SURVEY SAMPLE, METHODOLOGY AND DATA COLLECTION

The choice of venue for this survey was based on the assumption that the future of e-money would most likely be shaped by the technology and the applications flowing from related technologies. This assumption was valid for the European surveys as well and as a result, all survey analysis in this section reflects only the views of innovators and operators and excludes academicians, central bankers, private bankers, investors etc. The exhibition in Miami attracted nearly all known innovators and operators of e-money, and it may be argued that it had nearly the widest coverage of all such commercial exhibitions around the world.

This survey questionnaire comprised 24 questions, most of them with a comments section. The questions entail four basic themes. The first involves questions on the financial regulation of e-money, including the implications of central bank regulatory proposals on innovation and competition. The second theme was the problems and obstacles for e-money arising from technological development, innovation and applications such as a future base for e-money access, as well as future trends influenced by these obstacles. The third theme addressed the direct and indirect influences of e-money on financial market structures such as the future medium of exchange for e-commerce, the potential impact of e-money on the industry, non-bank firms that may gain competitive advantages over banks, potential issuers of e-money, and banks' position in the industry. The last theme involved policy issues arising from the development of e-money, especially for the long run, including its implications for central banking and national currencies.

The first eleven questions in this survey are from the first survey and the rest are from the second. The reasons for combining the two surveys that were conducted earlier were, first, e-money technology (both hardware and software) is changing very fast. Secondly, the particular aim of this survey was to make a comparison of the results, which needed a combination of two European surveys. This survey was conducted at the Cardtech/Securtech2000 Conference and Exhibition, 1-4 May 2000 in Miami Beach, Florida, which was announced as 'the World's premier card and security technology conference and exhibition'[57] at its tenth anniversary. The venue described itself as 'sizzling solutions for a digital world'[58] and promised 'everything you need to know about smart cards, biometrics, public key infrastructure, identity, e-commerce, mobile telephony, loyalty, mass transit, health care, banking... and more'. All the named sectors may be accepted as directly or indirectly related to the future of e-money. The reason for this is that every smart card with multi-application potential helps to create critical mass for rollouts with their available memory for electronic purse applications in addition to the original function. During the time of the survey, most of the named sectors exhibited mostly smart card-based solutions in their field of interest. The organisers expected more than 10,000 IT professionals and solution providers, not only from the US but all around the world (65 nations) to join the exhibition.

The exhibition promised opportunities to learn, network and conduct businesses in a total immersion in the latest technologies and real-world demonstrations, and more than 300 'hot' technology companies (card and equipment manufacturers, vendors, developers, integrators and producers of related technologies) were being hosted. They offered their solutions in 'identification and authentication, public key infrastructure, cryptography, anti-counterfeiting technology, electronic payments and more'[59]. As the organisers had 'promoted advanced card, identification and security technologies through educational and networking programs for professionals at every level of expertise' over the previous nine years, their intention for this year was to 'present a superior line-up of workshops and seminars and a comprehensive array of industry exhibits to further this vision'. The workshop and seminars'

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[57] Show Guide.
[58] Leaflet: Supplement to IDWorld.
[59] Show Guide and Leaflet: Supplement to IDWorld.

coverage highlighted the profile of survey sample, as almost all of them were directly or indirectly related to e-money[60].

The coverage of the survey was impressive: Compared to surveys conducted before, the number of participants was almost tripled. Operating system developers joined the exhibition without exception, (Maosco, Sun and Microsoft) three of them being represented individually. All of the major international scheme operators were there as well. The major smart card innovators seemed to play an active role not only in the marketing of multi-application potential but also in presenting current solutions to problems that could slow the speed at which applications reach their full e-money potential. At the same time, dynamic small and medium size innovators showed their enthusiasm for providing alternative and practical protocols and made proposals regarding niche problems surrounding the development of advanced payment systems, both for closed circuit trials as on university campuses and open circuits as in Internet environments.

As a result, it may be argued that the survey sample, which included almost all of the relevant international operators, almost all of the main national scheme holders and almost all of the e-money innovators around the world, was representative for data collection on e-money perception in the US.

The survey venue was visited one day before the exhibition started. Because of the extremely large size of the exhibition venue, it was decided to distribute the questionnaire on a selective basis. It was almost impossible to visit all of the 300-plus stands on the first day and to expect questionnaire responses from all of the participants. The exhibitors are divided into two groups according to business line. Those directly connected with e-money, such as scheme operators, operating system innovators, advanced smart card developers, secure payment solution providers etc, were given top priority for the distribution process. Almost all of these innovators and operators were given a questionnaire on the first day of the exhibition, and in the afternoon they were visited in order to gather the responses that were already available.

The second day was used for conference attendance, additional distribution of questionnaires and data collection. In addition to the survey, the event provided an opportunity to follow current discussions by attending presentations directly related to e-money. The final

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[60] Some of the topics were 'Advances in Card Technology', 'Enhanced Private Key Protection', 'Cryptography Technology', 'Smart Cards and the Internet', 'Multi-Application cards: Managing Business Relationships and Security', 'Changing the Face of Money' and 'Financial Applications'. The last two were being followed during the survey in order to shed light on the current stage of discussions and proposals surrounding e-money.

day was used mostly for collecting responses and filling replacement requests for lost questionnaires.

In all, 250 questionnaires were distributed during the survey, from which 97 responses were collected, giving a return rate of about 39%. This was lower than the rates of return for the European surveys (49% for the first survey and 70% for the second). On the other hand, the number of questionnaires distributed was higher than for the European surveys (107 and 105). The reason for this difference is the size differences in the survey samples. The very busy and hectic environment may explain the difference on the rate of return, as many exhibitors lost the questionnaires and had given their priorities to 'commercial' activities, which should be respected. The rate of return was calculated so as to avoid double counting. Replacements for lost questionnaires given were excluded from the total distribution figure.

Private interview sessions were conducted with major institutions that were believed to play critical roles for the development of e-money. They were questioned on their visions for the future and on their current proposals with expected adjustments. Most of these interviews provided useful information to update perceptions on the present level of e-money developments and to increase the understanding of future possibilities. There were some exhibitors who refused to fill out questionnaires arising from 'legal' concerns that led them to avoid expressing views on anything in order not to be 'judged' by industry regulators later, despite the guarantees on the anonymity of the survey.

The reliability of the survey sample finds support from an exhibition practice: The exhibition identity cards for entrance were multi-application smart cards with electronic purse capability. Every card contained the monetary value equivalent of USD 3, which was to be spent on the exhibition premises, i.e. generally on vending machines located throughout the conference area. The cards owned during the time of the exhibition were being tested as to functionality, and the application proved successful. The same card was given capabilities such as food allowances as well.

There has been some limitations regarding comparative aims in this survey. The first limitation is that the surveys were conducted at different times, the time lag between the first and last surveys being 14 months, which may be considered a 'long' time in this rapidly changing phase of innovation relating to e-money. The time lag between the second and final surveys was three months, which may be assumed to be quite reasonable. Time lags, rather than perceptual differences, may have caused most of the similarities and differences in the findings.

Secondly, the rates of return were different for all the surveys, as sample sizes are different, especially for the last survey, compared to the first two.

Finally, this thesis assumes that surveys conducted in Europe reflect the European perception whereas the last survey reflects the American perception, as it was conducted in the US. Because most of the innovators and almost all of the operators are structurally 'international', this assumption requires some caution. As an observation, there were many companies represented in all of the three surveys. On the other hand, it may not be wrong to argue that the settings of the surveys would reflect local views, as even international companies adapt to local approaches for their businesses, which is e-money in this case. Moreover, it was found significantly different associations on 7 of the 23 questions, which suggested that the samples are not overlapping (see appendix provided in section 6.3.7)

6.3.4. SURVEY ANALYSIS AND RESULTS

This section has focused on differences in survey results, as the earlier analysis provided the innovators and operators perceptions in depth and it seems unnecessary to go through a similar set of opinions here. The survey analysis includes a 'comparison' between survey findings categorised as a reflection of the American perception and the European surveys, which are categorised as a reflection of the European perception.

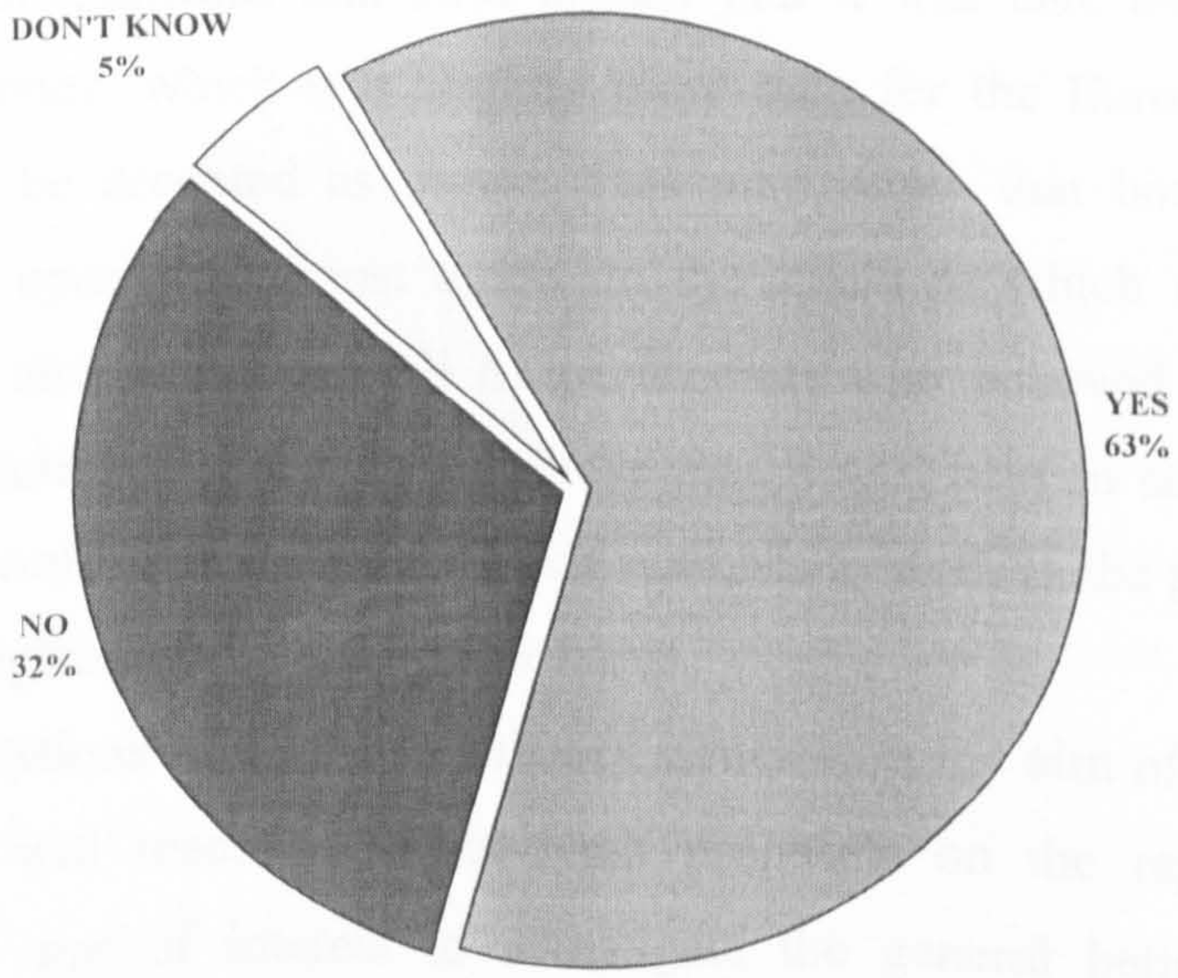
The first part of the analysis looks at the basic differences in the findings of this survey as compared to the European surveys. This section comprises four divisions: regulation-related results, technical issues, financial market structure and policy issues. A comparative table is presented in the appendix (section 6.3.6), which summarises the results. The comparison is based on the table instead of the charts for the data with similar results. The reason for choosing this approach is that the preference has been put on the differences in order not to repeat findings that are similar to those already analysed in connection with the European surveys.

The determination of questions with different opinions among European and American innovators and operators decision was taken with the aid of a statistical test, i.e. the Chi-square test with a significance level of 5%. The Chi-square test compares observed frequencies to expected frequencies in the samples. In this case, the EU survey results are compared to the US survey. As 'quantities' were not numerical in these surveys, the Chi-square test was chosen over correlation analysis to measure association between quantities. (Neave and Worthington, 1988). The second appendix (6.3.7) gives the overall p-value results. In summary, seven questions out of 23 provided totally different opinions between Europe and the US whereas

four questions came out with close opinions and the remaining twelve questions gave similar, if not the same, results. Next, those responses to the questions that provided major differences compared to the European surveys will be analysed individually in depth, using both bar and pie charts. Bar charts will include a line giving the findings from the European surveys in order to make the comparison easier.

The question "Do you think that electronic cash has a potential to replace central bank money?" aimed to find out whether e-money technology is perceived as mature enough to replace currency in circulation produced by central banks' and treasuries' banknotes and coins. Due to the importance of the issue, it was reasonable to delete the 'to a certain extent' option from the possible answers. This was done to clarify further whether the presumed potential of e-money would be confirmed by innovators and operators with a clear choice so that one of the most critical issues connected with the emergence of e-money could be analysed with a clearer result. Consequently, this was the only question that was changed compared to the European surveys. Because of this adjustment, the p-value is not applicable in this question.

CHART 6.3.1: CAN E-MONEY REPLACE CENTRAL BANK MONEY?



The US innovators and operators confirmed the potential of e-money to displace central bank money in circulation with all its implications for payment system stability, e.g. the correlation between efficiency of the payment system and efficiency of the monetary transmission mechanism. The majority of respondents believed in that potential without

limiting their expectation to any extent, surpassing non-believers (31%), as only 32% did not see a potential for e-money to replace central bank money. In the European survey, even with the exclusion of the 'to a certain extent' option, believers in e-money technology's potential to eliminate banknotes and coins surpassed non-believers by 17%.

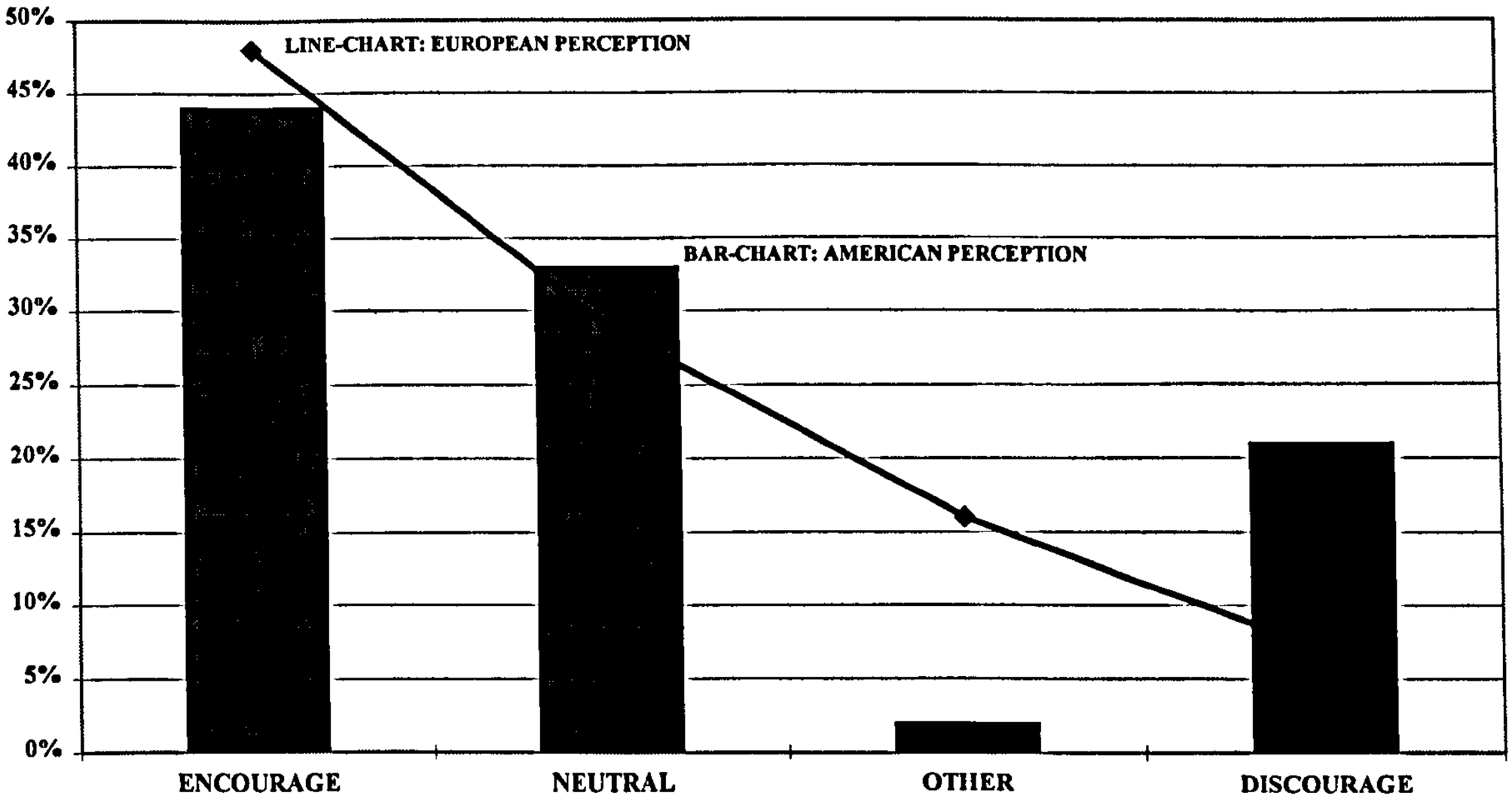
This result may be a confirmation of the maturing stage of e-money technology. The increase in the number of believers confirms this result, but as 32% did not agree to this potential i.e. 15% higher than in the first survey, it appears that there is no full consensus yet on the elimination of central bank money. The ever-changing pace of e-money related technologies might be a reason for the lack of full consensus.

The complementary question to the first one was "If yes, When?" This was answered by 63% of participants, those who said 'Yes' to the first question. The aim of the question was to find out the expected lead time for e-money technologies to replace banknotes and coins and to quantify whether central banks and regulators would just take their time to analyse e-money products or should immediately develop policies arising from their responsibilities for monetary stability. It was expected that such a finding might give central banks and regulatory bodies an idea of the timeframe for their decision-making.

The result indicates that 56% argued that it will take e-money 10 years to replace central bank money, which was slightly more than for the European survey (55%) but the difference may be accepted as minor. This may imply that both European and American innovators and operators almost agree on the speed at which central bank money would disappear from circulation, and all 61 participants who believed in the total replacement of currency in circulation by e-money believe that it will happen sooner rather than later. This agreement was confirmed by the statistical analysis as well, as the p-value for this question was 0.999, i.e. the highest among the 23 questions.

Two questions addressed regulatory issues with the aim of finding out how innovators and regulators will react to central bank proposals on the regulation of innovation and competition. It was of interest to investigate the general belief that there is a negative correlation between regulation and innovation, especially in the US. The intention was to find out whether innovators and operators regarded regulation as a barrier to further innovation and whether it was regarded as anti-competitive. In the EU questionnaire participants were asked how they felt about 'ECB regulatory proposals', whereas the US participants were asked about 'potential central bank regulation', as the FED had not yet made any regulatory proposal.

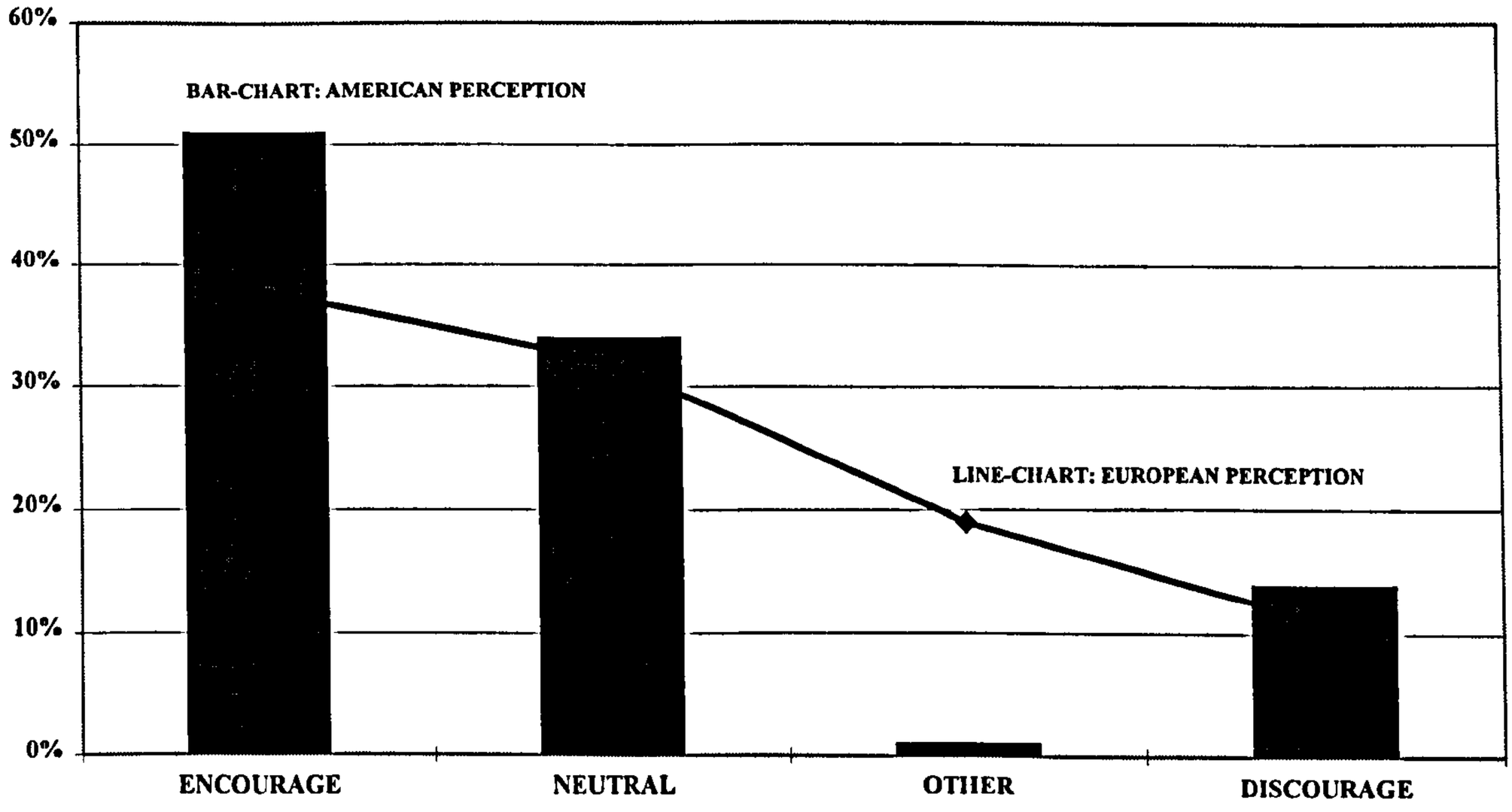
CHART 6.3.2: INNOVATION IMPLICATIONS OF CENTRAL BANK REGULATION OF E-MONEY



In the European survey, almost half of the innovators and operators apparently favoured regulation, as they did not regard it as a barrier to innovation incentives and less than a third saw a neutral effect for ECB proposals on innovation. In this survey, support for the encouraging impact of regulation dropped below 50%, but the main difference was the 14% increase for the 'discourage' option. American innovators and operators seem to have a concern for the impact of central bank regulation on e-money innovation, at least to a much greater extent than their European counterparts, but there are no radical differences. The real difference seems to lie in the fact that the typical EU participant preferred to stay out of the discussion if he was not familiar with the ECB proposals and so choose the 'other' option, whereas the typical US participant actively joined in the discussion, so that the preference for 'other' option decreased by 14 % compared to the EU. Consequently, the p-value for this question was 0.005.

As regards the impact of central bank regulatory proposals for competition among different e-money schemes, the chart below shows the results. The question had a p-value of 0.001.

CHART 6.3.3: COMPETITION IMPLICATIONS OF CENTRAL BANK REGULATION OF E-MONEY

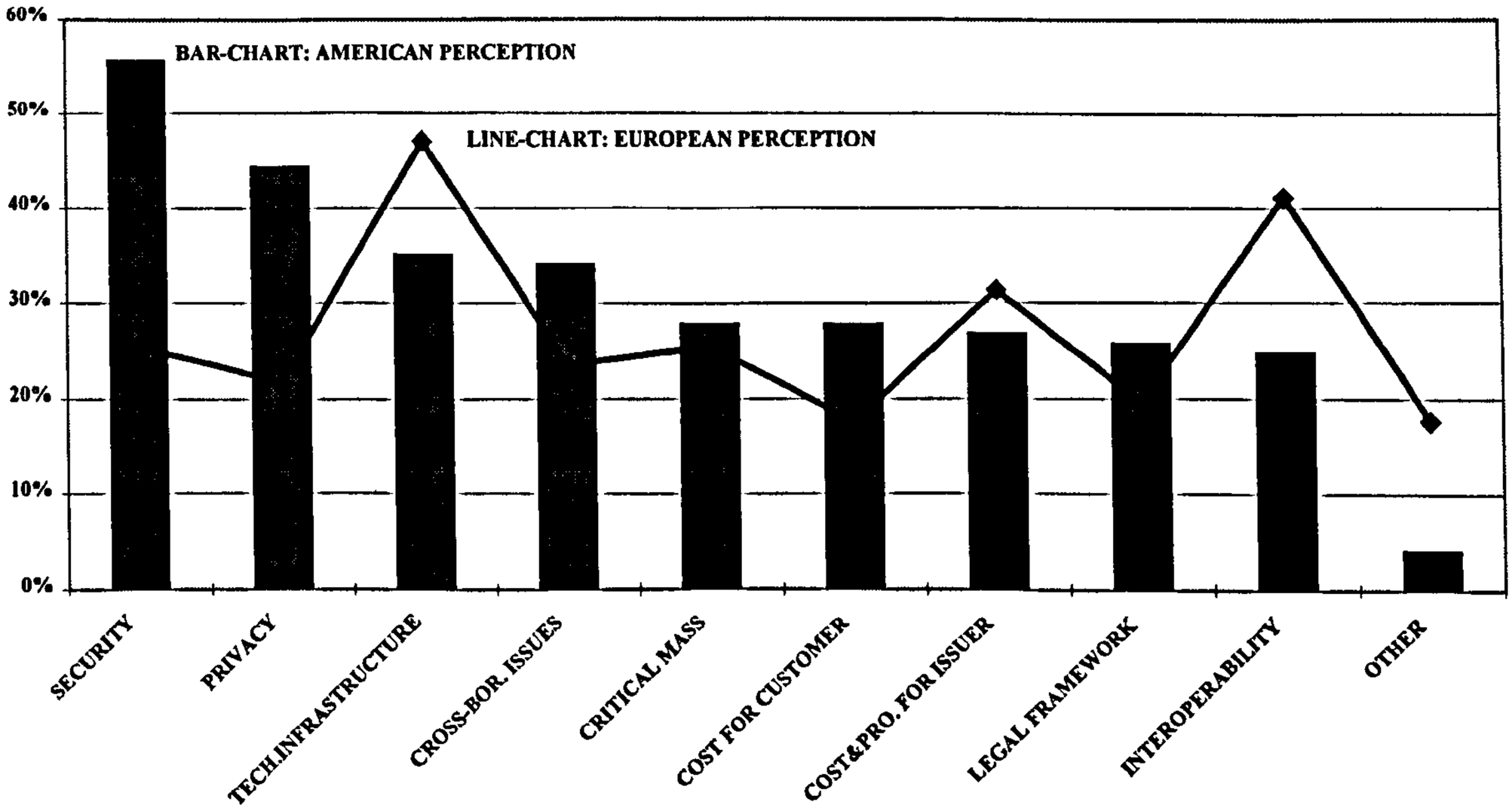


As the chart shows, support for neutral effects in the American survey was not much different, being just 2% less than in the European survey. The real difference was with respect to the belief that central bank regulation would encourage competition in e-money business, which got 13% more support in the US where it exceeded the 50% level. American innovators and operators in a sense argued that even though regulation may stifle innovation it might support competition among different e-money proposals. There seems to be no clear indication that central banks should be concerned about their regulatory attempts with regard to direct or indirect discouragement of innovation and competition. In either case, supporters of the 'encourage' option outnumbered supporters of the 'discourage' option. Interestingly, European innovators and operators were concerned more with competition whereas Americans seemed to be more concerned with innovation. The strong intervention by American law enforcement agencies in recent days with regard to monopolistic practices could have affected this difference, as innovators and operators on the other side of the Atlantic might rely on regulators for the defence of competition in corporate America.

The question that has provided another very different outcome for this survey with a p-value of 0.002 was about obstacles to wide acceptance of e-cash as a replacement for central bank money. The questionnaire listed some of the problems thought of as the main obstacles to the successful emergence and strong maturation of e-money, and the respondents were asked to give their priorities. The aim of the question was to find out what kinds of barriers now and in

the future would limit the practical realisation of the technical potential of e-money. The chart below shows the results.

CHART 6.3.4: MAIN OBSTACLES FOR E-CASH TO REPLACE CENTRAL BANK MONEY



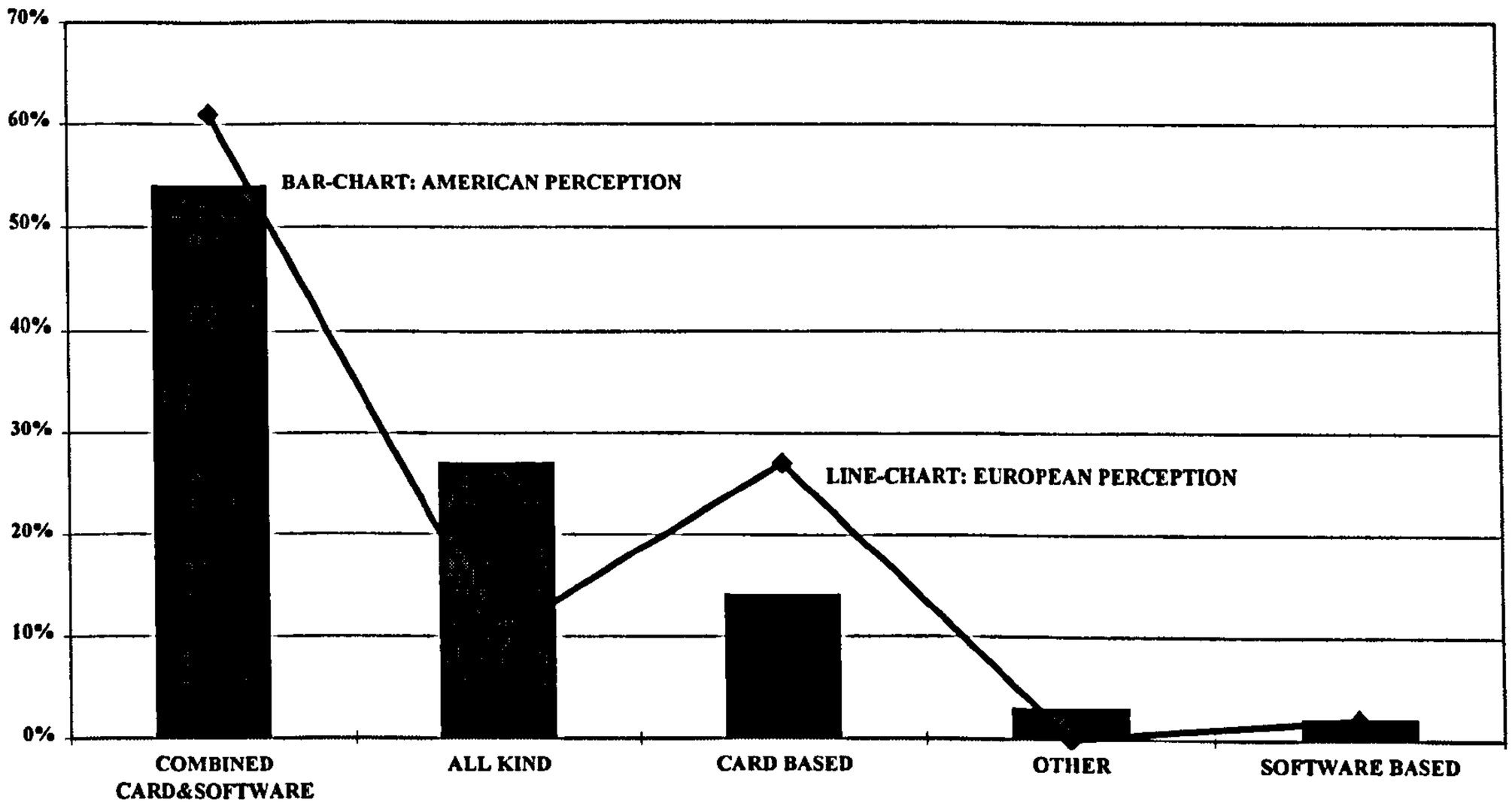
Participants in the European survey, felt that the required technical infrastructure, including retailer readers, customer cards and software, was the leading obstacle for e-money to replace CB money, as almost half of the participants indicated this. Interoperability of different e-money schemes ranked second, and cost and profitability for issuers ranked third. Few of the participants mentioned security and privacy as main obstacles. The picture in the US is totally different. As the above chart shows, the US innovators and operators gave top priority to the security level of e-money schemes and privacy of e-money holders was ranked second. The differences were not limited to this at all: Interoperability, which was the second biggest issue for Europeans, came out almost last for the US.

The agendas of innovators and operators on opposite sides of the Atlantic seem to be quite different in terms of presumed obstacles. They seem to put quite different weights on quite different issues. One explanation for the difference as regards the security issue may be that Europeans had already experienced the convenience of smart cards, especially in France, whereas America seems only now to be catching up, but differences still remain unresolved for privacy perception.

In another question, three different proposals on the future base for e-money, namely card-based, software-based or a combination of the two technologies, that could be supported by an operating system were analysed to determine which one seems to be most favoured by

innovators and operators. It still seems unclear whether there will be a demand for both card-based and software-based e-money or for some other combination. The p-value for the question was 0.039.

CHART 6.3.5: FUTURE BASE FOR E-MONEY SCHEMES

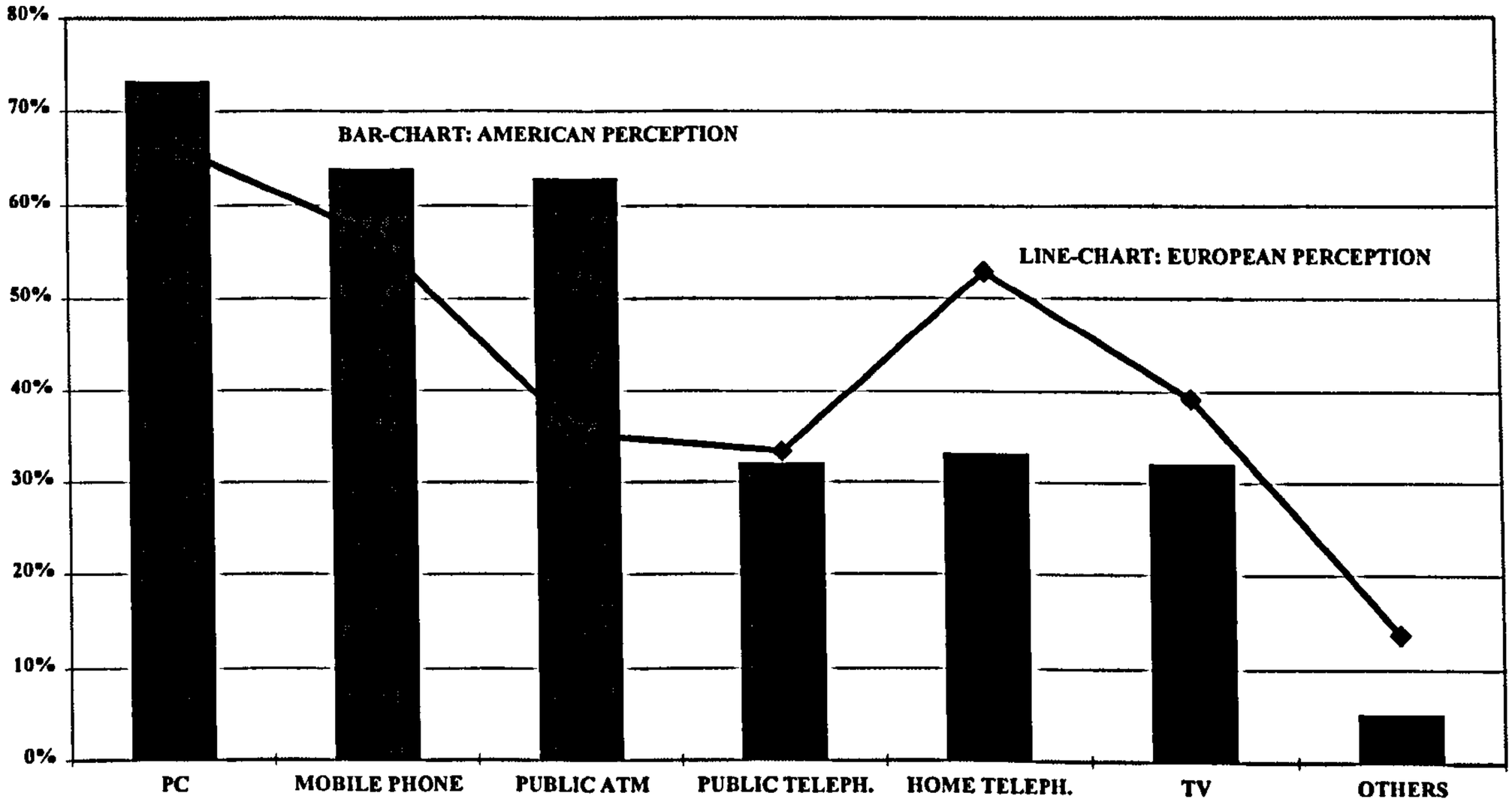


According to the results, the future base for e-money schemes would be a combination of card and software-based products. In this survey, the preference given to the combined version again seems clear even though it was 7% less than in the European survey. The real difference was the decline of 13% for card-based solutions. This result may be related to the relatively mature smart card penetration, especially in France, whereas the US could be considered more advanced in Internet-based services. The biggest jump was at the 'all kind' option, a reflection of Americans attaching more importance to the coexistence of different types of e-money bases, compared to Europeans. The result still points to smart cards, as they seem to be the only technical product that can support a card and software-based solution with their individual capabilities and network adaptability. Central banks and other policy-makers may be influenced in their views on e-money by the need for a common solution for payment media, both for conventional and virtual transactions. The convenience of such a choice seems to be confirmed by innovators and operators on both sides of the Atlantic. Other options here included 'ID card based solutions'; 'authentication based biometrics' and 'biometrics', which are the original responses given by the participants.

One question intended to find a leading indicator for decision-makers as to what technology that should concentrate on in their policy reactions addressed another critical

problem surrounding e-money schemes, namely the potential access medium for e-money in the future. The aim of the question was to find out potential distribution channels of e-money for future financial transactions, including activities such as downloading purchasing power from a financial service provider's account into a chip card, sending money via DTV networks, etc. The result, which got a p-value of 0.058, is displayed in the following chart.

CHART 6.3.6: ACCESS MEDIUM FOR E-MONEY FOR THE FUTURE



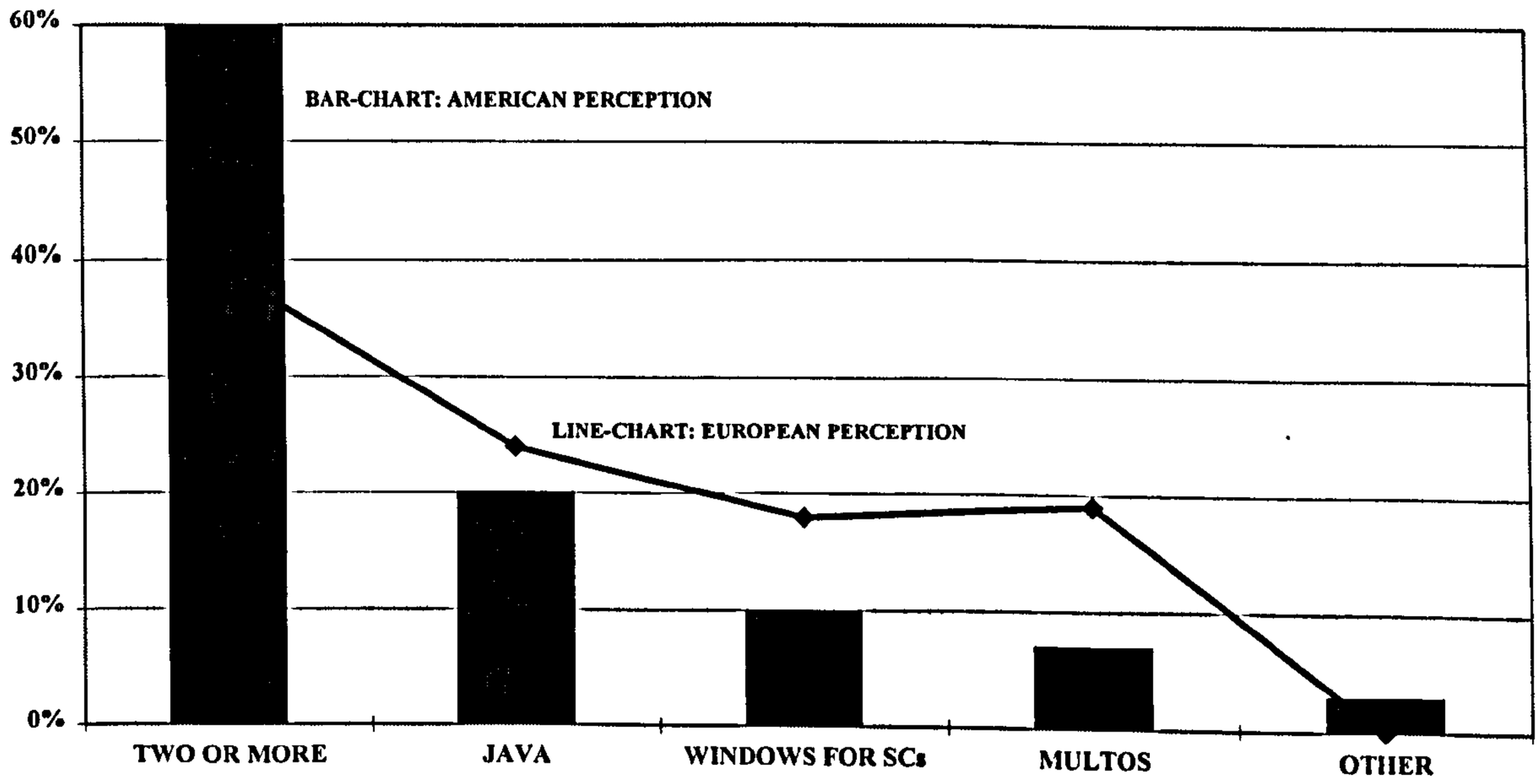
In the European survey; the majority named personal computers as the best access medium for the future and mobile phones came in second. The third best medium was the home phone. TV, Public ATM and the public phone followed the first three options. As the above chart shows, the preferences among American innovators and operators did not indicate a major difference, as the PC and mobile phone took the first two places. However, the major difference as compared to the European perception was ATMs, which ranked as the third most favoured future access medium for e-money, compared to fifth in the European survey, with the difference being 28%. DTV, on the other hand, seems less favoured by American innovators and operators. Some participants named alternative devices such as 'parking meters, wireless devices, medical cards and transportation tickets, smart cards and readers, and special readers'.

These results may underline the importance of ATM networks in the US compared to DTV technology in Europe, which is reflected in new terms such as 't-commerce' to represent DTV commerce. The overall result from the two surveys seems to present a three-fold future: The first, e-commerce, as represented by the PC, seems to be relatively well-developed already. The second, m-commerce (mobile phones) seems to be very popular in current discussions.

Lastly t-commerce is growing rapidly in some European countries such as the UK, as DTV penetration increases fast on the heels of the first two. The operators and innovators seem to imply that e-money will be circulating with all these network-based business solutions in digital form and will provide payment solutions for financial transaction settlements in e-commerce, m-commerce and t-commerce.

The question 'Which operating system may dominate the future of e-money technologies?' was designed to investigate whether a particular operating system will play the critical role in shaping the future of e-money. There may also be more than one operating system, which would require interoperability for end-users for acceptance of e-money as final settlement at transactions. The p-value for this question turned out to be 0.015.

CHART 6.3.7:WHICH OPERATING SYSTEM MAY DOMINATE FUTURE OF E-MONEY TECHNOLOGIES?

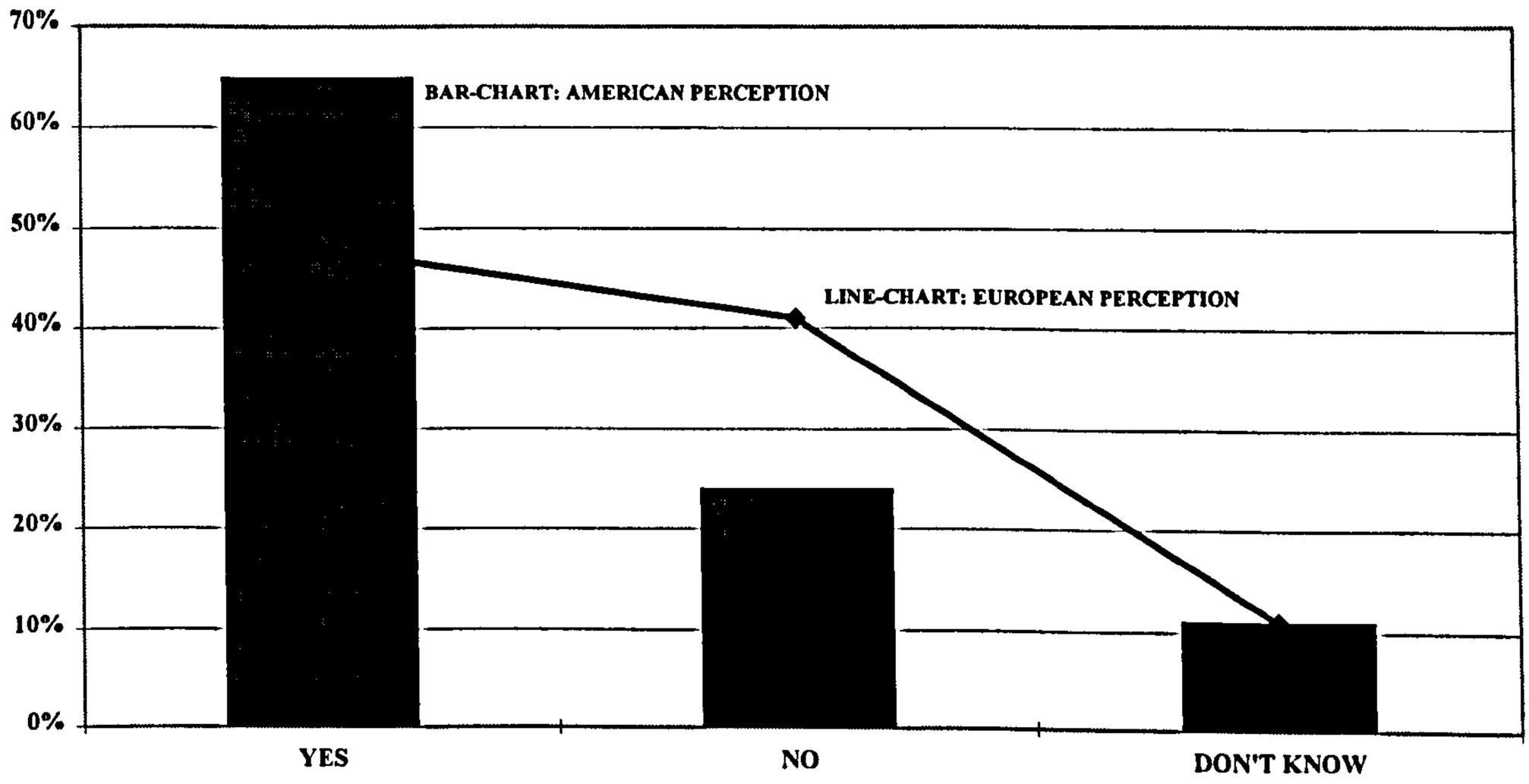


The European survey demonstrated that more than one-third of the participants believed in more than one operating system in the future. The rest supported particular systems. Here, the picture seems quite different, as the supporters of 'two or more' operating systems increased 21%. There was also much less support for individual operating systems to dominate the future of e-money. As interoperability supports the 'general and immediate acceptance' of e-money, it is expected to play one of the most critical roles in exploiting e-money potential. Scheme operators, as a result, may look for common platforms for PCs, mobile phones, DTVs, ATMs, hand-held devices etc to support alternative operating systems for each device. Other potential operating systems named by participants were 'Unix' and 'Linux'. The result

underlines the importance of interoperability among different e-money schemes in order to sustain acceptability of e-money whenever it is offered.

The question whether banks will remain as the main players in the financial services industry was intended to gather information that will help central bankers to react to the emergence of e-money technologies with regard to its impact on the future of banks within the financial industry. The results are shown below (p-value 0.046).

CHART 6.3.8: WILL BANKS REMAIN AS THE MAIN PLAYERS IN THE FINANCIAL SERVICES INDUSTRY?



The European survey indicated that less than the majority of participants believed banks would be able to sustain their central role in the financial industry. In contrast, the second survey clearly suggested that banks would maintain their key position in financial service provision, as almost two-thirds of the innovators and operators in the US pointed to their comparative advantage in financial services, especially as payment system experts. As a result, the US may not experience a real challenge to the dominance of banks in the financial service industry whereas European innovators and operators see better possibilities for non-banks to enter into banking services, especially payment services.

This may also imply a comparative advantage for non-banks to extend their involvement in financial services in Europe. For example, almost all the major supermarket chains in the UK have already started to provide banking services on site, and some European telcos provide a billing service added to telephone bills, allowing telephone account-based crediting. With the advent of mobile and DTV-based technologies, it may not be surprising to see alternative models for the provision of basic banking services. Many distribution channels

that now seem highly hypothetical could be realised in the medium or long run. As far as central banks and financial supervisory authorities are concerned, there is a definite need to spend more time and effort investigating possible future financial trends in Europe whereas the US innovators and operators are more convinced that banks will maintain their competitive edge over non-banks.

FINANCIAL REGULATION: So far, the analysis of the comparative survey has dealt with the major differences between the EU and the US innovators' and operators' perceptions with respect to e-money. The questions analysed have had p-values of less than 0.06, except for the second question, which was related to the first one. P-values for the rest of the analysis are higher than 0.06, and there seem to be no major differences between European and American perceptions. Consequently, charts will not be employed in the following analysis; comparisons will generally rely on the table in the first appendix. However, the answers will be briefly summarised in the text.

The question about the expected reaction of central banks to e-money developments addresses the differences between the American and European current reactions. Question 6 in the appendix at section 6.3.6 gives the results (p-value 0.179). The majority of the participants expected central banks to regulate e-money in advance on both sides of the Atlantic. This may imply that differences between regulatory agencies were not quantified by innovators and operators with regard to their first choice, which clearly shows that in advance regulation is expected, but with regard to second best choice there seems to be more support on the American side for a 'wait-and-see' policy.

Central banks and regulatory agencies may have some difficulty in justifying this clear expectation in favour of in advance regulation for two reasons: First, regulation may be demanded not because of a clear welfare effect but just to clarify the unclear and unsettled standardisation among different e-money schemes and difficulties in the search for common platforms for different e-money proposals. Secondly, the e-money industry may prefer that central banks act as a kind of 'common denominator' for solving the conflicts and arguments with regard to the emergence of e-money so that they can manage the risk of investment loss due to the backing of loosing proposals during the discovery process.

TECHNICAL ISSUES: The question "Which medium of access technology is most likely to dominate the future e-money developments?" was asked in order to evoke a single choice among alternatives. Question 12 in the first appendix at section 6.3.6. gives the results (p-value 0.082). In the European survey, the majority of the respondents felt that personal

computers would dominate the future access media for e-money. The US survey gave a similar picture, with PC and mobile phone taking the first two places. However, hand-held devices seem to be more popular, and consumer acceptance of such devices appears to be stronger in the US. The same argument may hold for ATM networks, but DTV does not seem to be as popular as the other alternatives. It can be concluded that the primary access channels for e-money are likely to be PC and mobile phones, supported by hand-held devices in the US and possibly DTV in the EU area. The overall picture seems to be that the PC (e-commerce) and the mobile phone (m-commerce, including hand-held devices) stand a good chance of dominating in the future, whereas ATMs and DTV (t-commerce) will likely play a supportive role. Of course these channels may be combined in solutions such as PDAs in the future as the technology comes on stream.

Another question addressed the most critical technology for the future success of e-money applications. The aim was to get the views of innovators and operators on the most critical technology for shaping successful e-money rollouts. The p-value for the question was 0.571, so that little difference is indicated vs the earlier surveys.

The European results indicated that smart card technology is perceived as the most critical technology for the future success of e-money proposals. In this survey, smart card technology gained additional support from the American innovators and operators as being the most critical technology, but Internet applications instead of ranking second as for Europe were considered to be just one of the equally important technologies. Participants listed alternative critical technologies as 'biometrics', 'security, encryption, authentication', 'customer's acceptance', 'retail and POS infrastructure', 'back office plus card and terminal management systems' and 'security'. The preference for smart cards by innovators may not be surprising due to the fact that smart cards can be considered to be the only technology that can communicate with all the e-money related platforms, including PCs, mobile phones, DTVs, ATMs and hand-held devices. (Appendix at section 6.3.6, question 14)

FINANCIAL MARKET STRUCTURE: The problem of whether non-financial institutions should be allowed to issue e-money was investigated to address the clear European choice for limiting the issuance of e-money to financial institutions and whether innovators and operators approve European policy choice in the US. The majority in Europe favoured allowing non-financial institutions to issue e-money. Only around a third were against non-financial institutions being in the e-money business. American innovators turned out to be less supportive of non-bank issuance of e-money. The results (p-value 0.588) may seem a bit

paradoxical in light of the general impression that Americans are less restrictive than Europeans in respect of financial services provision. This may be explained by the stronger support for banks over non-banks in the competition for financial services provision in the US. The 'other' option reflected a question asked by a participant: 'Why not? What is Barter?'. This response may reflect the richness of discussions among innovators and operators. (Appendix at section 6.3.6, question 9).

The question whether e-money technology could reduce barriers to entry to the financial services sector was intended to cover both horizontal entries to new services by financial institutions and vertical entries by non-financial institutions to the banking industry. The question got a p-value of 0.876. In the European survey, a majority believed that e-money technology would reduce barriers to entry. In this survey, the support of this view was 5% less and 25% higher than the 'no' responses. The implications not only for the regulation of e-money but also for the regulation of the whole financial system may be that it might accelerate current trends toward 'functional regulation'. Obviously, a reduction in barriers to entry could also enrich customer choice and stimulate competition and so increase in the overall efficiency of financial services. (appendix at section 6.3.6. question 10).

There was a question about the privatisation of money. It may be argued that private money and free banking experiences began to attract more academicians involved in the discussions after the advent of e-money. The aim of the question was to investigate the stance of innovators and operators on private money. Question 11 in the appendix at section 6.3.6 shows the results (p-value 0.134). The European survey supported, by a majority, the resistance to the privatisation of money. Almost one third of the participants stayed out of the discussion but less than a tenth favoured the privatisation of money. Here in the second survey, the participation of innovators and operators increased in the discussion. Moreover, 14% clearly gave direct support to the privatisation of money.

This result may indicate two policy conclusions. First, it may indicate more support for private monies in the US compared to Europe. This result may not be surprising, as Europe currently has an agenda for monetary union. Secondly, it may show that in two years time the supporters of e-money have increased from 8% to 14%. Either result could concern central banks and other financial authorities as sovereigns of national currencies, and there may be a case for the long run (if not short run) denationalisation of money, as dreamed of by intellectuals for some time now. These relatively small percentages may carry a large weight since privatisation of money would be a great challenge to the status quo, established over

many years. This survey made it even much clearer that central bank money is no longer an unchallenged truism. One participant responded to the question on privatisation of money with the question 'It already is. Do you really think that the FED is controlled by the government?', with the likely meaning that money is already private in the US as the government has no direct control over the US dollar.

The question 'What may be the reasons for the failure of alternative e-money proposals like Digicash?' was aimed at collecting empirical evidence on the reasons why some e-money schemes (at least their first versions) failed. The p-value was 0.424. In the European survey, nearly half of the participants blamed the lack of co-operation between banks and e-money innovators. The picture did not change much here, as more than 45% of American e-money innovators and operators blamed the lack of co-operation with banks for the failure of early e-money business proposals. Participants mentioned the following reasons as well: 'Difficult to use or program', 'social and cultural inertia', 'lack of secure transactions', 'the consumer', 'privacy and security concerns', 'lack of merchant acceptance' and 'comparison to other e-cash schemes: the best will only succeed'. (Appendix at section 6.3.6 question 15).

The question 'Which payment instrument is best suited for 'retail' e-commerce transactions?' was aimed to determining whether current payment alternatives can eliminate the demand for e-money arising from retail e-commerce (p-value 0.505). The European survey results suggest that e-money will be a 'demanded or required' medium of exchange, in one way or another, for e-commerce transactions. In this survey, e-money seems to get stronger support (by a 7% margin) as the main alternative for retail e-commerce transactions. Credit and debit cards, which enjoy strong consumer awareness and understanding, once again failed to surpass e-money as the future payment solution. On the other hand, the latest survey did not name cheques and e-gold as alternatives to e-money, and credit and debit cards share the pie (Appendix at section 6.3.6 question 16).

One of the questions was 'What may be the impact of e-money on the future of financial services industry?'. It aimed to clarify the impact of e-money on financial institutions with regard to different suggestions ranging from 'no serious impact at all', to 'a serious development similar to the first use of money in very primitive societies' (p-value 0.540). Around a third of the participants believed that e-money will mainly reduce barriers to entry to the financial services industry in the European survey; for the US the figure was 29%. The difference between the American and the European perceptions on this question showed up in the weights given to the 'all' response in the questionnaire, which ranked second in the US

compared to fourth in the first survey. On the other hand, as one participant also argued that 'it (e-money) will give banks a new channel for customer relations'. (appendix at section 6.3.6 question 17).

The question 'Which institutions are best placed to compete with banks in providing e-money schemes?' was intended to find out which institutions are expected to effectively compete with banks in e-money applications. Question 18 in the appendix at section 6.3.6 shows the results (p-value 0.185).

In the European results, telecommunication companies were given a clear priority, as the majority of participants favoured them as the banks' main competitors. Internet service providers, software houses, and supermarkets and retail chains followed telcos with equal weights. In the second survey, the big picture did change, as less than the majority favoured telcos as the biggest challengers to banks in the provision of e-money and 20% less than in the European survey. The secondary order seems quite changed as 7% more participants in the US favoured Internet service providers, and supermarkets and e-commerce brands also got more support. This implies more diversification as compared to the views of European innovators and operators. Participants also named 'third sector companies', i.e. 'EDS' and 'voucher companies', as alternative potential e-money scheme operators.

The conclusion as regards policy, specifically in terms of the medium of exchange function of e-money and money in general, may be left to the market, including telcos, as the technology comes in stream. To the extent that central banks ensure that payment system stability is not threatened by market practices, particularly in terms of contagion effects on the store of value and unit of account functions, who provides these services may not be crucial for monetary stability. As a result, telcos and other firms with similar capabilities may be allowed to compete against banks if they can create a customer base with increased service quality under fair competition principles, which will benefit all on the final analysis. This trend finds more support in Europe (by favouring telcos), whereas the US case is diversified among additional alternatives.

As the technology comes on stream, payment systems might become less dependent on the expertise of the financial system. One example of this trend may be the telcos providing alternative payment methodologies, e.g. Sonera (Finnish Telecom), which allows vending machine operators to vend through telephone numbers, so that the customer is charged via his phone bill. That is why another question addressed the potential issuers of e-money: 'Who should be allowed to issue e-money?'. The aim was to determine whether banks are still

favoured as 'payment system experts'. The comparative table is provided in the first appendix at section 6.3.6 question 19. (p value 0.435).

In the European survey, the participants seemed neutral on the issuers of e-money, as they equally (34%) favoured the 'only banks' and 'any firms capable of handling e-money technology' options. In the US survey, there was strong support for banks as the sole issuer of e-money, as a clear majority of innovators and operators gave them top ranking of the alternative options. The support for banks was 17% more in the US than in the EU. This result may give a clear advantage to American banks to compete against potential e-money issuers, as they get strong support from innovators and operators. It might additionally imply that American banks enjoy a better reputation in the US among innovators and operators, especially with respect to being potential e-money issuers, compared to European innovators and operators with regard to other companies, as e.g. telcos. One response, which illustrates the social concerns behind technologic developments, might be worth mentioning here: 'No one, because technology should not control human finance'.

POLICY ISSUES: The question about the impact of e-money on the ability of central banks to continue to be the sole provider of the monetary base addressed the issue arising from the potential of e-money technologies to allow alternative e-money issuance in different forms, e.g. digital circulation of gold, both as a payment medium and store of value. According to the survey results provided in the appendix at section 6.3.6 question 21, in the US more participants seemed to believe that banks could use the benefits of e-money to their own advantage. They did not openly give the same support to central banks. Their view would likely be realised if e-money extends the potential of issuance of currencies in digital form so that it is 'generally and immediately' suitable for PC, mobile phone and DTV networks globally and that smart card-aided local transactions also be enabled (so that good money can go anywhere in the world, without any limitation on its ability to drive out bad money). Obviously, there was no clear distinction between the EU and the US perceptions on this question because the p-value was 0.800.

Another policy issues related question examined whether e-money may lead to a new free banking era. The question also dealt with the main aspects of free banking. The aim of the question was to try to get empirical evidence on the emerging expectations about the re-appearance of a free banking era, mainly via increased computing power and reduced cost of communication.

The European survey results showed that almost half of the participants expect that e-money technology will lead to a new free banking era, even though 20% limit this expectation to a certain extent. In this survey, the participants seemed more concerned about the argument in the first place, as only 11% chose the 'don't know' option. Secondly, the supporters of a free banking era reshaped by the help of e-money technologies was 2% higher and 24% limited this to a certain extent. Those who saw no turning back to free banking amounted to more than a third. The innovators and operators both in the US and Europe expressed a clear expectation of free banking practices in the future and there was no clear difference of opinion here as summarised in appendix at section 6.3.6 question 22. (p-value 0.750).

The question concerning central banking and money implications of e-money was about the potential for a 'world currency'. Some academicians and practitioners have argued that computers, mobile networks and DTV networks will create a global economy with no borders that will require a 'world currency' or at least a 'world medium of exchange'. The aim here was to get the opinions of the innovators and operators in the US with regard to these expectations (p-value 0.528).

In the European survey, a slight majority rejected the idea of a 'world currency'. In this survey, the rejection rate for American innovators and operators was 8% lower, and those who believed in the potential emergence of a 'world currency' through the elimination of national currencies amounted to 3% more. One participant argued that his would only be possible with 'IMF's participation'. These minor differences among European and American innovators and operators might have arisen from local circumstances, as Europe has an agenda for a currency union (Euro) whereas the US agenda is a kind of 'dollarisation', especially among Latin American countries. In either case, the confidence among innovators and operators may have serious implications for discussions such as 'international lender of last resort', 'sustainability of local currencies after currency unions among major economies' and 'national regulatory policies under international currency era'. Obviously, developing countries may be one of the main sides in these discussions, as their money would be threatened by the availability of superior money.

The last question of the survey investigated the issuance of e-money. It asked participants whether central banks should issue e-money for their own account, thus competing with private banks and/or other institutions. The European results indicated that only a quarter of the participants believed that 'money should only be governed by central banks'. On the other hand, more than a third of respondents clearly expressed their concerns about central

bank involvement in the issuance of e-money. Additionally, almost a quarter of the participants believed in competitive issuance of e-money, arguing that central banks should compete with private issuers in e-money schemes. The results were not radically different from the US results, in which 27% supported only central bank issuance of e-money, whereas 29% were concerned about central bank involvement in e-money issuance. Less than a quarter supported competitive issuance and the percentage of participants who preferred to stay out of the discussion reached 22%, which is the highest for this survey. These results may imply the total rejection of central bank involvement, as innovators and operators who rejected the central bank involvement in e-money issuance exceeded supporters in both surveys on both sides of the Atlantic as summarised in the appendix at section 6.3.6, question 24. (p-value 0.522)

6.3.5. CONCLUSIONS AND RECOMMENDATIONS

The first conclusion that might be drawn is that the potential for e-money to replace central bank money was confirmed by the American innovators and operators as it was by their European counterparts. The same result was reached more than a year ago with the first survey. This result may put more pressure on central banks and financial service authorities to increase co-ordination for their policy action with regard to the advent of e-money because of its borderless characteristics, a tendency that is already confirmed e.g. by published BIS survey results (BIS, 2000). Additionally, e-money innovators and operators argued that replacement of currency by digital bits and bites representing monetary value would be realised sooner rather that later. Keeping in mind the very long existence of banknotes and coins in the history of economic development, even 20 to 30 years for full e-money take-off may not be regarded as a 'long time'.

Innovators and operators in Europe did not regard central bank regulation of e-money as a negative influence on either innovation perspectives for further developments in e-money technology or competition among different operators and innovators. The innovators and operators on the other side of the Atlantic share the same belief but are somehow relatively more concerned than their European counterparts about the negative impact of innovation vs competition, and they are more involved in the discussion.

The main obstacles for e-money to replace central bank money were regarded quite differently in the US and EU. Participants in the European survey stated that technical infrastructure, interoperability, and costs and profitability for issuers are the main problems,

whereas security and privacy are regarded as the leading problems for a successful e-money take-off in the US.

It is likely that the future key access media for e-money will be personal computers in e-commerce and mobile phones in m-commerce, as both of the surveys seem to confirm. However, the differences as between the two surveys is in the priorities. The American side gave more support to ATMs and hand-held devices while the Europeans paid more attention to DTV technology.

In the European survey, the innovators and operators almost agreed on a combined card and software base as the e-money 'infrastructure' for the future, an opinion which is shared by their US counterparts. There seems to be some differences as to secondary priorities. The US participants place less reliance on smart card-related common solutions, but they did feel that virtual and conventional financial transactions might require a combined solution.

The European operators and innovators felt that, instead of a single and dominant medium, the e-money would be shaped by two or even more operating systems. The US participants gave this view even stronger support, by a margin of 21%. These results might increase the concern of policy-makers around the world for an interoperability requirement for alternative e-money proposals before the differences in implementation become too complicated to be changed.

The majority of European innovators and operators did not even see banks as the main players in the financial service industry. Once again, the US perception was almost totally different on this issue, as 17% more of the participants gave clear support for banks to defend their positions in the future as the main players in the financial service industry.

Other issues addressed in this questionnaire disclosed closer perceptions among the EU and American innovators and operators. Other than the above-mentioned differences, their opinions did not differ widely. Whereas seven questions underlined different perceptions, the rest of the 24 questions resulted in closer opinions. As an overall conclusion, there seems not to be a clear consensus among innovators and operators in Europe and the US that could form a base for explaining all the differences between the e-money perceptions of the FED and the ECB. Similar thoughts, perception and approaches to e-money among innovators and operators clearly surpassed the differences. The differences were mainly limited to the position of banks within the financial industry, access media for e-money, operating systems, innovation and competition-related issues, the potential e-money issuers and the main obstacles to an e-money take-off. This result may mean that e-money innovators and operators would like to have closer

co-operation and co-ordination among European and American central banks in particular and among central banks around the world, in general, in order to develop similar responses to the emergence of e-money. It may be true that when the business practices are somewhat similar and market structures are not radically different, the perceptions as to industry regulation may be expected to be similar or at least not radically different.

The BIS seems to have found a common ground for increasing the level of understanding for the advent of e-money. In the future, it may play a bigger role in sustaining a discussion platform to eliminate (or close the gap between) perceptual differences in order to bring some kind of policy consensus. Moreover, there may be an inclination to ask more from central banks around the world (with the increase in the globalisation in financial services provision) in supplying global solutions for global financial services, and it may be that no single policy response will successfully address a particular issue on an independent prescription base. This request may emerge especially from the borderless characteristics of e-money circulating itself in PC, mobile phone, DTV and hand-held device networks and having the advantage of addressing also conventional payment solutions to conventional transactions by utilising the possibilities of smart cards.

Such a demand may force central banks to work hard to find shared grounds on a sustainable policy reaction to e-money and related issues. This survey has found a clear demand for a closer policy action on e-money from central banks, as innovators and operators did not express widely differing perceptions regarding e-money in the surveys discussed here, the differences being largely limited to secondary choices.

6.3.6. APPENDIX 1: COMPARATIVE TABLE FOR SURVEY RESULTS

QUEST: *Major Differences*	ANSWERS	EU	US	EU - US
1. Do you think that electronic cash has a potential to replace central bank money?	A) Yes	**35,00**	**63,00**	-28,00
	B) No	18,00	32,00	-14,00
	B) To a certain extent	47,00		
	D) Don't know	00,00	05,00	-05,00
2. If yes, when? (Connected to Question 1)	A) Before 2005	22,00	21,00	01,00
	B) Before 2010	**33,00**	**35,00**	**-02,00**
	C) Before 2015	17,00	16,00	01,00
	D) Before 2020	11,00	10,00	01,00
	E) After 2020	17,00	18,00	-01,00
3. What may be the impact of central bank regulation on innovation regarding e-money technologies?	A) Encourage Innovations	**48,00**	**44,00**	04,00
	B) Discourage Innovations	07,00	21,00	-14,00
	C) Neutral effect on Innovations	29,00	33,00	-04,00
	D) Other	16,00	02,00	**14,00**
4. What may be the impact of central bank regulation on competition among e-money issuers?	A) Encourage competition	**38,00**	**51,00**	-13,00
	B) Discourage competition	11,00	14,00	-03,00
	C) Neutral effect on competition	32,00	34,00	-02,00
	D) Other	19,00	01,00	**18,00**
5. What are the main obstacles for e-cash to replace the central bank's money (or to be widely accepted)? (Please tick all relevant answers)	A) Costs for the customers	17,64	27,84	-10,20
	B) Costs/profitability for the issuers	31,37	26,80	04,57
	C) Security	25,49	**55,67**	**-30,18**
	D) Privacy	21,57	44,33	-22,76
	E) Interoperability	41,18	24,74	16,44
	F) Legal framework	19,61	25,77	-06,16
	G) Technical infrastructure	**47,06**	34,05	13,01
	H) Cross-border issues	23,53	34,02	-10,49
	I) Critical mass of customers	25,49	27,84	-02,35
	J) Others	17,65	04,12	13,53
7. What is the base for e-money schemes of the future?	A) Card based	27,00	14,00	13,00
	B) Software based	02,00	02,00	00,00
	C) Combined card&software based	**61,00**	**54,00**	07,00
	D) All of the Above	10,00	27,00	**-17,00**
	E) Other	00,00	03,00	-03,00
8. What 'access' medium for e-money will be used the most in the future by the customers? (Tick all relevant answers)	A) Public telephone	33,33	31,96	01,37
	B) Home telephone	52,94	32,99	19,95
	C) Mobile telephone	56,86	63,92	07,06
	D) Television	39,22	31,96	07,26
	E) PC	**66,67**	**73,20**	-06,53
	F) Public 'ATM'	35,29	62,86	**-27,57**
	G) Other	13,73	05,15	08,58

QUEST: *Major Differences*	ANSWERS	EU	US	EU - US
13. Which operating system may dominate the future of e-money technologies?	A. Multos	19,00	07,00	12,00
	B. Java	24,00	20,00	04,00
	C. Windows for Smartcards	18,00	10,00	08,00
	D. None of the above but	00,00	03,00	-03,00
	E. There will be two or more operating systems	**39,00**	**60,00**	**-21,00**
20. Will banks remain as the main players in the financial services industry?	A. Yes, they can supply financial services more efficiently than other firms	**48,00**	**65,00**	**-17,00**
	B. No, other firms have been gaining comparative advantages especially in digital economy	41,00	24,00	17,00
	C. Don't know	11,00	11,00	00,00
QUESTIONS: *Regulation*	**ANSWERS**	**EU**	**US**	**EU - US**
6. What should be the reaction of central banks to e-cash?	A) In advance regulation for guidance	**56,25**	**57,45**	-01,20
	B) Wait and See	04,17	13,83	**-09,66**
	C) Leave it to the Market	35,42	27,66	07,76
	D) Other	4,17	01,06	03,11
QUESTIONS: *Tech. Issues*	**ANSWERS**	**EU**	**US**	**EU - US**
12. Which medium of access technology is most likely to dominate the future e-money developments?	A. Personal computer (PC)	**42,86**	**38,95**	03,91
	B. Mobile telephone	32,86	28,42	04,44
	C. Palm	04,29	11,58	-07,29
	D. Digital TV	18,57	08,42	**10,15**
	E. Automated Teller Machine (ATM)	02,86	10,53	-07,67
	F. Other	04,29	02,11	02,18
14. What is the most critical technology for the future (success) of e-money?	A. Smart Cards	**30,00**	**34,07**	-04,11
	B. Internet Applications	25,71	14,29	**11,42**
	C. Wireless Application Protocols for mobile phones	10,00	10,99	-00,99
	D. Digital TV	04,29	01,10	03,19
	E. Palm	00,00	01,10	-01,10
	F. Operating Systems like Java, Multos, Windows for Smartcards	05,71	08,79	-03,08
	G. All of the above	17,14	21,98	-04,84
	H. None of the above but	11,43	07,69	03,74

QUESTIONS: *Financial Markets Structure*	ANSWERS	EU	US	EU - US
9. Should institutions other than banks be allowed to issue e-money?	A) Yes	**50,00**	39,00	**11,00**
	B) No	36,00	**43,00**	-07,00
	C) Don't Know	14,00	17,00	-03,00
	D) Other	00,00	01,00	-01,00
10. Do you think e-money schemes can decrease barriers to entry to the banking industry?	A) Yes	**51,00**	**46,00**	**05,00**
	B) No	21,00	21,00	00,00
	C) Neutral	15,00	19,00	-04,00
	D) Don't Know	13,00	14,00	-01,00
11. Should money be privatised?	A) Yes	08,00	14,00	-06,00
	B) No	**61,00**	**69,00**	-08,00
	C) Don't know	31,00	14,00	**17,00**
15. What may be the reasons for the failure of alternative e-money proposals like Digicash? (Please tick all the relevant answers)	A. Lack of demand for e-money	20,00	15,12	04,88
	B. Lack of business case for e-money	17,14	09,30	07,84
	C. Lack of coordination with banks and operators	**51,43**	**46,51**	04,92
	D. Lack of investment and advertisement	08,57	03,49	05,08
	E. Lack of expertise and management skills	10,00	01,16	**08,84**
	F. Exaggerated expectations	14,29	06,98	07,31
	G. Unsustainable cost of infrastructure to get critical mass	10,00	10,47	-00,47
	H. Other	08,57	06,98	01,59
16. Which payment instrument is best suited for 'retail' e-commerce transactions?	A. E-money	**42,00**	**49,00**	**-07,00**
	B. Credit cards	36,00	31,00	05,00
	C. Debit cards	20,00	20,00	00,00
	D. Checks	01,00	00,00	01,00
	E. E-gold	00,00	00,00	00,00
	F. Other	01,00	00,00	01,00
17. What may be the impact of e-money on the future of financial services industry?	A. E-money will allow financial institutions to issue their own money	04,29	05,81	-01,52
	B. It will only increase the efficiency and productivity of financial service providers	28,57	20,93	07,64
	C. It will decrease barriers to entry to the financial service industry by reducing operating and managerial cost and increase competition	**31,43**	**29,07**	02,36
	D. Technology companies will gain comparative advantage for financial services	20,00	12,79	07,21
	E. All of the above	15,71	24,42	**-08,71**
	F. It will have no impact	02,86	05,81	-02,95
	G. None of the above but other	02,86	01,16	01,70

QUESTIONS: *Financial Markets Structure*	ANSWERS	EU	US	EU - US
18. Which institutions are best placed to compete with banks in providing e-money schemes? (Please tick all the relevant answers)	A. Telecommunication companies like BT and Vodafone	**62,86**	**43,30**	**19,36**
	B. High-tech companies like IBM	10,00	18,56	-08,56
	C. Internet service providers like AOL	28,57	35,05	-06,48
	D. E-commerce brand names like Amazon.com	15,71	20,62	-04,91
	E. Software companies like Microsoft	28,57	18,56	10,01
	F. Supermarkets and retailer chains like Wal-Mart and M&S	28,57	23,71	04,86
	G. Other	01,43	04,12	-02,69
19. Who should be allowed to issue e-money?	A. Only Banks	**34,29**	**51,09**	**-16,80**
	B. Only Telecommunication companies	05,71	03,26	02,45
	C. Only Internet Service Providers	01,43	01,09	00,34
	D. Only Software companies	01,43	00,00	01,43
	E. All of the above	20,00	13,04	06,96
	F. Any firms capable of handling e-money technologies	34,29	30,43	03,86
	G. Other	01,43	01,09	00,34
QUESTIONS: *Policy Issues*	**ANSWERS**	**EU**	**US**	**EU - US**
21. Can e-money technologies eliminate the power of central banks as the sole providers of monetary base in the future (by offering alternative monies issued by other institutions)?	A. Yes	23,00	24,00	-01,00
	B. No	**37,00**	**39,00**	-02,00
	C. To a certain extent	34,00	29,00	**05,00**
	D.Don't know	06,00	09,00	-03,00
22. Can e-money technologies lead to a 'free banking' era (A system of competing currencies issued by various institutions and without a Central Bank)	A. Yes	28,00	26,00	02,00
	B. No	**33,00**	**39,00**	-06,00
	C. To a certain extent	20,00	24,00	-04,00
	D. Don't know	19,00	11,00	**08,00**
23. Can e-money create a 'world currency' by eliminating most of the currently available national currencies all around the world?	A. Yes	35,00	38,00	-03,00
	B. No	**52,00**	**44,00**	**08,00**
	C. Don't know	13,00	18,00	-05,00
24. Should central banks issue e-money for their own account, thus competing with private banks and/or other institutions?	A. Yes, money should only be governed by central banks	26,00	27,00	-01,00
	B. Yes, all firms including central banks should compete with each other in e-money schemes	24,00	22,00	02,00
	C. No, central banks should not compete with financial services providers	**34,00**	**29,00**	05,00
	D. Don't know	16,00	22,00	**-06,00**

6.3.7. APPENDIX 2: TABLE OF ASSOCIATION (CHI-TEST)

QUESTIONS (Numbered as the questionnaire)	P-VALUE[61]
4. What may be the impact of central bank regulation on competition among e-money issuers?	**0,001**
5. What are the main obstacles for e-cash to replace the central bank's money (or to be widely accepted)? (Please tick all relevant answers)	**0,002**
3. What may be the impact of central bank regulation on innovation regarding e-money technologies?	**0,005**
13. Which operating system may dominate the future of e-money technologies?	**0,015**
7. What is the base for e-money schemes of the future?	**0,039**
20. Will banks remain as the main players in the financial services industry?	**0,046**
8. What 'access' medium for e-money will be used the most in the future by the customers? (Tick all relevant answers)	**0,058**
12. Which medium of access technology is most likely to dominate the future e-money developments?	0,082
11. Should money be privatised?	*0,134*
6. What should be the reaction of central banks to e-cash?	*0,179*
18. Which institutions are best placed to compete with banks in providing e-money schemes? (Please tick all the relevant answers)	*0,185*
15. What may be the reasons for the failure of alternative e-money proposals like Digicash? (Please tick all the relevant answers)	0,424
19. Who should be allowed to issue e-money?	0,435
16. Which payment instrument is best suited for 'retail' e-commerce transactions?	0,505
24. Should central banks issue e-money for their own account, thus competing with private banks and/or other institutions?	0,522
23. Can e-money create a 'world currency' by eliminating most of the currently available national currencies all around the world?	0,528
17. What may be the impact of e-money on the future of financial services industry?	0,540
14. What is the most critical technology for the future (success) of e-money?	0,571
9. Should institutions other than banks be allowed to issue e-money?	0,588
22. Can e-money technologies lead to a 'free banking' era (A system of competing currencies issued by various institutions and without a Central Bank)	0,750
21. Can e-money technologies eliminate the power of central banks as the sole providers of monetary base in the future (by offering alternative monies issued by other institutions)?	0,800
10. Do you think e-money schemes can decrease barriers to entry to the banking industry?	0,876
2. If yes, when?	0,999

[61] P-Value implies a close association as it gets closer to 1 and opposite when it is close to 0.

7. THE IMPLICATIONS OF ELECTRONIC MONEY

This chapter discusses e-money, its relation to free banking and some implications for central banking including monetary policy and policy instruments. It first looks at the free banking implications including the synergy between two concepts. Then, it considers monetary policy adjustment mechanism from the 'electronification of payment systems' point of views. Finally, the chapter concludes with the potential influence of e-money velocity of circulation, money multiplier and monetary policy.

7.1. FREE BANKING IMPLICATIONS OF E-MONEY[62]:

This section investigates e-money, its relation to free banking and some implications for central banking. It begins by introducing its conceptual framework for modern central banking, in terms of which it then rehearses the free banking argument. It then reviews the development of e-money in terms of both electronic payment methods and electronic issue, with special attention paid to the latter. The discussion includes both mainstream developments, such as Mondex, and 'alternative' schemes such as LETS. From here it proceeds by way of a consideration of the synergy between electronic issue of money and free banking precepts, to a consideration of some implications for the future of central banking generally. It offers a 'contestable' model of central banking, which endeavours to show the effects that e-money may be expected to have (and, indeed, may already be having) as regards monetary policy, financial supervision and seignorage

7.1.1. INTRODUCTION

The aim in this section is to discuss the possible impact of e-money on central banking. The frame of reference is the free banking debate, which revolves around the issue whether or not central banks are in fact necessary and useful. The free banking controversy has highlighted several conditions, which are critical for monetary systems to function well in the absence of a traditional central bank. However, the way in which these conditions come into play seems being transformed by information technology.

The analysis firstly introduces a conceptual framework summarising the role of central banking in a modern monetary economy. This framework is based on distinguishing the

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[62] An earlier version of this section is under review as "Gormez Y. and Houghton H.B.; 'Electronic Money, Free Banking and some Implications for Central Banking', Bank of Finland Discussion Papers".

different functions and tasks of central banking as regards the management of the monetary system, in order to find out how the development of e-money might affect the "public-good" nature of these functions.

The following section overviews the case for free banking as an alternative to the current monetary policy framework and pinpoints the parts of the argument relevant to the emergence of e-money.

After that, it reviews the development of e-money in terms of both electronic payment methods (representative e-money) and electronic issuance of currency (independent or competitive e-money). The analysis focused on the latter because were it to be shown that e-money qua unit of account was not an alternative to conventional money circulation, then its ultimate effect is unlikely to go beyond the displacement of currency in circulation by advanced payment systems including credit and debit cards or advanced clearing systems – something that has been going on for some time now. After defining e-money, the paper investigates its implications with regard to finance, banking and the functions of money.

The following section considers the relationship between e-money and free banking precepts. The discussion details how e-money helps to address three main aspects of the free banking debate – the lender of last resort function, currency backing, and multiplicity of currencies. The focus of this section is on possible implications for the future of central banking generally, rather than predicting radical change to the current monetary policy framework.

Followingly, the analysis offers a 'contestable' model of central banking, which endeavours to take into account effects that e-money may be expected to have on monetary policy and seignorage. That section stresses the importance of the market mechanism on central banking and argues that this may enable (or force) central banks to offer some of the benefits associated with "free banking" even under the present institutional arrangements, while defending the integrity of money for the whole society.

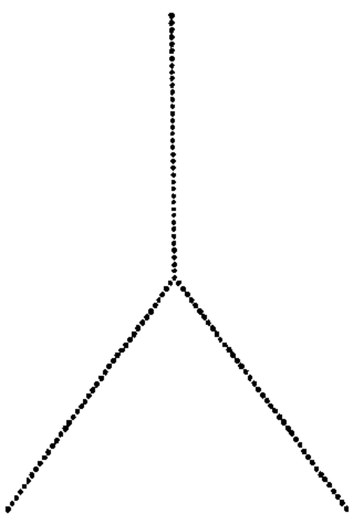
The last section presents the conclusions and recommendations.

7.1.2. AIMS OF THE ANALYSIS

There may be a need to clarify the view of central banking that provides the background to this paper, and the conceptual framework in terms of which the discussion is formulated. The focus is on the central monetary authority in its most basic functions, shorn of its role as banker to or agent of government and no longer handling debt management or other services that can as easily be provided by private firms.

In this context, the central monetary agency is assigned three main functions – facilitating price stability, promoting financial stability, and ensuring the integrity of money, with the third of these arguably subsisting in the other two (Figure 7.1.1). Money is a public good which has certain systemic network externalities at its core. In a word, the integrity of money refers to money's ability to remain a reliable and stable cover for purchasing power over time (short, medium and long-term). It refers to the soundness of money, implying the absence of 'bad' (over-issued) money, while the concept of a stable measure connects it to the unit of account function of money and related topics, such as network externalities and the enforcement of legal tender provisions. Integrity of money, in other words, entails anything that increases or sustains the reliability of the unit of account by convincing economic entities to trust to the future quality of money. It covers the avoidance of inflationary effects but goes beyond that to include anything that may have an influence on the reliability of the unit of account.

FIGURE 7.1.1: THREE MAIN FUNCTIONS OF CENTRAL BANKING

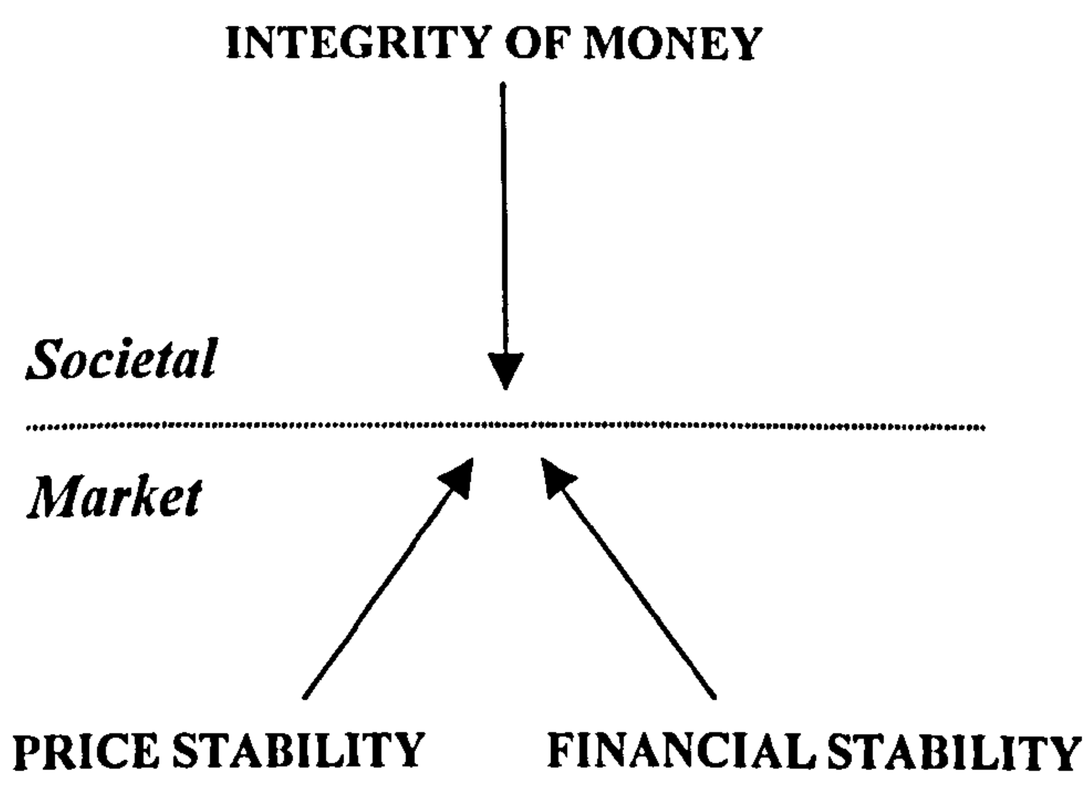


It is in this sense argued here that the integrity of money subsists in price stability and financial stability, since its ability to act as a stable measure will be maintained if price stability is maintained and if price stability in turn is not undermined by financial instability. Price stability can be understood as a short-hand reference to the wider concept of central bank independence (whether instrument or goal, partial or complete) with its concern to provide a constitutional context appropriate to price stability and its need to meet the challenge posed by competition in the quality of money -the possibility of enabling good money to reaching the end user. With its focus directly on the avoidance of inflation, price stability is clearly related to the means of exchange function of money, also referring to currency competition with a mechanism of direct danger of substitution in case of an unreliable monetary policy. Financial stability, on the other hand, addresses such issues as free entry to financial service provision and the perfection of information by promoting financial awareness of individual economic

entities. It also deals with problems of regulation and supervision of the financial sector and is thus related to the store of value function of money, although that there is continuing debate over whether financial supervision should or can be divorced from the conduct of monetary policy.

For exploratory purposes, a further image (Figure 7.1.2.) can be derived from Figure 7.1.1, an image that is not an arbitrary invention. It has its genesis in Keynes's (1923) discussion on monetary reform and seems to be born out in current experience by the case of the Reserve Bank of New Zealand (RBNZ), for example, which describes its strategy as one that, wherever possible, leaves it to the markets to do the central bank's work. As regards monetary policy, this means the pursuit of price stability by way of single objective monetary policy. In terms of supervision, the RBNZ calls on banks (99% of which in New Zealand are foreign-owned) to account directly to the public in terms of meaningful reporting and transparency. The third function, the integrity of money, the Bank reserves to itself in its capacity as sole issuer of the NZ dollar - a fact, the Bank believes, that gives it a force over against otherwise autonomous global markets. While one may wonder at the certainty of this last claim, the interesting point in terms of the preferred framework is that the RBNZ may not be just a one-off or special case. It may indicate a generic along the lines of the Goodhartian (1988) definition of a central bank as an "outside agency to regulate and control the banking system … in the otherwise free working of a free market."

FIGURE 7.1.2: A POSSIBLE GENERIC FORM OF CENTRAL BANKING



This image also reflects Issing's (1999) criticism of Hayek's (1990) claim that it is free competitive issue of money that guarantees a stable and efficient monetary system. For Issing, money is accepted as a public good, because money acts as a basic convention in society, like

language and standards of physical measure. Issing points to the network externalities involved in the use of money in transactions and criticises Hayek's assumption that complete, symmetric and free information would obtain in a monetary system based on competitive currency. He also questions the transition period and argues that the change to competitive issue would be inflationary itself and generate uncertainty for future prices. For these reasons, Issing envisages money as a public convention standing above the fray.

Finally, such a generic image may serve to indicate, in responding to modern developments, central banking is undergoing a transformation away from unitary forms towards an articulated expression. The interest is, therefore, in developing a relevant, appropriate, and viable tool of analysis for understanding the possible effects of e-money's seeming affinity with free banking on central banking generally, giving evidence where available of such effects

7.1.3. FREE BANKING: DEFINITION AND CHARACTERISATION

The location of monetary policy in central banks is a recent development in the history of finance. Central banks became monetary policy makers only as the gold standard was replaced by fiat money, which was controlled by governments. There are alternatives to central banking as practised today, such as currency boards, full convertibility (under a commodity standard) and free banking.

The assumption of this section is that central banks are facing fundamental changes, which may in the end lead to their demise or, as argued here, a transformation of their behaviour in a way that approximates the free banking concept at least in some key respects. This possibility is not an invention, of course; as the existence of central banks is already under discussion. For example, King (1999) believed that central banks might be at the peak of their power. The author argued that there may be fewer central banks in the future, and their extinction cannot be ruled out as societies have managed without central banks in the past and they may do so again in the future. This was also the focus of a recent World Bank Conference on the future of monetary policy. Although these discussions do not directly consider the idea of free banking as an alternative to the current monetary policy framework, it may be that, once the continued existence of central banking is brought into question, free banking may yet emerge as an alternative, or provide an important benchmark in whatever transformation comes about.

White (1995) defines free banking as a monetary system without a central bank, under which the issuing of currency and deposit money is left to legally unrestricted private banks. This definition represents a general consensus in the free banking literature - see, for example, Dowd (1993). White points out that, as a monetary regime, free banking consists of two main elements - unregulated issue of transferable bank liabilities and unmanipulated supply of base money or basic cash. There is no government role with regard to the quantity of money produced inside or outside the banking industry, and outside money free of central bank control is desirable. Money issue is not seen as a device of governments to achieve their goals, but operates as the means for individuals to pursue their own purposes. That said, White (1995) does not reject the idea of a clearinghouse (considered later in this section) at the centre of the financial system when without a central bank; his view is that this should be a market mechanism designed to eliminate imperfections within the financial system. The author underlined the lessons from free banking theory and Scottish free banking experience under free conditions as follows: (i) Bad money does not drive out good. (ii) Counterfeiting does not pose a major problem. (iii) Banks are not inherently phone to over-issue and suspension. (iv) Banks will not hold chronically insufficient or excessive reserves. (v) Bank runs are not an endemic problem. (vi) There is no clear need for a lender of last resort. (vii) No pyramiding of reserves, making credit inherently unstable, takes place (viii) No natural monopoly exists in the production of paper currency. (ix) Proliferation of bank-note brands is not a problem.

As envisaged by Dowd[63] and others, free banking is regarded as the multiple issue of currencies by competing banks, whose notes, however, are interchangeable and redeemable against a "community-recognised commodity", while option clauses protect against "sudden excessive demands for liquidity". This last is an arrangement that obviates the need for a lender of last resort, since free banking is a system in which monetary and financial stability are guaranteed by market determination of the preferred currencies and interest rates. Dowd (1996) has underlined the basic requirements for successful free banking based on private money. One of them was the emergence of a clearing system. Another was the use of option-clauses - auto-

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[63] Dowd (1992) gave three basic arguments about the misperceptions on free banking: The first one is that historical experiences of free banking were not prone to inflation as the price level was tied to an anchor commodity where inflation and deflation occurred as a result of changes in market conditions to the anchor commodity. The second is that free banking did not create an unstable financial system but lead to the emergency of clearing settlements to return over-supplied notes and deposits to the issuers to sustain stability. The third is that historical free banking experience contradicts with the argument that currency issuance is a natural monopoly because even the economies of scale did not create a dominant bank to influence the banking system as a whole and competition did not threaten other bank's share to create a monopoly.

control mechanisms used in cases of 'fire-sales' (selling assets under their value to get the liquidity in a crises) to defend against bank-runs. The final one was the development of a private lender of last resort within the financial sector to help individual institutions that were solvent but facing a liquidity crisis. In an earlier study, Dowd defined the distinctive features of a free banking system as (i) multiple note issuers who would guarantee to redeem their notes in a commodity recognised as valuable (ii) a regular note exchange between note issuers, and (iii) the insertion of option clauses into the convertibility contracts to protect the note issuers against sudden excessive demands for liquidity (Dowd, 1993).

An important contribution to the literature came from Hayek (1990). While not restricting free banking to a commodity standard only, Hayek defended that the past instability of the market is the consequence of the exclusion of the most important regulator of the market mechanism, money, from itself being regulated by the market process. He thereby invoked the idea of the invisible hand as the basic requirement for a successful monetary policy regime. Hayek also argued that central banks should be abolished, since the free issue of competitive currencies would solve the lender of last resort and elasticity of circulation problems in a financial system. He proposed that the demand for a lender of last resort arises from liquidity crises created by nationalised currencies, whereas under competitive issue there is no risk of excess liquidity as the competing currencies are fully backed by purchasing power. It is in this sense that central banking can be seen to be not the only choice for a monetary policy framework, especially if it is not able to guarantee the integrity of money as a reliable medium of exchange and store of value.

Free banking as an alternative to central banking was also discussed by Capie, Goodhart, Fischer, and Schnadt (1994). Although they described today's free banking proposals as a 'somewhat fringe academic exercise without much support from financial practitioners'; they emphasised that free banking ought not to be discounted as an alternative to central banks and currency boards for the operation of monetary systems. They pointed out that the preference of governments for central banking stems from national pride and seigniorage interests, while the financial community in general and commercial banks in particular support the central banking option for two reasons of their own. First, commercial banks economise systemic non-interest bearing reserves by offering a safety net. As a result they are able to reduce individual bank capital requirements when providing leadership in joint exercises such as establishing payments and settlement systems. Second, commercial banks enjoy an influence on central bank decisions through the dynamics of the relationships between controllers and

controlled, supervisors and supervised. (This influence may not, however, extend to the full theory of capture, which argues that commercial banks capture central banks and thus approve their operations.)

Capie and his colleagues identified four problems associated with free banking theory: (i) It may lead to extra transaction costs. (ii) Some additional bank reserves of real assets may be needed. (iii) There may be possible minor inefficiencies connected with multiple note issue. (iv) It seems indeterminate how the system as a whole behaves since free banking theory relies on the law of flux[64]. They also noted that an insufficiently capitalised bank would adopt a riskier portfolio due to the incentive to allow any resulting loss to fall on the depositors or an insurance fund.

They then summarised four responses of free banking advocates to the argument that free banking may lead to bank runs and contagious panics. The first is the denial of the likelihood of such events in a free, competitive system. The second is the argument that an implicit central bank safety net or a deposit insurance scheme invites moral hazard (absent in free banking), while intrusive regulation to minimise moral hazard leads to further distortion and misallocation of resources. The third is that free banking decreases susceptibility to instability through its adoption of self-regulatory mechanisms such as option clauses, clearing houses, and narrow banking. The fourth is the denial of any sizeable externalities and social losses in excess of internalised private losses in the case of banking failures. Such possible externalities were not found to be potentially greater in banking than in other industries.

Clearing House and 'Central': Central to the free banking concept is the clearinghouse under which the financial system not only currencies clear, but over issue is pre-empted. If a participant issues more than it can clear, the clearing house immediately will realise it and put sanctions on the member so that the problem will never get out of hand. It is important to note, that, although against central banking, free banking recognises, both theoretically and in practical instances, the need for a centralised clearing function – not on political grounds, to be sure, but out of the practicalities of enabling the interchangeability of currencies yet providing for the return of over-supplied or 'bad' money. It is also said that this clearing function is in the self-interest of the issuers of currency. Moreover, Horowitz (1992)

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[64] The theory of reflux is explained as a situation where a note issuing bank will lose/gain reserves at the clearing if it expands faster/slower than other competing note issuing banks.

regards clearing as neutral to the players so that it can be said to be without (or contextual to) rather than within the market.

In the light of the free banking debate, if one considers central banking in its economic, as distinct from its political meaning, the adjective 'central' can be read as referring not to governments' use of central banks as instruments of centralised financial control, but to the fact that the financial system ineluctably has nodal points or centres, places at which the system as a whole comes to a focus. Since this also underlies the free banking concept of a clearinghouse, it is not, therefore, a question of whether or not such a central agency can be avoided, but of the form it takes, whether it is forced by a 'central bank', which is given a monopoly by fiat or whether it is shaped by market forces: national or international financial markets for example.

Insofar as free banking is based on competitive issue of money, end-user preference is a function of the soundness or backing of money, not just its name. It is important to note in this regard that, although sound money usually means 'real' backing, real can have various meanings, ranging from 'solid gold' to non-inflationary behaviour. In this sense, if a national currency (even if state-issued) fulfils the requirements of price stability in a way specified by the users of money, it should be able to compete with other currencies. In this sense, the recent advent of central bank independence and stability-oriented central banking arrangements may act as a transition arrangement or conversion device. Monetary arrangements working much like the free banking system may not, therefore, be as distant a prospect as one might think, hence the importance of avoiding too fixed usage of terms, giving rise to a false contrast between the free banking doctrine and the underlying nature of modern financial developments.

In sum, free banking envisages an environment without central banks and is put forward as an alternative to central banking, meaning central banks when subject to political manipulation and thus made into distorting agencies. Whatever the final outcome of the debate[65], these arguments and counter-arguments reflect the fact that central banking is not the

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[65] One example may be given for this debate. Capie and Wood (1991) discussed the reasons for concerns with banks more than other firms in the economy. The basic reason was given as that the failure of one bank can lead to the failure of another with a risk of the total collapse of the whole banking system, which may also cause a collapse in the stock of money via the working of the money multiplier. They, however, questioned the need for central banks to go further from being lender of last resort for such crises and their function for supervision and regulation of the banking system. However, Goodhart (1991) gave three main reasons for a need for a central bank. These are information asymmetries in financial markets, depositor protection in the financial industry and systemic problems surrounding the banking system. Wood (1991) commented on those arguments that deposit insurance gives rise to a moral hazard by letting banks to take risks at the taxpayer's expense. He added that managed money since early 1900s has been a major inflation and recession era, as the cost of having a lender of last resort.

only monetary policy framework available. It is Hayek's contention that other approaches should be explored, competitive money issue in particular. His point is that in a free environment with concurrent currencies, it will be people with better ideas who determine development through their imitation of what works best, as opposed to a national currency system where only those with power can shape evolution.

7.1.4. RELEVANCE OF E-MONEY TO FREE BANKING

E-money may have different shapes. Up till very recently, electronisation of the payment systems has been based on improvements in account-based systems, their reach (domain) and their speed. Account-based systems record all the transactions and authorise them centrally, whereas non-account-based systems circulate e-tokens through telecommunication networks or on smart cards and may allow transactions without central authorisation. Account-based e-money systems are really very little different from the debit card of credit card networks of EFT systems currently in use. Token-based e-money, on the other hand, is radically different in the sense that it introduces an electronic form of currency.

Ultimately, the impact of the perfection of account-based systems of electronic transfer and the expansion of token-based e-money is the same because both compete with (or create an alternative to) the use of conventional currencies in payments. Paper currency has hitherto been able to compete against account-based payment systems because of its anonymity and the absence of verification costs, which have been prohibitively high for micro-payments. Now, the challenge to paper money comes from both sides – the reduction in verification costs on the one hand and the development of electronic tokens, which avoid verification altogether. The major difference between these two systems is actually just the cost of authorisation as e-cash targets micro-payments. The other is security. If the authorisation cost can be lowered to a certain level so that even micro-payments are executed by accountable systems, it may be expected that even the non-account-based systems may prefer to authorise all the transactions due to security concerns. In that case, the distinction between token-based systems and account-based systems would become rather blurred.

Regardless of the form of e-money, the main technological developments behind e-money are firstly the decreasing cost of communication, and secondly the increasing computing power in ever smaller units. The first one favours all kind of networking models including the conventional and mobile Internet and also local, national and international networks based on PDAs, DTV, ATMs and any other networking model that will be designed and developed in

the future. Cheapening communication not only allows to lower the operating cost of existing networks but also provides an opportunity to create alternative or competing local, national or international networks as well.

The increasing power of computing allows the operation of networks with improved data and risk management techniques, including artificial intelligence and cryptography. It may be argued that e-money will be the most sensitive data on the networks and unless managed perfectly with almost risk-free technology (or at least less risky than currency), the e-money will never succeed. This development is thus very critical. Increasing computing power will also reduce the cost of secure hardware including smart cards, as more advanced processors are being developed.

The formal definition of e-money offered by the ECB, which has been discussed in section 4.1.1. The definition is unsatisfactory, however, in two respects: Firstly, it may overemphasise the technical distinction between account-based and token-based systems, which have ultimately similar effects. Secondly, it does not distinguish clearly enough two quite distinct kinds of e-money issuance strategies: the conventional strategy of a new electronic payments medium and the more radical one of electronic issue of alternative, competing currencies (not based on conventional, government-organised monies).

The two different kinds of e-money may be called as "representative" and "independent" respectively. As long as it is representative of legal tender under a given monetary policy framework, 'e-cash' is a form and extension of cash generally, an addition to coinage, notes, cheques and debit and credit cards, etc. In this respect, e-money is clearly nominal in its effects - such as increasing velocity - and may be regarded as neutral in terms of systemic change. It has important implications for the current monetary framework, in that it makes payments easier and hassle free, revolutionises monetary base management and enriches currency choice through making it easier to use several currencies and/or to switch between them. It would reduce the demand for conventional central bank money. But, e-money as a mere representation of a given currency may have no different effect on monetary policy frameworks than what has already been caused by advanced payment systems, which have decreased the proportion of currency in circulation to total money stock especially in the last couple of decades.

However, the impact of e-money would seem to be most significant when it comes to the electronic issue of non-bank money, that is, money issued without reference to banking reserves. If e-money is introduced as independent money, not a representation of any

conventional currency, it may have the potential to revolutionise the competition among monetary policy frameworks. This impact may well be different for developed and developing countries: For developed countries, it may provoke 'currency competition' among core currencies such as Dollar and Euro, or perhaps between these traditional currencies and new, privately issued monies (if the performance of the incumbent central banks is seen as unsatisfactory by money users). For developing countries, it may facilitate and speed up currency substitution to dollarisation and/or Euroisation. Other that that, three distinctive effect may be more direct in finance, banking and money:

Implications for Finance: E-money and related technologies would seem to have powerful consequences and serious impact on the future of finance for at least two main reasons. Firstly, with increased on-line connection between the service provider and the end user, information quality is not only increased but it individualises it as well. Mutual flow of information allows both the service provider and the customer to develop a better relationship base, which will allow lowering the potential of panic during financial crises. This new model of relation may allow individual valuation of particular financial service providers so as to decrease systemicity (contagious) between financial institutions. Because once the end-user has all the information about the service provider including the potential risks that may arise from any change in the financial market conditions, any potential danger for a systemic run may be expected to decrease compared to conventional financial market conditions.

Secondly, all the financial assets may get digitised even further, a trend that is already clear. Recently, bonds, bills and securities are all electronically represented as electronic assets with a technology similar to EFT, allowing smaller and flexibly denominations for example. As a result, clearing, trading and custody services are getting to be cheaper, easier and more importantly, open to any customer all around the world, which eliminates local independence. E-money, in this respect, favours all these electronisation of finance by providing a medium for sustainable micro-transactions and speed up the reach of individualised services. To give an example from current financial markets, an alternative to SWIFT or credit and debit card networks may be both cheaper to design and easier to operate so as to open the market for competition, which will increase efficiency and effectiveness of the service quality

One interesting impact of e-money phenomenon is very apparent in the emergence of 'closed circuit currencies', ranging from the marginal and 'low tech' but numerous LETS[66], through corporate barter arrangements in the conventional business world[67], to experiments in bank-created e-money such as Mondex, and Internet-based currencies such as Beenz. As a consequence, payment systems become simplified and easier to handle, inviting new entrants into the industry, challenging credit and debit card infrastructures as well. Mondex and Beenz have been mentioned intentionally in particular because, first of all, of more than fifty e-money proposals with very different approaches to micro-payment solutions on the Internet, Mondex is one of the few to allow person-to-person transfers without the involvement of financial service providers. Thießen (1999) surveyed most of these proposals ranging from Digicash to Mondex. The second reason is that, although the company that operates Beenz began the scheme as a purely Internet-based approach, it recently co-operated with Mondex to benefit from smart card technology in order to issue and redeem Beenz on conventional transactions as well, so that Mondex cards will be used to earn and spend Beenz. In this connection, it is worth noting that almost all the major banks now operate Internet-based services, but there are also non-bank initiatives, such as Prudential Insurance's "Egg"[68], which has received deposits of more than £6 billion in less than two years.

Implications for Banking: Whatever other functions banks provide, whether these be credit creation, intermediation or settlement, they all rely on the precision and objectivity of their record keeping. They also are all required to maintain a clear distinction between their own funds, which they seek to increase, and the funds they manage for others, which they, are required to match and hold at net zero. On the other hand, as the case of LETS makes very clear, the essential banking function is that of a shared or centralised accountant and has a societal nature. Insofar as banks carry out other functions, however, none of them is as core as its bookkeeping service and none of them can as reliably be assumed to belong to banking on a permanent basis. Goodhart (2000) addressed this advantage of banks as well when he mentioned the need for portfolio selections consultancy that may sustain bank's future in the financial markets. More importantly, the more money can be created outside the banking

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[66] Good (1998) mentions 470 such systems in the world, mainly in the US, Canada, Australia, New Zealand and Britain, as well as around 30 low-technology local currencies. There are also many LETS schemes in France, Belgium and Italy. They typically have less than 300 members, often people from 'alternative life-style' movements.

[67] The oldest established is the WIR system in Switzerland. Founded in 1934, it now has over 60,000 members and an annual turnover in excess of 2,500 million CHF.

system – in the financial markets, for example, or in the folksier LETS schemes - the less does it rely on bank deposits.

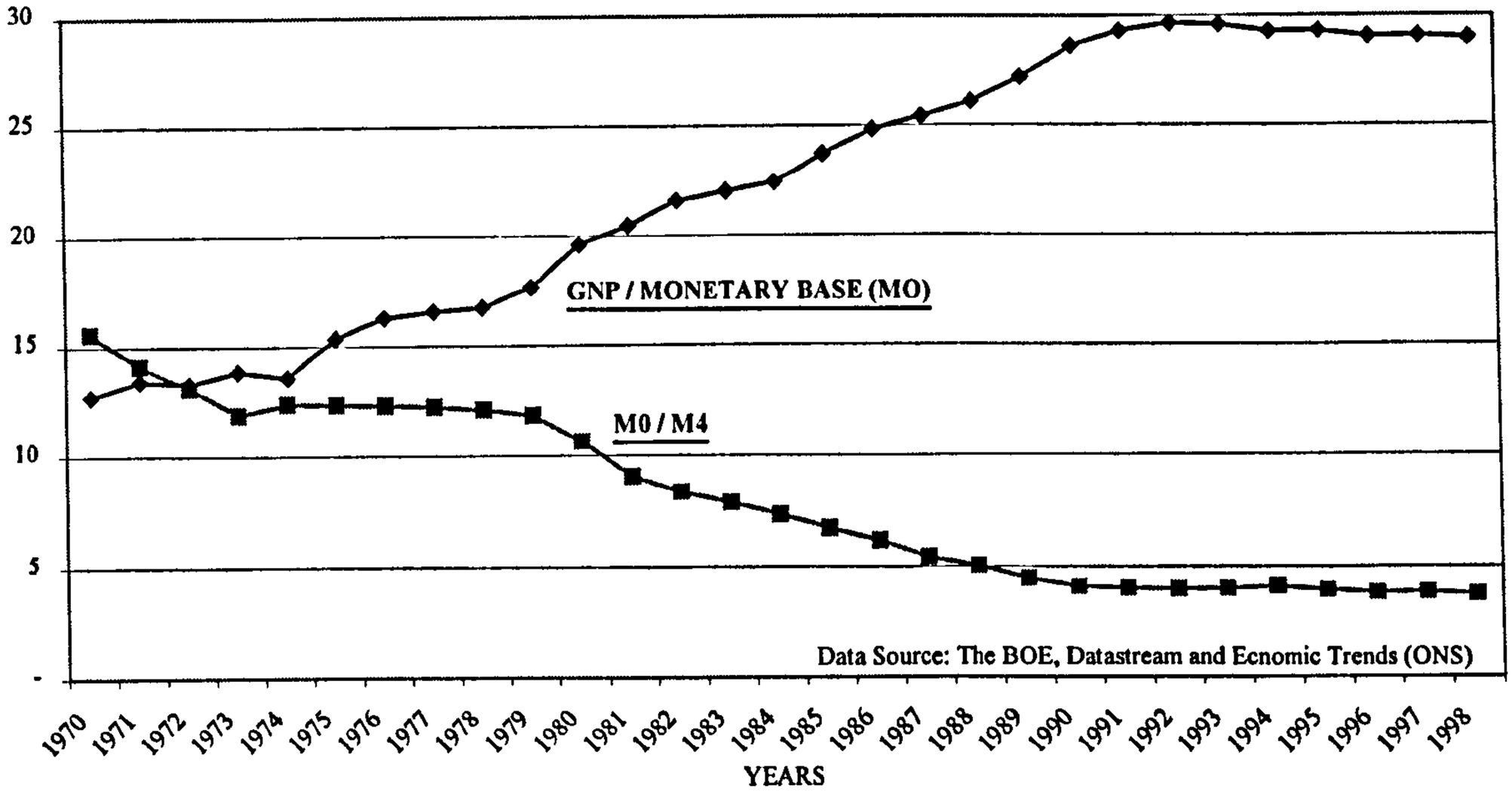
E-money creates an opportunity to decrease the cost of banking in one way and makes easy to handle portfolio management procedures by allowing to increase the size of the number of customer and the service regions by allowing network-based solutions, with the power to ignore location dependence. This, at the end, enriches end-users' right to choose among financial service providers and increase competitive pressures on service providers though very flexible opportunities to change the service providers to which proving the best service with the most reliable data. These developments can only be reinforced by the fact that the fixed investment necessary for an Internet bank has fallen to around $1 million (Gosling, 1999). This may suggest a 'structural change' in the establishment of banks so as to reduce the barriers to entry to banking arising from the high amount of fixed and operating cost and limiting barriers to the expertise that banks has been accumulating for many years. Competition, as well, will be powered with ease of entry so that any new establishment with expertise based solutions for banking services with increased quality will get a better chance for success.

There is also the fact that, as a seemingly inevitable process in history, the monetary base as a proportion of total money stock has been diminishing for quite a long time. Indeed, it may be that one of the important effects of e-money is its potential to change totally the traditional management of the monetary base.

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[68] www.egg.com

CHART 7.1.1: VELOCITY AND M0 WEIGHT IN MONEY SUPPLY



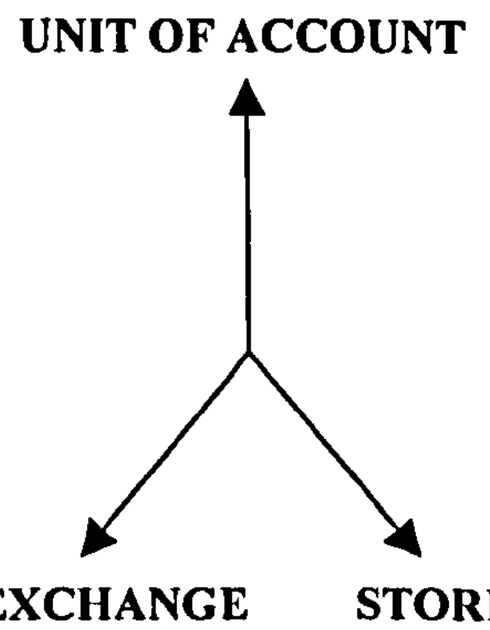
The Chart shows the UK trends since 1970 for the velocity (defined as total GNP divided by total monetary base (GNP/M0)) and money multiplier (defined as monetary base divided by total money stock (M0/M4)). In the period prior to 1990, the proportion of monetary base in the total money stock decreased to as low as 4%, while velocity more than doubled to nearly 30.

Again, this decrease is not caused by e-money as such, but by improvements in electronic payment instruments such as debit and credit cards and the development of same-time financial applications such as direct credit and debit. Indeed, it is not difficult to imagine that, in a perfectly digitalised or electronic payment infrastructure, in which all manner of transactions including micro payments are effected through digital transfer of value from payer to payee, the record keeping nature of money will enable the identification of any potential lack of demand (within the registered economy at least) for banknotes and coin as a medium of exchange. Combined with such developments, which serve only to further individualise the bookkeeping function of money, e-money can be expected to promote the growing trend towards what one can term 'self-administered banking' and 'narrow banking'. Together with telephone banking, online banking, mobile-phone banking, computer-based accounting, and all other aspects of electronic finance, e-money enables and promotes the individual person or organisation, household or firm, as the locus of financial awareness and responsibility. Banks and the banking system generally are thereby rendered more and more a resource or tool and less and less the determinant of their clients' financial actions.

The Functions of Money: One of the implications of the improvements in the electronic communications and computing technology is that they alter the traditional complementarity between the functions of money. In monetary systems based on paper currency and slow and expensive access to information, the three functions of money (unit of account, means of payment, and store of value) were almost always connected: the same instruments – money – served as means of payment, were nominated in the unit of account (actually, defined the unit of account), and were also an important form of wealth. Exceptions to this occurred only in exceptional circumstances (under hyperinflation, rationing of goods, financial crisis and so on) when the integrity of money is no longer obvious. The reason for the almost universal connection of the three functions is in the associated savings in transaction costs under the traditional payment technology.

Electronisation of payments and transaction situations in general has the power to change. This is the result of improved communications and information. When up-to-the minute price information (such as exchange rates and asset prices) are available in any transaction, and when wealth can instantly be transferred from one asset to another, the reasons why the functions of money should be connected become weaker and weaker. Transactions may be paid for with assets which are not denominated in the same units in which the prices are quoted; and the amount of wealth actually kept in the form of the means of payment may be minimal. The three functions of money in a "unified" system can be thought of as exhibited below.

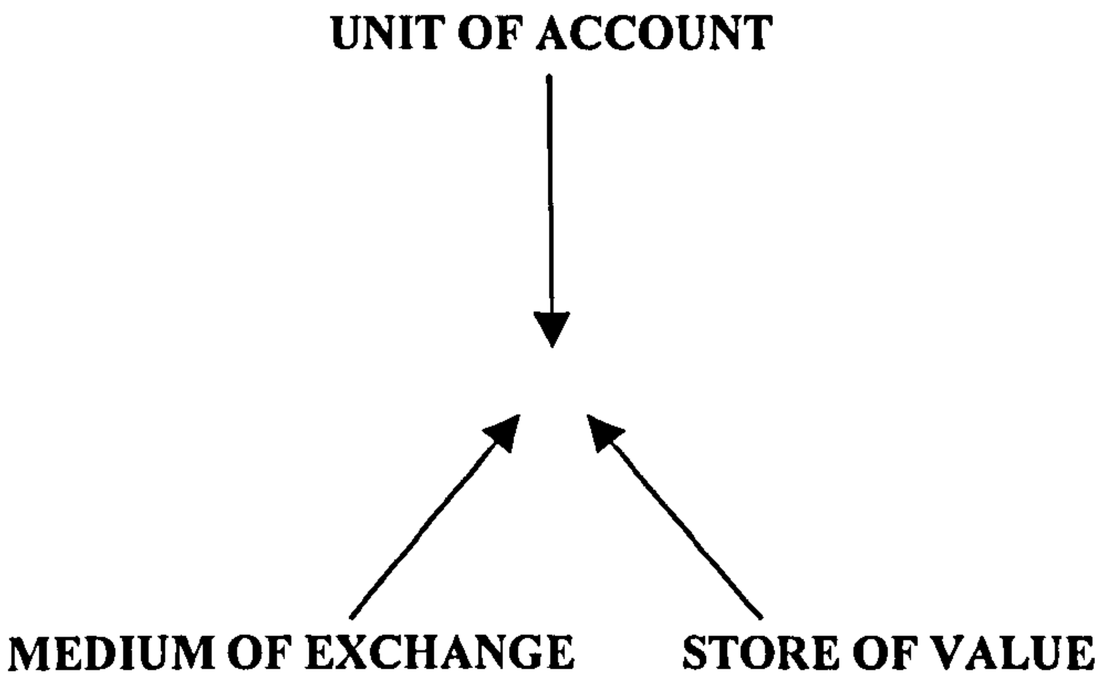
FIGURE 7.1.3: UNIFIED MONEY



If represented thus, the idea arises that the three functions of money may be the monetary version of earlier depiction of the three main functions of a central monetary agency (see Figure 7.1.1) If that were the case, it would be reasonable to expect that, just as central

banking seems to be undergoing a transformation from a unitary to a devolved or articulated form, so money may also be subject to the same process. In other words, one may need to pass from the idea of money as consisting of three functions somehow linked and held together as if from a central point, to the notion of money as the combination or combined effect of three distinct processes (Figure 7.1.4).

FIGURE 7.1.4: ARTICULATED MONEY



This development, if it occurs, makes it increasingly difficult for central banks to rely on their legal tender powers as suppliers of the mandatory means of payment to entail a unified unit of account in their respective economies, or a large demand for central bank money (reserves or currency). This is not necessarily a new idea. Issing (1999) mentions the prospect for separating the functions of money, as do Browne and Cronin (1995). E-money just extends this possibility and changes the dynamics of money as a result.

7.1.5. THE SYNERGY BETWEEN OF E-MONEY AND FREE BANKING

The direct or indirect relationship between e-money and free banking has been addressed quite often recently. For example, White (1995) argued that the technology gives an opportunity to issue private bank notes as smart card balances, which are transferable without bank involvement. He added that digital payment technology has begun to foreshadow a world in which central bank currency is obsolete - replaced, perhaps, by privately issued currency in the form of balances written to smart cards or downloaded to personal computers and transferred by means of electronic wallets or over the internet. He also investigated the potential of e-money to make small denomination currencies interest-bearing for the first time in the history, and concludes that, when combined with anonymity e-money would facilitate the public's turning away from government-based notes and coins. Selgin (1996) proposed that the more financial innovation succeeded the less reliance the public would place on central banks

as direct sources of exchange media. Therefore, he argued, the public could afford to deny the central bank and its discretionary powers. More than that, Browne and Cronin (1996) pointed out that laissez-faire banking could emerge endogenously over time in response to technological improvements in information and financial products.

The literature on the issue seems quite rich. To cite some of them, for example, Smith and Weber (1998) mentioned the current legislative developments in US and noted that it removed the legal impediments to private banknote issue. They found it quite likely to see a re-emergence of privately issued substitutes for national currency in developed economies. Dywer (1996) is another advocate to cite the potential of e-money to create a new era for free banking. These authors published their papers on the FED sources, an action to confirm that it is not only academicians to analyse free banking but even central bankers seem to investigate the implications for the current financial system.

In another contribution, Birch and McEvoy (1997) discussed private currency issue and noted that the discussion of e-purses solely as a new medium of exchange may be a short-term view. Craig (1996), for example, argued that a competing foreign currency may provide a discipline to keep a domestic fiat currency sound with the help of greater freedom of international trade. In a parallel analysis, Greenspan (1998) explained the dramatic expansion in cross-border financial flows with very rapid increases in telecommunications and computer-based technologies and products and added that even a reluctant government has little alternative other than deregulating and freeing up internal credit and financial markets.

Bordo and Schwartz (1995) have taken granted that outside-money arrangements will remain in the hands of governments for, at least, near future. They found restoration of either gold or bimetallic-based monetary standard highly unlikely and doubted that central banks would cease to function as monetary authorities in the foreseeable future. England (1996) argued that the improved inflation performance among developed countries in recent decade is a result of the growth of effective competition among national currencies. As competition increases among nationally provided currencies, the author stated, economic stability in both developing and developed countries increases as well.

The effects of electronisation are not limited to the retail use of currency but they extend also to the role of the central bank as the supplier of reserves to banks. According to Friedman (1999), three factors bring into question the future of the central bank's role as a monopolist over the supply of bank reserves: the erosion of the demand for bank money, the proliferation of non-bank credit, and the development of private bank clearing mechanisms.

The conclusion, he warned, would be that central banks' ability to conduct monetary policy might deteriorate as they could not affect the price level of goods and services in the non-financial economy unless they had direct control on interest rate setting.

Goodhart (2000) did not agree with Friedman, arguing that only incompetence (in monetary policy) rather than the information technology revolution or e-money may bring about the demise of central banks and give a comparative advantage to free banking. He did not see the possible anonymity with disposable e-purses as important. Goodhart argued that e-money cannot replace central bank base money because only the latter can, in his view, enjoy full anonymity, full security and legal tender status. However, even if currency demand decreases to zero, the central bank is expected to be able set the interest rates though direct quotation to the financial markets.

Obviously, central banks can defend the money that they produce as long as they have the power to make unlimited losses with the full support of the nation. But, the risk of currency substitution may force central banks to leave rates to be determined by market forces. As long as the support behind the central bank is both safe and sound, the market price may be affected by central bank interventions, but once the market questions the cover of money, the risk of financial crises may follow, as it happened in Turkey in 1994. In practice, it may be that central bank intervention is rendered unnecessary by the realisation of the efficiencies to be brought by information technology in general and e-money in particular.

Freedman (2000) reached a similar conclusion while making a case for the continuation of central banking. He named two instruments necessary to its survival: the potential to refuse the settlement on payment systems other than its own, and -when necessary- making or taking deposits on financial markets to force the market rates under its control. But, again, the issue was not that free banking would require such things, but that they offered a way for central banks to continue their role in monetary policy management. Woodford (2000) defended a similar line of argument. Obviously, the power to impose tax gives the power to defend the central bank as well, but the concern here is whether central banking is the most efficient way to maintain the integrity of money with its full cost or whether e-money can increase alternatives to the 'right to choose' with regards money.

All these discussions support the relevance of e-money to free banking. In free banking terms, the basic requirement for an e-money proposal would be the promise of convertibility with any other currency demanded by the holder. Provided the regulatory environment were set to allow private competing currencies, this requirement would now be met more easily than,

say, 20 years ago. While it may not be appropriate to expect a revolutionary transformation of current financial systems, further deregulation of domestic and international financial institutions may lead of itself to an evolutionary transformation towards free banking.

The relation between e-money and free banking, as a result, seems that e-money has very significant, even synergetic, effects. Not only does e-money foster a clearer understanding of the nature and workings of money, and thus of its 'proper' management with its influence on banking and finance that has been analysed in the earlier section, but its electronic issue may provide a technical means to bring free banking into play. Provided the electronic issue of money does not become subject to excessive regulation or outlawing, it may enrich currency choice through a process of substitution that has been supported by the e-money-based financial service provision. Chief influences of electronisation which suggest such a scenario are the following:

1. Because bits and bytes are more easily re-defined than banknotes and coins, it may be easier to revise or change currency representation, leading, in the case of countries, to easier entry and exit to monetary unions, and facilitating inter-currency switching by end-users and, therefore, private money issue. This view may be supported by the long planned currency conversion in the Euro area with conventional banknotes and coins. In a future with e-money, any serious financial problem that threatens the Euro may allow individual members to express their reaction with the possibility of designing a new monetary framework. On the contrary, e-money also eases to join in a short time as well for those potential members who has been attracted by well-managed Euro. This mechanism, at the end, puts purely economic pressure to the ECB to respect the integrity of Euro so as to exclude any kind of political pressure. As a non-national (denationalised) currency, it allows non-Euro economies to think of leaving the defence of the integrity of money to ECB as well.

2. Thanks to the opportunities for transparency afforded by Internet applications, money can be backed as easily by commodities as by indices, or both. It does not mean to turn back to commodity backed currencies but the monetary institutions may not take the risk of inflating their currencies because of these opportunities that has been available with the advent of e-money technologies. Integrity of money may be defended with the cover of money, which is explained in the following sections but if the society prefers to see a commodity backing, e-money can only help to realise such a demand.

3. The increasing use of distribution channels such as the Internet, DTV, PDAs and mobile phones, may enable 'good money' to reach end-users more easily. Conversely, end-

users in need of a reliable medium of exchange may find it easier to reach better alternatives. For the same reasons, mismanaged money, what Rudi Dornbusch calls 'funny money'[69], may become limited. E-money in these mechanisms extends the reach of currency substitution to micro transactions other than medium or large transactions. In a sense, currency substitution includes not only store of value but medium of exchange function of money as well. This puts extra pressure to the sustainable inflationary currencies around the world.

4. Ease of access to e-money may speed up the formation of a critical mass, the moment when people generally become willing to accept the new proposed unit of account because they become convinced that it now enjoys widespread recognition and appropriate world-wide liquidity and systemic support. This potential of e-money allows institutions to challenge mismanaged currencies with stronger proposals. The face of alternative proposals may be limited only to imagination. Instead of a non-governmental institution such as ECB, a gold mine company in Australia, for example, may get into the money business to offer an alternative to inflationary currencies with the help fast speed enrichment of distribution channels to ease access to the offer. This option may be open to any company who can create and sustain a customer base for their offer. To complete the picture, these many attributes of electronic banking clearly reflect key features of Hayek's (1990)[70] conception of denationalised money – such as basketisation, autonomous agreement regarding the unit of account, and indexation.

The defence of central banking per se does not explain currency unions, the dollarisation trends spreading in Latin America, or the currency substitution in developing countries' unstable monies. To discuss the relation between e-money and free banking are not, therefore, to address directly the threats to central banking, but to consider the opportunities it

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[69] "When funny money is no joke", Financial Times, 3.1.2000. Monetary reformists also use this term, but they mean time dollars and the like.

[70] Hayek, (1990) interestingly mentioned the potential of electronic money to solve technical problems like the demand for small coins to create a uniformity in order to make life easier for end-users. He wrote in the footnote (page 51) that: 'replacement of the present coins by plastic or similar tokens with electronic markings which every cash register and slot machine would be able to sort out, and the 'signature' (asterisk on the original text) of which would be legally protected against forgery as any other document of value'. Issing (1999) evaluated Hayek's proposal under e-money developments as digitalisation revolution is supported by accelerating progress in computer and communication technologies. The Author mentioned the difference between the elimination of central bank money through innovative and cost efficient e-money products and Hayek's proposal to remove central banks at once for all. The first difference, he argued, is that in the first case, the elimination of central bank money will be a gradual evolution through innovation and improvements in payment technologies rather than a sudden legislative elimination. He named second difference as the preservation of unit of account function of national currency in the first case and as a result preventing adventurous characteristics of Hayek's proposal during the transition.

presents to create a better monetary regime. This is a crucial point. There may well be continued use of interventionist settlement of interest rates through forced clearing procedures and depository instruments, but it is worth mentioning that foreign exchange interventions have failed many times since 1980 and in different parts of the world.

Insofar as free banking considers that sound money not only delivers price stability but also financial stability, it may now be only a matter of time before free banking challenges central banking in practical fact with the advent of e-money. Such a development would be influenced by the manner in which free banking addresses three key questions which e-money serves to emphasise: (i) the role of lender of last resort (ii) the backing of currencies (iii) the multiplicity of currencies

Lender of Last Resort: Under present monetary policy framework, the misbehaviour of one financial institution can have disastrous consequences for the financial system as a whole with regards the risk for a total collapse of the money stock. In order to prevent contagious risk, central banks are given the sole right to issue money without limit and for as long as it takes, provided the situation is in extremes and the danger is systemic. The lender of last resort is a costly arrangement and there is always a risk for socialisation of private losses.

On the other hand, free banking leaves it to the market to 'discipline' bad money and it does not entertain the need for a lender of last resort. It is believed that the system will never fall into a systemic risk because the invisible hand of market mechanism forces every individual financial institution to be ready against bank-runs. It is also believed that weakened and unfeasible institutions will be replaced by the competitors before they create any systemic risk. If the danger still persist, Dowd and others envisage 'option clauses', whereby in extreme circumstances banks can exercise compensatory delays to withdrawals. This is a concept of prudence – appealing to the depositor to avoid rash investment and precipitate action.

E-money serves to reinforce free banking by providing it with a powerful instrument for its realisation and it may decrease the need for a lender of last resort for at least two reasons. The first one is because option clauses becomes very easy to arrange, manage and realise, thanks not only to the electronification of money but also electronic finance, electronic distribution channels and electronic relationship management. E-money serves to decrease the costs of making and performing on option clauses and all manners of contracts between issuers and users. Secondly, it creates new frameworks to analyse individual defenders of the integrity of money so as to take individual decisions, which in the end, eliminates systemic structuring within the financial service provision. It allows individual institutions to develop personalised

relations with the end users so as to be ready to convince them on the quality of their service in case of a fall of a financial institution. Lender of last resort function is not to save individual institutions and unless one failure does not effect other members of the financial system, there will be no need for it in the first place. With increased end-user awareness supported by e-money, no economic entity will question the overall stability of the system when they can easily reach to the data that can convince them about the integrity of money that they rely on.

It may be worth to mention at this stage the possibility and consequences of a seamless emergence of free banking since even present events seem to be taking their cue from free banking precepts. In the case of Long Term Capital Management (LTCM) in the autumn of 1998, for example, the New York FED orchestrated, but did not participate in, a bail out by other Wall Street banks, who, presumably, mustered enough reserves to meet the situation. Losses were not socialised. Similar can be said of Barings in 1996. In the case of the Reserve Bank of New Zealand, even though it has regulatory responsibilities, its requirement on banks to account direct to the public appeals to, or at least induces, their common interest as financial service providers to co-operate against systemic risk. E-money confirms this direction and even enhances realisation of it. The pre-emptive techniques of free banking can readily be introduced as pre-stated conditions requiring e-money users to click on "acceptance" before proceeding. These developments already give signs of free banking practices even under current monetary policy framework and e-money can only extend the reach of these practices.

Currency Backing: If it is clear that a lender of last resort is not envisaged by free banking because it is not necessary, attention may be turned to two related topics – the cover of money (backing of currency) and a multiplicity of currencies (currency competition). The unit of account function of money generally has two aspects. On the one hand, for money to enjoy general acceptance, the unit of account needs to be widely recognised, otherwise circulation will be impeded and people will not wish to use it. Thus, for example, the US dollar enjoys far greater global acceptance than the Russian rouble. In crisis moments, however, the unit of account in itself is not enough. Money's ability to act as a medium of exchange becomes a matter of its backing or its cover. Until 1973, gold provided the anchor for all currencies, even though technically it was held at a remove. Since then, foreign currency reserves (that is to say, other units of account) have played an increasing role. To give an example, the backing for the US dollar is the power of the US economy to keep the value of dollar against other currencies strong enough to eliminate any loss of the value for end-users. Liquid money and capital

markets and strong fiscal structure with budget surpluses further sustain the cover of the US dollar.

It is important to consider the question of cover in the context of the overall approach (Figure 7.1.5). It may be no accident that much of 20th century monetary history centres on a debate about cover and the quest for a replacement to the gold standard of equivalent effect but without the disadvantages of gold. It was during the beginning of the 20th century that central banks (in the negative sense) came to the fore, printing bad money seemingly without constraint. The ultimate cover of such money is future tax revenue, which is an indirect reference to future profitability. Tax cover and fiat finance may disguise but cannot change the basic economic fact that the cover of money entails a spectrum between potential values and created values, future profitability and existing assets, or a mixture of the two. Where the spectrum lies depends largely on economic conditions.

FIGURE 7.1.5: SPECTRUM OF COVER

CONSUMABLES **(TAXATION)** **FUTURE PROFITS**



This image is neither new nor radical. In terms of analytical framework, the spectrum of cover suggests that 'cash', or money as a medium of exchange, is related to the finite things that one can buy. Insofar as money is not backed by consumable goods, it cannot but be a potential (and in crisis moments, actual) call on future profits. This is the true match for money as store of value. This image is important because it is ordering, on the one hand, yet admits to a wide variety of backings, on the other. One cannot say, for example, that gold is good and assignats[71] are bad. Indeed, free banking experience embraces both. The point is that the backing has to be appropriate and adequate.

[71] Even though all of around 60, (Schuler (1992) gave this number arguing that they lasted from a few years to over a century) free banking experiences around the world were in one way or another backed by gold or a similar commodity (metallic standard), French experience provides an actual example for fiat money based free banking including coins backed by bank-notes. White E.N. (1991) explained two periods in French Revolution that free banking played a role. One was 1790-92, where private notes were redeemable into government supplied fiat money. The other was 1797-1803, where coin was exchanged upon demand. The first period was a reaction to the scarcity of smaller denominations not provided by the monetary authority and private banks emerged as 100 percent reserve banks to issue 'bills of confidence' in small denominations fully backed by fiat money. The government was supplying the outside money as assignats in large denominations and free banks supplying the inside money under a competitive basis. Bills of confidence were widely accepted as a medium of exchange even they were not legal tender and banks discovered soon that they could operate with fractional reserves. The second

In the world of so-called alternative currencies, often the same software package is used, but the currencies are denominated by reference to local artefacts or symbols. For example, tales in Canterbury (after the famous book by Chaucer), but yawls in nearby Whitstable (a type of fishing boat used there). Similarly, these currencies have a variety of economic underpinnings. Some are related at 1:1 or other parities to the national currency and to each other. Others define themselves in terms of a set wage. The yawl, for example, being equal to £5 per hour, regardless of what one does – jobbing gardening or legal services. Likewise, in New York State an Ithaca Hour is equivalent to one hour of work valued at $10. The same trend holds for virtual (i.e. Internet-based) experiments as well. Digicash, for example, was intended to create a pure Internet-based representation of national currencies, whereas e-gold represents a digitalised allocation of gold, enabling it to be used as a medium of exchange for virtual life with the potential to reach conventional life in the same way as achieved through the co-operation between Mondex and Beenz, namely, smart cards.

Provided e-monies remain uncontrolled and unregulated other than the free workings of markets, therefore, their emergence implies a furtherance of free banking precepts. This possibility is especially real because e-monies support independent clearing systems with decreased demand for central bank money and allow non-bank credit expansion through an easing of distribution channels. A further feature - anonymity – reinforces this trend and may prove possible with the development of 'blind signature' technology or, more simply, by the use of disposable tokens issued on the networks of PCs, DTVs, PDAs palms and mobile telephony. E-money, as a result, puts extra pressure to keep the cover of money strong enough to keep the integrity of money to sustain the trust. As a result independent issuers of e-money may decide to back (or cover) the issued amount with alternative choices. For example, the issued amount of money may be fully backed with money market funds. Another backing may be stock exchange indexes or any kind of real estate funds. Actually there is no limit on the

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period was between 1797 and 1803 after the closure of free banks did not solve financial system problems and assignat inflation created financial turmoil including the closure of all banks. From 1797, private banks started to emerge serving basically commercial community, smaller banks but not the general public. There were few dominant banks in Paris whose notes accounted the main stock of exchange media. Private bank's notes were accepted by government tax collectors. The second period ended by forcing these free banks with armed forces in order to create a national bank. The author named lessons from the French experience with free banking as the absence of any apparent interest in the insurance of bank notes or deposits. He also mentioned that it was not abandoned because of systemic defects but to create a national bank. Nataf (1992) described the French experience as to function as freely satisfying public in a smooth way despite the difficult times of war, theft and embezzlement. According to the author, French free banking had strong prosperity, solvency and stability but still eliminated to create a national bank.

alternatives for backing because anything that can sustain end-user's trust on the integrity of money may be used as backing. There seems nothing wrong with the current backings of major world currencies as well. As long as the US dollar and Euro are competitive and end-users in the US and Europe are allowed to choose between these two currencies, they may compete with their backings as well. In this case, the backing of the currencies is just the future potential on either side of the Atlantic to sustain the strengths of these economies. As far as financial stability is sustained on both areas with competent central banks, the end-users will have no reason to ask for an alternative backing but once there is a demand for another backing, then e-money can only help to design a new arrangement and help to sustain the compatibility against weakened currencies.

Multiplicity of Currencies: The prospect of unregulated currencies implies multiple currencies or currency competition, giving rise to the question of how these would work. The case of LTCM, for example, illustrates the ability of financial institutions to create excess credit, a characteristic made more problematical where the money involved is e-money and one that may warrant a review of the relation between the monetary base and credit creation. It follows that the nature of the respective covers may be defined differently, and yet 100% cover is maintained in both cases (Figure 7.1.5).

The fungibility of cover is supported by the clearinghouse system, which does not arbitrate over what the 'right' cover should be, but leaves this to the market. After free banking theory, multiple currencies do not proliferate, but are subject to rationalisation. In their ultimate expression of self-administered banking (home banking, etc.), one can envisage one currency per person. This is wholly impracticable, however, since trade and division of labour even between two people requires a common element, a universal language enabling communication. It is said that multiple currencies imply a worldwide bank, but surely this, too, requires a common language. However many names given to separate currencies, they need to be linked. To be sure, these linkages do not need to be determined, as under the gold standard, from gold (or some other backing) via a primary currency or numeraire, thence to all others. Rather, the independently determined currencies will coalesce in an implied reciprocator ('best basket'), a shared unit of account one level up, so to speak. Parities may not all be 1:1, but parities will be needed and they will need to be based on floating, so that market forces can be allowed to work to discover the best denominator. Put another way, the actual parties to any transaction are free to determine the parity that suits them.

Insofar as this scenario goes beyond national economic considerations and the world economy at large becomes the primary frame of reference, here again free banking's recognition of the need, at least as advocated by Hayek, to denationalise money. This, as is readily conceded, leads to a shrinking number of currencies – the logic of which may be the universalisation of finance. Global financial markets and electronic finance in particular do not respect national monetary jurisdictions, so that their impact must be to promote homogeneity in the fields of monetary policy and supervision, and the denationalisation of money. Indeed, for this purpose, there could hardly be a more effective means than e-money.

The denationalisation of currencies gives rise to a further consideration, however. To denominate money in a national motif is to mask the fact that what really matters is (a) its interchangeability with other currencies and (b) their mutual convertibility into real rather than fiat or, perhaps better put, sound rather than unsound, cover. In this respect, e-money easily extends the reach of good money with the best cover to the end holder, functioning successfully both as a medium of exchange and as a store of value. Every holder of money also gets to choose from among currencies that are independent of local availability constraints. The multiplicity of currencies in this regard makes more than one unit of account available as the common denominator in trade at both local and international levels with the right to choose the currency that is most preferred. This practice is limited at the moment on the level of currency substitution but e-money extends the reach of good money and increases the level of competition among national and international, which helps to save individually strong money with sustainable integrity.

As a result, privately issued independent e-money may not find a place to challenge the influence of the US dollar or Euro but this may not lower the impact of e-money to ease free banking practices. A competition between Euro and the US dollar itself may extend the reach of free banking to possibly a better financial order and legally supporting this potential by allowing legal tender status on both sides for both currencies may further enrich free banking practices.

7.1.6. CONTESTABLE CENTRAL BANKING

The fact that e-money not only supports free banking, but provides a medium for its implementation, gives rise to a question concerning the interface of this development with modern central banking. It seems that there is a need to envisage a transitional arrangement that

enables central banking to move towards free banking. This is what it refers to the concept of contestable central banking.

Definition: Because of the controversies associated with central banking, the term may require some introduction. It does not refer to the central bank as the agent to or banker of government in the traditional sense. Even though central banks have acquired many functions that they fulfil on behalf of governments, the focus is on their role in what one might call systemic management of the economy. While for many people this may be a proper and appropriate role for government, this analysis does not regard monetary matters as needing to be carried out by governments. Indeed, history shows that when governments control central banks they often cause considerable financial and monetary mischief. Contestable central banking looks beyond central banks as instruments of short-termist and/or inflationary policies. The concept thus takes account of such actual developments as the transfer of debt management out of central banks and the private delivery of public account operations. It also envisages a change of emphasis in the role of central banks towards financial data collection, as in the example of the recent the BOE Act, which gave the Bank the right to collect from any source all kinds of data pertaining to a full analysis of the functioning of the economy. Finally, contestable central banking entails taking the international or global context as a primary frame of reference, and is thus compatible with free banking concepts of denationalised money.

It is here not claimed that contestable central banking equates with free banking, but that it may describe a transition route towards it –a natural evolution away from interventionism to contextual influence. White (1995) arguing that the rationale of free banking is simply that of a spontaneously evolved or 'natural' monetary order also shares this approach. Under free banking, at the centre of the economy is a clearinghouse for financial institutions based both on competitive issue and competitive backing. In this system, financial data are generally available and the onus is on the user to assure himself that he is not accepting 'bad' money. E-money can only enhance the transparency and general availability of data that free banking contemplates. Similarly, as its name implies, contestable central banking distinguishes between central banking and central auditing, referring to arrangements in which central bank functions have been reduced and focussed on to the collection and analysis of financial data, rather than direct management of money flows. Money-become-information becomes the medium for making sound judgements for otherwise market-based activities, enabling the markets to do the work of the central bank, especially with regards to monetary policy and financial supervision. In this sense, a contestable central bank acts as a societal agent in its own

right, focusing on contextual decisions, but otherwise leaving the direct provision and management of financial flows to the markets, a concept that very much reflects free banking's clearinghouse.

A concrete indication may be the latest developments in the case of the BOE. As well as having made price stability the focus of its monetary policy, pursued in the framework of central bank independence, the Bank has devolved supervision. It has also set up a Monetary Policy Committee (the MPC) as a body of financial and economic experts with a clearly economic remit – to deliver price stability. Whether or not the Bank can be seen as a model, the fact seems certain that it illustrates a clear trend in central banking to allow central bankers to take decisions in accordance with market initiatives, rather than government interests. As a result, central banks have started to publish informative reports explaining current and expected monetary conditions. This trend towards market orientation may be a step towards full dependence on the 'invisible hand' working of market forces. From the denationalisation of money point of view, the ECB may provide a similar example in this argument as Euro is an international currency in character. More than that, actual dollarisation is already effective in some Latin American countries. These examples may show that traditional monetary framework is already under a transitory process.

It is in this sense that contestable central banking can be seen to mark a possible transition from a central banking-based monetary policy framework towards free banking. Therefore, contestable central banking could be characterised in the following way:

1. Societal but market-oriented institutions
2. Expertise based, rather than government appointed monetary policy committees focussed on market solutions instead of interventionist policy instruments.
3. Exclusion of debt management.
4. Exclusion of liquidity management relating to public accounts.
5. Exclusion of financial supervision.
6. Exclusion of Issue Department through privatisation of bank note issuance and the Mint.
7. Maximum transparency on decision making process.
8. Maximum efficiency in data analysis and risk management.

This operational definition of contestable central banking presupposes the image of the central bank as a societal agent in its own right, mandated by and reporting directly to parliament (or its equivalent). The main purpose of the mandate is to spell out in constitutional and legislative terms what the central bank is responsible for and to ensure its autonomy both

from the government of the day and financial interests. The legislative context also sets out how the bank's mandate is to be reviewed and revised and how conflicts are to be resolved. The bank operates in a context of democratic accountability. Not, however, by way of electoral procedures, but by acting in a clear and transparent manner, and by reporting in a clear, regular, and meaningful way to parliament or its equivalent, not necessarily to a national but possibly international as well. It operates in a contestable capacity as regards the workings of economic life generally with the same data being also available internationally. Its ability to work in this way is strengthened by complete freedom in terms of when, how, and what it communicates, provided its transparency and reporting requirements are enhanced thereby. The central bank is essentially charged with supporting the well being and even operation of the economy as a whole, for 'systemicity'. The essential concept here is the promotion of a stable level of economic activity through the maintenance of price stability. Enhanced consumer awareness for financial services by e-money can only help such a framework to be efficient and effective.

Described thus, contestable central banking is clearly not synonymous with free banking, but it may be setting the stage for a more fundamental change of regime. It could, for example, result in central banks behaving as central agencies to help financial institutions find opportunities to reduce operating costs (e.g. payment system standardisation). They could distribute financial data for all economic entities, thus facilitating its analysis by anyone, while also publishing its own financial reports parallel to independent sources. This would serve to inhibit over-issue of any type of e-money (whether backed, indexed, or simple fiat), thus helping guarantee monetary and financial stability by preventing the systemic risk caused by regulatory illusion. With all the above in place, it would then be a relatively simple step for central banks to allow private money issue, eliminating legal tender in favour of competitive issue –not perhaps within single economic areas such as the Eurozone, but between the Euro and the US dollar, for example.

Thus, contestable central banking can be seen as a means for promoting the integrity of money under free markets as far as possible and of limiting interventionism with regard to interest rates, foreign exchange rates and similar financial indicators. It is directly accountable to society in the first place but has well defined responsibilities to report to and be audited by parliament. It reports to the public through periodical reports, even daily when this is needed to maintain confidence in the integrity of money and stability of financial markets. Contestable central banking rejects any kind of political interference in policy instruments and disdains the creation of moral hazard. Market settlement and market transmission mechanisms are given top

priority and stability is defended through expertise with increased risk management and data analysis techniques. The main function of contestable central banking is to fulfil the 'centralised' characteristics of the financial system, which is a common feature of both central and free banking, with centralised here meant in an operational, rather than power sense. It also offers a transition path out of 'incompetent' central banking. Central banks compete with each other to sustain the integrity of their monies within free market rules and they do not prefer to create barriers to entry to their currency zones with any means including legal tender arrangements. End users are allowed to have the right to choose the money that they want to have and they have the right to contract on the money they prefer. Whether this leads to 'competent' central banking or free banking will remain to be seen. In either scenario, e-money is a parallel phenomenon that enriches the solutions to the problems of current monetary policy regimes.

Transforming Seigniorage: As rehearsed already, the concept of contestable central banking distinguishes between three main aspects or tasks - the conduct of monetary policy, supervision of the financial markets, and maintaining the integrity of the unit of account – and then envisages their articulation or devolution. Such an image of the development of central banking has a profound implication in that the seigniorage relation disappears and, with it, the possibility that seigniorage can be abused or highjacked by the government of the day for non-economic purposes. Omitting any mention of it might have suggested that this aspect of the financial system would be unaffected, an unlikely event that it would have been disingenuous to ignore.

Current developments may result in a redefinition of seigniorage, away from the "irrational" and inflationary habit of "printing money" to pay debt, a concept of seigniorage that should be confined to immature approaches to central banking. The expectation here is that money is sufficiently understood nowadays, at least in the developed economies, so as to be beyond the mis-management entailed by such practices. The latest financial turmoil in Russia, for example, had much to do with not having appreciated that the inflationary effects of manipulating the domestic monetary base would invite currency substitution and thus undermine the financial system. In the Russian case, it is likely that any seigniorage gains expected were more than cancelled out by the punishing short-run interest rates that the mis-management incurred, as has been the case in other such situations[72]. This hardly makes a case

[72] In 1994, the overnight interest rates in Turkey have jumped above 1000 %.

for seigniorage. On the contrary, seeking income from the printing of money is likely only to cause distortions in the money stock, leading to monetary and financial crises. Consequently, it may be better to limit the definition of seigniorage to the amount of profit from money business made by public authorities through their production, distribution and management of money.

In recent years, for example, especially in developed economies, a significant portion of profit has come from the interest earnings from the bond and bill holdings of monetary authorities used to back the amount of currency in circulation. For example, the US Treasury earns around 5% seigniorage on the issuance of dollars. The BOE also profits from bank note issue through its Issuing Department (see Chart 7.2.4), so that even in current circumstances central banks can make a profit without dealing with banknotes and coins, since the Issue Department of the BOE is accounted separately. As the chart shows, the Banking Department is independently profitable, with some of its profit even being transferred to HM Treasury. At the same time, the cost of central banking has been diminishing along with that of conventional banking, thanks in part to the effects of cheaper computing and communicating costs.

7.1.7. CONCLUSIONS AND RECOMMENDATIONS

Especially in the last decade, there seems to be a general interest on laissez-faire banking. It might have been started as an academic interest on the topic without many support from the financial world but currently, it may be argued that even central bankers (Greenspan, 1997 and 1998; Issing 1999) started to re-evaluate free banking experience in an historical perspective and reach to new decisive conclusions about free banking as an alternative or complementary approach the current financial system.

Three basic reasons might have played an important role in these developments. The first one is that central banks are not a source for national pride as it was during the evolution of central monetary authorities. The globalisation of financial markets allowed different national currencies to compete each other both in retail and wholesale transactions and many countries seem willing to give up a national central bank for further monetary stability and efficiency. The ECB and dollarisation proposal may be given as empirical evidence for this argument. Secondly, technological developments such as smart cards and financial innovation undermined seigniorage-orientation among central banks and increased dedication to price stability as financial globalisation created an international demand for a safe and sound financial system in addition to domestic pressures. Thirdly, an overview of free banking experiments seems to provide detailed information for an alternative for central banks as some

additional evidence has been put forward in favour of free banking even though a full agreement has been reached yet.

The emergence of e-money products seems to play an important role for laissez-faire banking. But, it may be an underestimation for the potential of e-money products if this process is judged only as an elimination of banknotes and coins. To sum up, the impacts and effects of e-money are broad ranging and far-reaching. They may be summarised three areas in particular:

1. For two main reasons, e-money may lead to a new era for free banking type practices. Firstly, innovation in payment technology is reducing the fixed costs of banking business. Being cheaper than printing, distributing and retrieving banknotes through banking systems, the creation of digital strings of money is likely to reduce the cost of maintaining a payment system infrastructure for the economy as a whole. This may attract more economic entities to provide financial services, as the natural barriers to entry to the banking sector become less effective. Secondly, as the computing power increases, risk management and data processing with huge amounts of entries might become risk-free and less costly to process. It may then be possible that the information monopoly of banks relating to financial services may deteriorate, giving further opportunities for non-banks to supply financial services to customers. Such a development may decrease the special treatment of banks over against other firms, so that the argument about the private positions of banks in an economy may become even harder to defend.

2. The development of e-money further implies radical changes with regard to money, banking, and finance due to the manner in which it 'befriends' markets solutions to monetary problems. Its impact in terms of the lender of last resort function, currency backing, and multiple currencies is likely to be especially powerful.

3. Technically, e-money may have different impacts for different functions of money. With regard to the unit of account function, it may be expected that e-money would decrease network externalities by both decreasing the fixed cost of networking (for example private clearing systems are already available) and by lowering the cost of switching from one local network to the other (choosing alternative units of account without difficulty provided legal tender laws are adjusted to allow 'freedom to contract' in preferred currencies).

With regard to the medium of exchange function, e-money would facilitate currency competition by allowing economic entities to provide technically efficient and effective alternative monies to reach end-users. Competitive issue is not necessarily national in character; it may be international as well, witness the competition between the Euro and the US

dollar. Even at its current stage of development, e-money in banking services provision of 'multiple currency-based individual accounts' that are transferable to any currency at any moment of time, while one bankcard may allow to spend in different denominations anywhere in the world. E-money thus offers local, national and international solutions to settlement problems, thereby enriching the cover of money. Through LETS, anything from bread to time may be defined as money as long as there is a community willing to accept it and such 'local' solutions may be extended to wider regions provided the supply of the instrument manages to create enough demand. E-money enables anything - from gold to seashells – to be distributed electronically within local or international networks. Such a development increases people's understanding of money and financial markets and puts pressure on financial institutions to be more transparent to the society they serve. It brings good money in reach of anybody on earth as far as they have a network connection, and increases the awareness of the growing importance of stable currencies at the international as well as the national level.

With regard to the store of value function, e-money would increase the quality and quantity of information available. This would greatly help to reduce imperfect information possibilities, to increase data processing and risk management techniques, and to make easier portfolio selection procedures. Secondly, it would decrease barriers to entry to financial service provision, a fact already observable in the financial industry. With regard to systemic problems for the financial industry, it is likely that e-money will support individual assessment of the safety and soundness of particular financial institutions. This would allow individual treatment of troubled financial institutions, decreasing contagious trends. By reducing the interdependence of financial service providers in this way, the risk of systemic problems may also be reduced as a consequence of e-money. Lastly, in the sense that e-money also implies or refers to the wider phenomenon of electronic finance generally, it is having a profound impact in the banking system. Taken as a whole, online banking, telephone banking, mobile-phone banking, computer-based accounting systems, and so on, are making entry into banking ever easier by making explicit and replicable processes that previously were not generally understood and were the province of experts.

Although explanations of them may not say so in so many words, current developments in the financial world seem to unfold along the lines indicated in this section. They approximate certain features of free banking, although not as a result of free banking advocacy, and they are reinforced, even accelerated by the emergence of electronic finance and e-money. Their

appearance suggests that, unless 'repackaged' in a contestable way, the future of central banking may become uncertain.

From this point of view, the advent of so-called e-money is both a technological and monetary phenomenon, and care should be taken not to underestimate its significance. If the 'incompetence' argument is accepted, the fact that e-money is of relevance in both central banking and free banking contexts indicates that it will increase the efficiency and productivity of the future of monetary systems, whether conducted within existing or revised arrangements.

7.1.8. APPENDIX: SOME INNOVATIVE FINANCIAL SERVICES

In this following part, relevant developments and products will be given as examples for further implications of e-money products for laissez faire banking.

Internet Banks and Electronic Cheques: Internet technology has been under discussion for a while but efficient banking on the Internet has gathered a pace recently as more attention is paid for its potential. Egg[73] is the banking arm of an insurance company and started as a telephone banking but converted fully as an Internet-based service provider and as of July 1999, it currently pays one of the highest interest for small value deposits in the UK. Within a year from the establishment of the company, the amount of deposits that the company collected from around half a million savers reached to £5 billion as of April 1999. The comparative advantage of the company against banks is to guarantee (at least up to 2001) to pay a deposit rate higher than the BOE base rate. But this is not a special case for the UK as an American based bank[74] named Netb@nk is also on the Internet and again offers an interest rate equals to the FED's base rates for the small scale deposits. Interestingly, the Bank accepts deposits up to a certain amount to give a Federal Deposit Insurance Company guarantee for its services whereas the minimum amount is $100 and pays daily interest on accounts.

The two banks seem to prove business cases for Internet-based financial services. Obviously, direct debit and credit infrastructures, wholesale payment system infrastructures, shared ATMs infrastructure contributed to the successful entrance of these banks to the banking industry. But there could be found more reasons for the sustainability of their success as they have an option for electronic cheques. In June 30, 1998, the US Treasury sent its first ever-electronic cheque over the Internet to a company for services rendered on a military contract.

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[73] www.egg.co.uk provided all the details about the company and online application is possible for banking services.

[74] www.netbank.com provides all the details of the services of the company.

This electronic payment solution is the result of a collaborative effort between members of the Financial Services Technology Consortium (FSTC)[75]. Electronic cheque may give a momentum for sustainable banking services on the Internet in a non-cash basis with direct credit of revenues and direct debit of expenditures. Such a banking service may be provided to help deposit holders for their accounting practices as the financial data could be shared on a digital format and manipulated for accounting purposes with the permission of account holders. This stage was foreseen by Hayek (1990) when he argued that accounting might play an important role on the denationalisation of money.

E-gold: Electronic presentation of purchasing power for national currencies or fully electronic on-line real-time banking services through the Internet may not be the only challenges for the current financial system to be transformed to a freer environment. The technological developments and financial innovation could provide e-gold circulation with perfect liquidity and full convertibility to any other purchasing power presentations including all the national currencies. The company presented its product as "gold itself circulated electronically, the ultimate world-wide free market currency"[76]. Gold & Silver Reserve, Inc. named[77] some of the services provided with an e-gold account as: Balance: To view current e-gold account balance. The weights of each of up to 4 e-metals (gold, silver, platinum, palladium) that owned are displayed. InExchange is to exchange government issued money (currency) for e-metal. OutExchange is to exchange e-metal for government issued money (currency). Redeem is to order delivery of your e-metal in specie held by the reserve. Spend is to spend some of e-metal to another person. Metal-to-Metal is to exchange one type of e-metal (gold, silver, platinum, palladium) for another.

An e-gold account could provide an alternative to current fiat money structured financial system services as it puts gold within reach for small investors. One very interesting application that may be supplied to end-users may be to allow *actual gold or platinum* (fully backed by the metals in real sense) cards being used for credit card transactions. In theory, any financial institution may issue these cards at the moment even they may have some exchange risk for the settlement date. The system may operate in this order. One bank may issue a payment card that spends actual metals such as gold or silver etc. The holder may spend any currency in any credit card accepting outlet. During the settlement date, the bank calculates all

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[75] www.echeck.org
[76] www.e-gold.com
[77] www.e-gold.com/acct/manager.htm

the spending and makes the necessary payment from the actual gold or silver account with the current prices of gold or silver on the 'spent' currencies on the market at that moment of time.

A Currency for the Internet: Beenz: This approach to the presentation of purchasing power is quite different than other approaches as it is not an electronic presentation of a national currency and it is not backed with any other metal or commodity. It is just a unique presentation of purchasing power on the Internet. Currently, Beenz can be earned[78] by visiting Web pages that offers Beenz for visiting, shopping or downloading a service. The account holder has to visit in order to get Beenz, and how many Beenz can be collected plus how often Beenz can be collected would be decided by Beenz providers. Beenz is not convertible at the moment to any other currency but those earned Beenz can be spent on Web-sites that offer products for Beenz. Recently, the concept has moved one step forward: Beenz earned on the Internet may be downloaded to a smart card and be spend on outlets on high streets, if any.

Examples such as e-cheque, pure Internet-based financial services companies, e-gold and Beenz may provide insights about the transformation of the financial services industry. It may be argued that new technologies in banking industry including payment systems innovations, digitalisation of financial assets and e-money already strengthened free banking supporters.

Local Currencies and LETS: Good (1998a) argued that even without a proven business case, there seems to be an increasing attention on cyber-money but people in general neglect the fact that high-tech payment systems are best defined as a form of private currency. The author defined private money as a currency, which is not backed by any government entity and cited that it can have all the characteristics of money as a medium of exchange, unit of account and store of value. It was mentioned that private money is not prohibited in the US if it complies with regulations such as to be smaller in size than the US dollar and issued in denominations valued at a minimum of $1. At the same time, any income received in private money must be reported to tax agencies.

Good analysed two different forms of current challenges to the US dollar. First one was named as local currencies, which are local, low-tech community arrangements to accept a medium of exchange other than the national currency. Ithaca Hours, which is an equivalent of 'one hour work' and equals to $10, was particularly named among around 30 low-tech local currencies. The author mentioned that a local currency is only as good as its acceptability

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[78] http://www.beenz.com/tour.ihtml

within the community and their success may be influenced by alternative medium of exchanges as wide-acceptance is a key to success.

The second one was named by the author as LETS, which is a computer-based membership organisation in which transactions generate credits to be spent within the predetermined community on a membership basis as a network supported by its own internal currency. Around 470 different LETSs were mentioned by the author in five different countries namely the US, Canada, Australia, New Zealand and the UK. A LETS was supposed to function as a clearing-house and information system as well as an account network with an advantage of having an unlimited amount of transaction depending of the network power.

Maybe, only e-money may not shape a future to create alternative financial systems to the current monetary arrangements itself without the parallel developments in financial service providers. However, at least one bank[79], which is among the global top-ten list, already offered a current account that will allow to translate savings into any currency that the deposit holder prefers, anytime and anywhere around the world using its ATM network in the US dollar, Euro and Sterling. The bank advertised that commission fees would not be charged for the multi-currency accounts. Consequently, it may be argued that financial service providers have already started to adjust themselves to extend the dimensions of free banking discussions by offering competing deposits to savers.

7.2. MONETARY POLICY IMPLICATIONS OF E-MONEY

The aim of this section is to investigate two particular implications of e-money for money multiplier and velocity. There are some important issues with regard this investigation. The first issue is the definition of e-money. Unless e-money is included in the calculation of the monetary base, it will be difficult to statistically track changes in the "true" definition of money supply. Exclusion or ignorance of e-money balances may therefore result in confusion similar to the effects of financial innovations that influenced monetary policy in the UK especially during 1980s. By disregarding e-money, the authorities may underestimate the strength of money supply, complicating the conduct of monetary policy.

The second issue is data collection. As e-money is electronic by definition, both the costs of related data collection may be cheaper, and management might be quite easier and more efficient compared to conventional methods. There may also be new opportunities to

[79] The Economist, June 26th, 1999, Page: 107.

deepen strategic analysis of money databases as collected data may provide more insights for monetary authorities on the behaviour of economic entities.

Apart from the definition and data collection, the third issue is statistical analysis of data. Here, the traditional methods for financial data analysis and financial aggregation would play the critical role. Once e-money is defined carefully covering all the aspects of conventional money, then monetary aggregates might need to be redefined as to include e-money balances in monetary base. Although it seems very easy to collect all e-money balances and add it to conventional monetary base, things may get complicated in a world of competing currencies. If e-money is just a replacement of conventional monetary symbol such as pound sterling (representative e-money), then it may be right to add it to conventional monetary base and Divisia indices where applicable. For monetary policy authorities, the critical problem here is to analyse alternative e-money proposals carefully (independent or competitive issue). They need to decide whether issuance of e-money provides a potential to represent a particular currency in electronic form or whether it creates a **totally new** medium of exchange that can replace conventional money in the economy. If e-money ends up being an independent new currency, the central bank might start to lose influence of monetary base as individuals substitute conventional currency holdings with alternative e-values.

Central Banks may not take the right decision unless they understand the nature of e-money. One of the most critical issues here seems to be the relationship between payment systems and e-money issuance. If e-money is treated as a threat to eliminate currency in circulation, then it may be useful to take a look at the historical developments in the area of payment systems. Because, there has been a decreasing demand for banknotes and coins as a medium of exchange as a result of alternative instruments provided by financial industry. The following part will look at the general developments in the payment systems industry from a historical point of view.

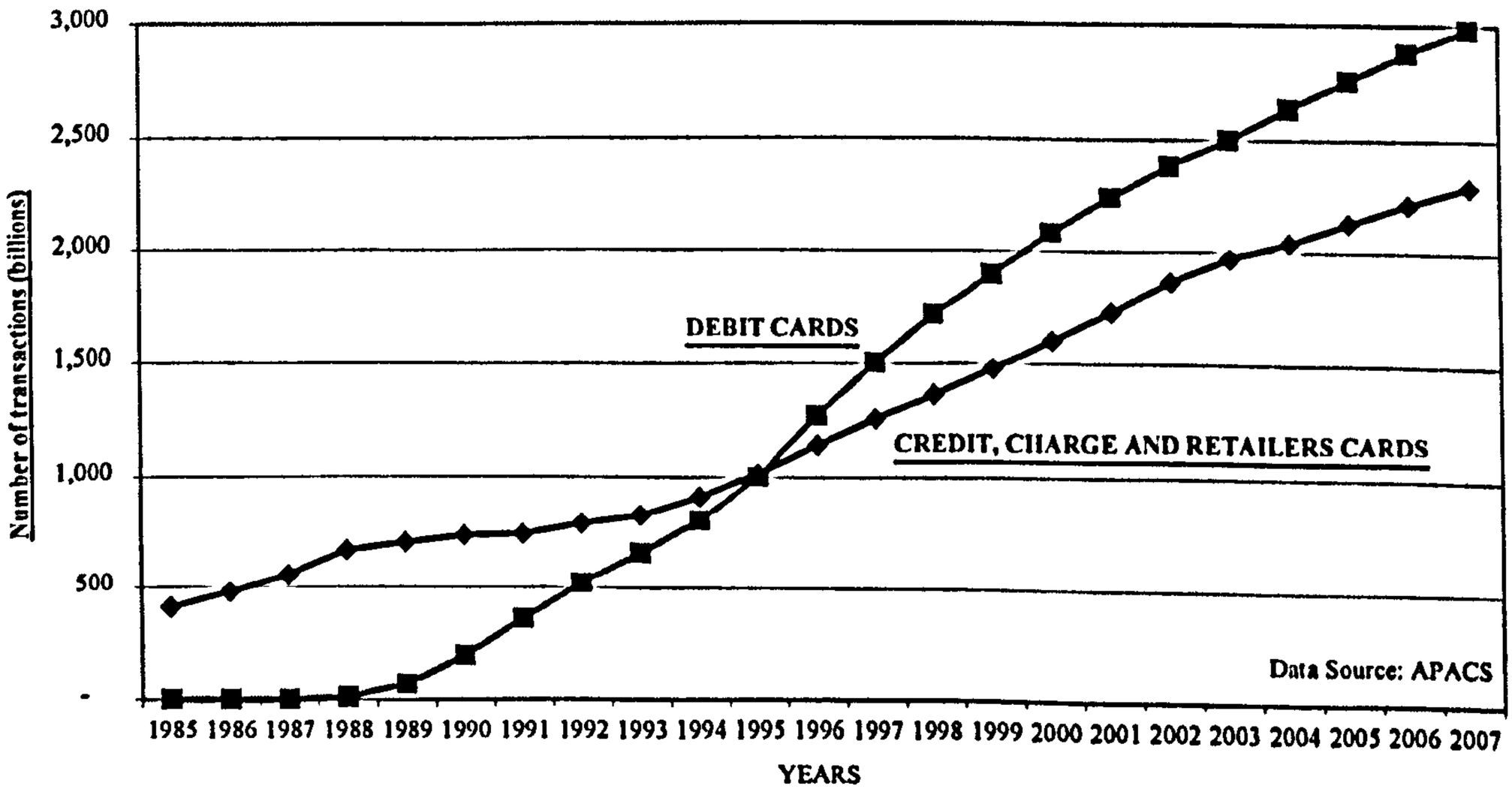
7.2.1. MONEY AND PAYMENT TECHNOLOGIES

Frazer (1985) named three great ages of payments: first notes and coins, then paper payments and, lastly, electronic payments. Without the help of technological development in the computer industry especially in data storage and data processing, it might not have been possible to observe so many developments in payment systems. Especially after 1960, there have been many revolutionary developments in the way that money is used in transactions with

credit cards, debit cards, EFTPOS systems and ATMs. Below is a short description of these developments including the instruments.

Credit Cards: Frazer (1985) defined a credit card as an identification document, identifying the holder for possessing a credit account that allows the customer to accumulate purchases, paying off the account, fully or partially, at regular intervals. The first example of credit cards was in financial service market as 'metal addressograph plates' before 1920 in the United States. By the help of the developments in information technology, many banks started to develop different types of credit cards in 1950s and private companies such as Diner's Club, Mastercard and Visa started to invest in credit card markets in co-operation with retailers and banks. Nowadays, credit cards are widely accepted throughout the world by many banks and retailers. On the other hand, after improvements in debit card system technologies, credit-based payment systems seem to have lost their competitive advantage to debit-based systems. This trend and its extrapolation are clearly exhibited in the following chart for the UK:

CHART 7.2.1: CREDIT, CHARGE AND RETAILER CARDS VS DEBIT CARD PAYMENT VOLUMES



The data up to 1997 is the realised figures and the rest is APACS projections. The chart illustrates the assumption that debit-based payment systems have overtaken credit card payments in volume terms and is projected to continue to do so in the next decade.

Cheque Guarantee Systems: Cheque is a written paper, which lets a receiver to transfer the indicated amount of money from the writer's bank account. The National Provincial Group took the first British cheque guarantee system in 1965. Its 'Travel Card' could be used by customers to cash cheques of up to £20 at any bank branch within the group

(Frazer, 1985). In the following decades, the amount guaranteed has risen by different banks more than £100. By now, electronic cheque is in financial service markets that guarantee the amount with an on-line real-time basis by controlling the account balance. It is recently argued that[80]: Electronic cheque, a new payment instrument combining the security, speed and processing efficiencies of all-electronic transactions with the familiar and well-developed legal infrastructure and business processes associated with paper cheques, is the first and only electronic payment mechanism chosen by the United States Treasury to make high-value payments to the public over Internet. For the past year, e-cheque has been in active use for the U.S. Treasury payments in the United States and, is under development in Singapore, and is under consideration elsewhere. E-cheque is the result of a co-operative effort undertaken by over fifteen banks, government entities, technology vendors and e-commerce organisations.

ATMs: According to Frazer, (1985) the very first cash dispenser in the world was built by De La Rue and installed at Barclays Bank's Branch at Enfield in 1969. Until the innovation of plastic cards with a magnetic stripe, ATM's only function was to give money with coded paper. During 1970s, ATMs started to give cash or to print an account balance. Recently they operate like a bank branch from giving cash to transferring money from one account to another and from currency exchange to buying and selling bonds and bills on-line real-time. An ATM is a machine, which is capable to recognise the customer who can use the machine for many different kinds of banking services.

EFTPOS: This is an electronic system which allows the buyer to transfer the cost of purchase from an account at the point of sale on a real time basis to the seller's account. The functioning of debit cards which lets the holder to use his/her bank account in making payments on an on-line basis may be the best example for an EFTPOS transaction.

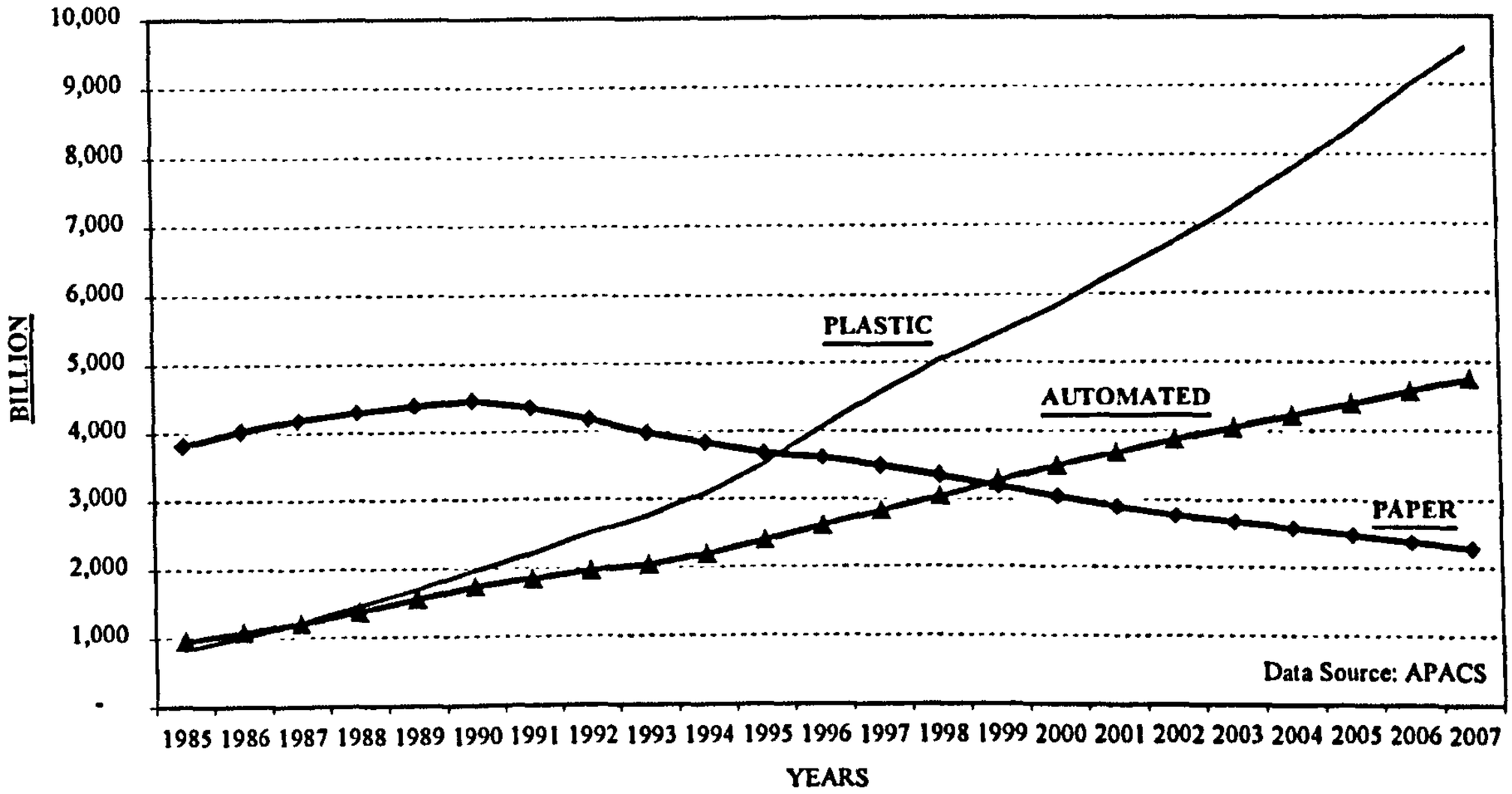
Direct Debit: With the help of data processing technology, banks can provide direct debiting services to their customers. A direct debit is an order to a bank to pay a certain amount or a certain type of bill such as telephone or electricity for a certain period of time to a certain third party. After a direct debit order, the customer does not need to follow the payments because bank will realise it at the specified payment dates. By this technique, all the telephone bills of a country may be paid (with an assumption of an account with a direct debit order for all the users) without the involvement of telephone users. Direct debit is obviously different

[80] http://www.echeck.org/

than standing orders, which is a periodically fixed amount of payment arising from a certain type of contracts with instalments.

Chart 7.2.2 shows trends in payment systems in the UK up to 1997 and gives APACS' projections until 2007.

CHART 7.2.2: PAYMENT SYSTEM TRANSACTION VOLUMES



The chart indicates that paper-based payments are not the most favoured instrument as it has been so until 1996. Then, plastic payment instruments such as debit and credit cards will be the preferred payment methods. Second best choice seems to be automated payment systems such as *direct* debit and credit. Especially direct credit seems getting popular all around the world through electronic benefit transfer systems and direct payment of wages (public and private sector) and allowances to bank accounts.

Electronic Payment Systems (EFT): Japanese Zengin system started to operate in 1973 as a centralised computer database for all the financial service companies to provide on-line authorisation for money transfers (Frazer, 1985). Like Fedwire in the USA, CHAPS in the UK and EFT in Turkey many countries have a kind of centralised electronic payment systems to make payments and transactions easier and easier. This kind of systems have been started for wholesale payments but with the help of technological innovation, the capacity of these systems became enough to support retail transactions, too. Even the international transfers may be supported by a similar system, which is called as SWIFT (Society for Worldwide Interbank Financial Telecommunication).

Telephone Banking: Telephone banking may be understood as a banking service, which is provided by a bank on direct contact with the customers on the phone (like First Direct in the UK). The new technology supports the banks to provide such a service. Mobile phone technology may support a radical approach to financial services with increased functions (WAP banking).

Internet Banking: Recently, there seems to be a trend to concentrate on Internet for banking. Some institutions even prefer and offer Internet-only banking such as www.smile.co.uk and www.first-e.co.uk. This may mean that the level of electronisation in banking industry is developed enough to sustain all kind of financial services without a 'brick and mortar' bank. An Internet bank seems to cost not more than a million the US dollar according to the latest figures, which extends the implications of Internet banking further (Gosling, 1999). Obviously, almost all the major international banks have opened their Internet Banking services as well. In order to understand why Internet Banking is so attractive from the cost of services point of view, the following figures may provide some insights. According to the US Department of the Treasury (2000), one transaction costs $1.02 in the branch, $0.54 on the telephone, $0.27 from the ATM full service, $0.02 on PC banking but only $0.01 with Internet Banking.

The following part looks at the electronic purse, which is the technology that created the multi-purpose prepaid cards and open the way to the possibility of making money electronic.

Electronic Purse[81]: is defined as a reloadable multipurpose prepaid card, which can be used, for retail or other payments by the BIS (1996b). Electronic purses differ from other cashless payment instruments because they are supplied in advance with generally accepted purchasing power. Their potential to reduce significantly the use of notes and coins is even greater than that of other debit instruments *since they are the first cashless instrument which would be used for very small amounts.* Wenninger and Laster (1995) defined e-purse as a prepaid card in which the record of funds can be increased as well as reduced. They assumed

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[81] Some relevant definition on e-purses: The relationship between technological development and financial service innovation may best be observed in single purpose prepaid cards. **A Single Purpose Prepaid Card** may be defined as a card that is bought in advance in order to buy a single kind of good or service like using public phones or travelling through the underground or at public bus chains. These cards started to get smarter and smarter and with the help of new technical discoveries. BIS (1996b) defines **Multi-purpose Prepaid Cards** as cards that can be used for a wide range purposes and has the potential to be used on a national or international scale but may sometimes be restricted to a certain area. These cards have a microchip embedded on them and as a result, they are able to make more than one job so that they can be used as a credit card and identity card at the same time. Whereas single-purpose prepaid cards may not replace money due to the lack of general acceptance; multi-purpose prepaid cards may be used as money depending on the level of general acceptance.

the stored-value cards same as the electronic purse and define it as a multi-purpose-prepaid card the size of a credit card. They argued that if e-purse is successfully implemented, it might fundamentally alter the way in which people spend money.

Chip Card *(*also known as **Integrated Circuit)** may be defined as a card containing one or more computer chips circuits for identification, data storage or special-purpose processing used to validate personnel identification numbers (PINs), authorise purchases, verify account balances and store personal records. **Smart Card**[82] may be defined as an integrated circuit card with a microprocessor that is capable of performing calculations. According to a report on prepaid cards (EMI, 1994) technological developments have enabled further improvements in the use of plastic cards. In this respect the introduction of the chip or "smart" card was seen as an important development. A chip card contains a microcomputer, consisting of a microprocessor and a memory component, which is embedded in the card, thereby allowing remote verification and, accordingly purchases at a local level which previously could only be executed, for security reasons, after on-line reference to a central computer.

The use of such a card need not be restricted to payment transactions, but could be extended to, for instance, the registering of retailers' promotional activities or even to totally unrelated functions such as the storage of medical information amounts (EMI, 1994). It is this technology that created the electronic purse, which has the potential to replace cash. Because, for an instrument to be defined as e-money, it should have no direct contact to an account at a financial service provider at the real time of transaction. Otherwise, the instrument is merely an another form of payment – not an independent representation of purchasing power. Telephone cards, for example, are stored-value cards, which are capable of storing purchasing power but just for a single purpose 'to make phone calls'. This purchasing power should not be accepted as money, electronic or not, but just a payment instrument, because money is a medium of exchange that can be used in any kind of transactions. The name 'prepaid card' implies an advance payment of purchasing power to be stored in a card but it does not have to be so. Technically, once money can be stored in a card, it may be prepaid or it may be earned.

Software Purse: Other than storing prepaid value in a card; after the developments in cryptography, it is also possible to store prepaid value in a personal computer. Software purse

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[82] The US Treasury Department (2000) gave the figures for smart card circulation around the world as 1.3 billion in 1997 and almost 67% of it was in Europe. The Projections for 2004 is estimated as 5.7 billion, a figure that may be accepted as a clear evidence of how smart cards may radically change the way economic entities pay and receive payments.

may be defined as multipurpose prepaid software, which can be used for any kind of payments on open networks (conventional or mobile). It should be re-loadable and have all the similar specialities of money. Software purse converts money to software records like bits and bytes. The purchasing power converted into a computer record with the help of cryptography in order to guarantee the security and with the help of encryption, records can be sent securely from one computer to another. Digital signature increases the level of secure authentication.

The reality of e-money in this process is that software purse[83] can be spent independently from a financial service account. Software purse may especially be preferred for payments through conventional or mobile networks. Open network such as Internet may be accepted as unsecured because anybody can reach to any kind of message in an open network. Without security measures such as cryptography, it may not be possible to circulate e-money in networks such as Internet.

All the above developments in payment systems have resulted in making the handling of money easier and easier. Because, with every development in payment systems, bank customers became more confident to find a particular instrument other than money to make transactions.

As analysed in this section, payments have been electronised especially in the last two decades even if it started in 1960s. In many countries such as the UK and Finland the plastic cards per capita has risen above one implying that many people prefers holding more than one card. One common limitation for all access products is the telecommunication cost that stops them being capable of electronising micro-payments. In the UK, debit cards may already be used to buy a chewing gum in some high street retailers' chains but this is not possible in corner-shops. In this sense, it may be argued that e-money will be the final frontier for transaction demand for banknotes and coins in circulation. In this regard, payment system

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[83] Some definitions may contribute to the investigation of software purses: **Cryptography** is "the application of mathematical theory to develop techniques and algorithms that can be applied to data to ensure goals such as confidentiality, data integrity and/or authentication" (BIS, 1996b). **Asymmetric cryptography** "(also called public key cryptography) is a set of cryptographic techniques in which two different keys (private and public keys) are used for encrypting and decrypting data. The private key is kept secret by its holder, while the public key is made available to communicating entities. **Symmetric cryptography** is a set of cryptographic techniques in which devices share the same secret key in combination with algorithms. For encryption, the same key is used for encrypting and decrypting and the decrypting algorithm is the reverse function of the encrypting algorithm" (BIS, 1996a). **Encryption** is "the use of cryptographic algorithms to encode clear text data (plaintext) into ciphertext to prevent unauthorised observation" (BIS, 1996b). **Ciphertext** is "the encrypted form of data" (BIS, 1996a). **Digital Signature** is "a string of data generated by a cryptographic method that is attached to a message to ensure its authenticity as well as to protect the recipient against repudiation by the sender" (BIS, 1996a).

technology improvements will only help to decrease the cost of sustainable e-money infrastructures.

The aim of above synopsis has been to emphasise that without even e-money, improvements in payment technologies have already decreased the weight of base money on the total money supply. In following sections the relationship between money multiplier and e-money will be investigated followed by an analysis on velocity.

7.2.2. MONEY MULTIPLIER AND E-MONEY

Sloman (1999) defined money multiplier as the number of times greater the expansion of money supply is than the expansion of the monetary base caused by that expansion, and formulated it as $\Delta Ms/\Delta Mb$ where Ms represents total money supply and Mb monetary base. The author stated that in the UK, the money multiplier is given by $\Delta M4/\Delta M0$ and demonstrated how it is calculated:

The total money supply is represented by M4 in the UK and may be divided into two as deposits in the financial institutions such as banks and building societies (D) and cash held by the public (C). Then, a rise in the money supply is be given as:

$$\Delta M4 = \Delta D + \Delta C \quad (1)$$

The monetary base in the UK is represented by M0 and consists of bank and building society reserves (R) plus cash held by the public. As a result, a rise in the monetary base is given by:

$$\Delta M0 = \Delta R + \Delta C \quad (2)$$

Money multiplier m is defined as $\Delta M4/\Delta M0$. Then, by substituting equations (1) and (2):

$$m = (\Delta D + \Delta C) / (\Delta R + \Delta C) \quad (3)$$

If it is assumed that financial institutions prefer to hold a given fraction (r) of any rise in deposits in the form of reserves, then;

$$r = \Delta R / \Delta D \quad (4)$$

and the public prefers to hold a given fraction (c) of any rise in its deposits as cash, then;

$$c = \Delta C / \Delta D \quad (5)$$

If the top and bottom of equation (3) is divided by ΔD,

$$m = ((\Delta D / \Delta D) + (\Delta C / \Delta D)) / ((\Delta R / \Delta D) + (\Delta C / \Delta D) \quad (6)$$

or,

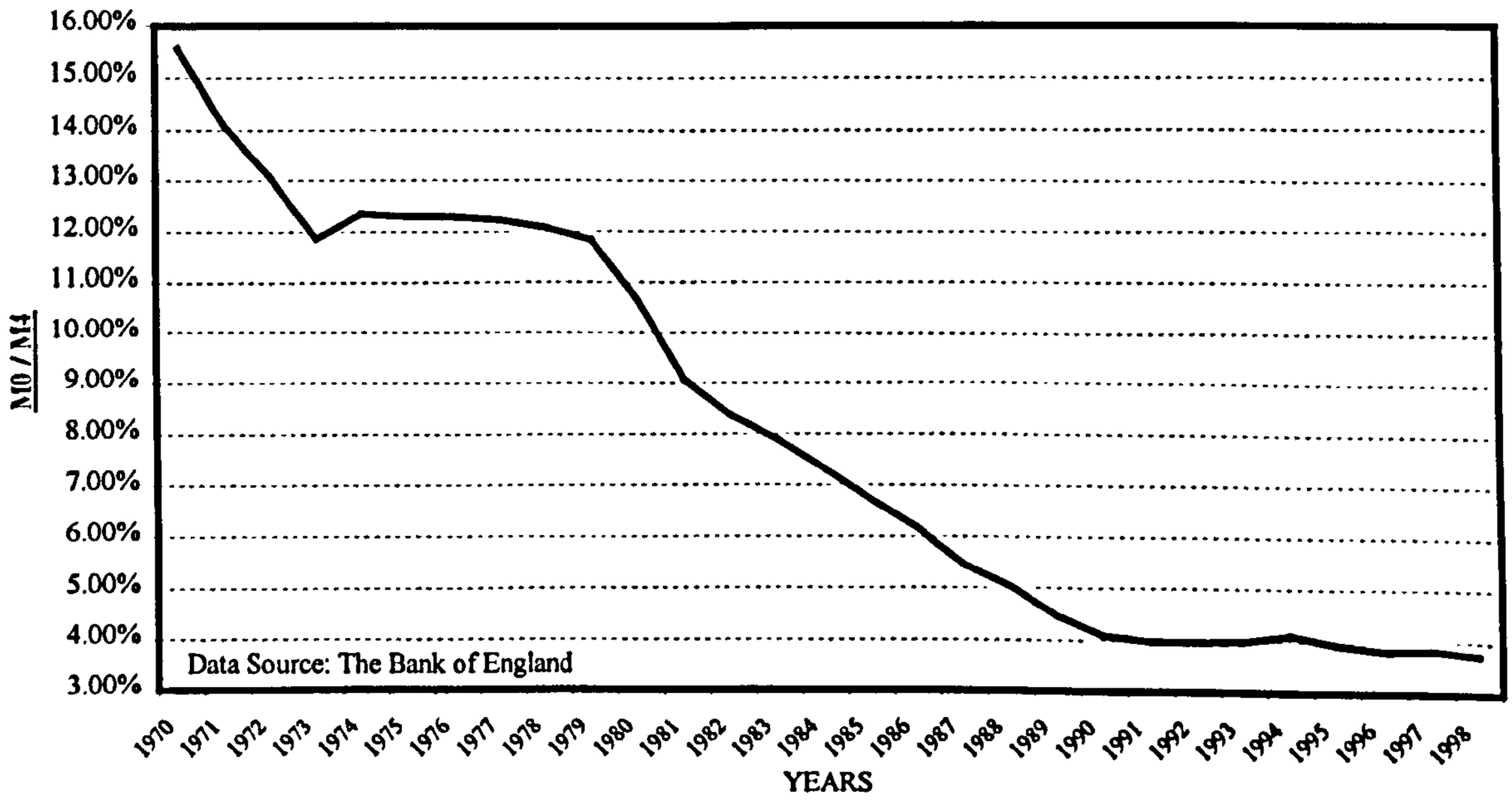
$$m = (1 + (\Delta C / \Delta D)) / ((\Delta R / \Delta D) + (\Delta C / \Delta D) \quad (7)$$

or,

$$m = (1 + c) / (r + c) \quad (8)$$

The money multiplier would be defined as ΔM4/ΔM0 in investigating money multiplier implications of e-money. According to this definition the trend of money multiplier is exhibited in the following chart from a historical perspective and starting form 1970 with the UK data:

CHART 7.2.3: MONETARY BASE TO BROAD MONEY RATIO IN THE UK



As the chart indicates, the weight of monetary base on the total money supply decreased from 16% in 1970 to less than 4% in 1998. This result may have implications for e-money discussions because the erosion of the monetary base has been a long-run trend. Clearly, it may be argued that even without e-money, central bank banknotes are already under threat as alternative payment systems provide better solutions to transaction demand for money.

Monetary aggregation is another issue here. When central banks need to make changes and adjustments on the definition and coverage of individual aggregates, there seems to be no reason not to do so. As the BOE made many changes since 1970, e-money may only cause just another alteration on the definitions, especially narrow ones.

Analysis of developments in the stock of money can help in an assessment of the state of the inflationary pressures in the economy. On the other hand, the relationship between money and inflation is complex because of variations in the level of wealth, financial innovations and disintermediation. For that reason, monetary aggregates are used as

information variables by the UK monetary authorities when analysing the appropriate stance of monetary policy, rather than as intermediate targets (Salmon, 1995).

After the experience gained during 1980s relating to monetary targeting, it may be accepted that UK monetary policy evolved step by step to a kind of monetary information management. The monetary information is used to define the variables that are analysed on the Monetary Policy Committee (the MPC) meetings and is shared with economic entities in full transparency. But, monetary aggregates are still regarded as indicators during the monetary policy decision making process. Recently, the high-powered (narrow) money definition in the UK is **M0** and it is defined by the BOE (1998) as:

- sterling notes and coin in circulation outside the BOE including bank's and building societies' tills plus,
- Banks' operational deposits with the BOE.

Broad money is named as M4 but there is more than one definition for it as given by the BOE (1998):

M4 Retail (M2): The UK private sectors':

- Holdings of sterling notes and coin.
- Sterling denominated retail deposits with the UK monetary financial institutions (MFI).

M4 Lending is the sterling lending by MFI to the M4 private sector.

M4: The M4 private sector's:

- Holdings of sterling notes and coin.
- Sterling deposits, including certificates of deposits, commercial paper and bonds, floating rate notes and other instruments of up to and including five year's original maturity.
- From 1995, liabilities arising from repos at the UK MFI.
- Estimated holdings of sterling bank bills.
- From end-1986, 95 % of the domestic sterling inter-MFI difference (allocated to other financial corporations, the remaining 5 % being allocated to transits).

From 1993, the Bank also publishes time-series for a Divisia index of money for personal and corporate sector and for the whole economy. Divisia money weights the components of simple-sum monetary aggregates to reflect estimates of the extent to which the component provide transactions services. As a result of this approach, time deposits component of M4 carries a low weight in Divisia money whereas M0 components carry higher weights as coins, banknotes and transaction balances are used largely for transactions purposes. The

growth rate of Divisia money measures the growth in transaction services provided by the financial sector as M4 component assets by adding their growth rates. Individual weights may vary over time depending on the presentation of transaction services but weights of all assets for a particular period adds always to one. Divisia money supports the decision making process in monetary policy framework by providing more information about different liquidity characteristics of monetary aggregate components separately and overall (Janssen, 1996). The Bank publishes another monetary aggregates as M3H for the purpose of European relations and this aggregate adds all the foreign exchange deposits in the UK financial sector to M4.

Changes in the Definitions of Aggregates: An important point in monetary aggregation in the UK is that the definitions of the aggregates have been changed almost totally from time to time. There is no aggregate such as £M3, which was an official target before. It is the same for PSL2. These changes are important in e-money discussions because if e-money has a potential to influence or even change the component of monetary aggregates, necessary adjustments may need experience to re-define influenced aggregates. Some of the changes in the definitions discussed by Goacher, (1993) may contribute to the analysis of e-money:

In 1987, **£M3** was relabelled as **M3** and the former M3 became **M3c**. **M4** was introduced and the former **PSL2** was relabelled as **M5**. **PSL1** was abandoned. M4 embodied bank and building society liabilities and **M5** embodied private sector liquidity.

In 1989, M1, £M3 and M3c were abandoned, as they comprised solely the UK non-bank private sector holdings of notes and coins with various groupings of bank deposits. Monetary targeting of £M3 failed almost every year except one and it was concluded that it was distorted as a measure of private sector purchasing power by changes in financial service industry especially through financial innovation and degree of deregulation. Instead **M4c** was introduced.

In 1991, publication of M4c and M5 were abandoned. In 1992, M4 was officially recognised as an important monetary aggregate by the Chancellor. **M3H** was introduced with an aim to cover foreign exchange deposits. **M2**, which was introduced in 1982 was redefined with an emphasis upon the definition of retail deposits and renamed as M4 Retail. The only stable measure is M0. It was introduced in 1984 and stayed as a monetary target between 1984 and 1993. The Bank still publishes M0 regularly as analysed above.

It may be agreed from these historical developments that monetary aggregates may be redefined or totally abandoned, as there happens to be a structural change in the financial service industry. It may even be a necessary step to introduce new definitions as it has been

done in the UK for so many years. It may be concluded that if e-money may create a need for revision of monetary aggregates then, central banks including the BOE have enough experience to do so.

The Role of Money in the UK Monetary Policy: It was 1970 when Goodhart and Crockett concluded that to the extent that price stability ceases to be an accepted norm, and expectations of inflation, or even accelerating inflation become wide spread, this claim that the rate of growth of the money stock may be a better indicator of the direction of policy, than the level of interest rate takes on merit. But because there will always be multiple objectives -for example the balance of payments, the level of employment, the distribution of expenditure etc.- no single statistic can possibly provide an adequate and comprehensive indicator of policy. After 27 years, Astley and Haldane, (1997) confirmed that money still has an important role to play, over both short and medium-run horizons, when gauging incipient inflationary pressures- as originally intimated by Goodhart and Crockett. They, on the other hand, found out that monetary aggregates have in the recent past not offered sufficient robust early-warning signals. Although information was found in money, it may not be a reliable indicator on itself as other indicators could provide information as well. These other indicators are recently analysed in the Inflation Report of the BOE in detail. It may be argued, as a result, that the role of the monetary aggregates is best seen as a complement to, and sometimes no more than a corroboration of, the messages from other indicators.

Breedon F.J. and Fisher P.G. (1993) looked at the leading indicator properties of M0 as base money with respect to inflation and found out that it is remarkably robust. They, on the other hand, argued that it is difficult to formulate to a clear structural story, which explains the link between M0 and inflation. Relating to broad money, Thomas (1996) concluded that it continues to be an important variable in the assessment of inflationary pressures. But, because the transmission of both nominal and real shocks to the rest of the economy involves a complex interaction between money, credit, interest rate and nominal activity, the message it conveys is often difficult to disentangle.

From the above discussions relating to the role of money, it seems that money is still given importance in the analysis of inflation and it plays a role in monetary policy as Inflation Report discusses monetary issues in a separate section. But, instead of discussing monetary aggregates as defined, disaggregating money into personal and corporate balances and calculating Divisia Index in order to clarify liquidity properties of different components has become more useful in understanding the real functioning on money in the UK economy. For

example, the MPC places less weight on an increase in broad money if it is related to the build up of cash by other financial institutions (OFIs) as it is likely to have little implication for aggregate demand. Conversely, an increase in broad money due to large increases in consumer credit would be seen as an important signal of inflationary pressure.

Back to the money multiplier, Berentsen (1997) investigated implications of e-money for it and argued that the liquidity effect of a conversion of central bank money into e-money balances depends on whether reserve requirements are in place. It was assumed that with reserve requirements, the marginal rate of return on loans is larger than the marginal cost of deposits. In the UK monetary policy framework, there is no binding reserve requirement other than a small proportion as cash ratio deposits. The author also demonstrated that the potential effect might mostly influence the conversion on narrow money. It was argued that if e-money balances are not included in the definition of narrow money, monetary base might either increase or decrease depending on whether the decrease in central bank money outweighs the increase in deposits.

In summary, the impact of e-money on base money and the money multiplier depends on the way e-money balances have been integrated to the monetary aggregates. What is clear is that e-money issuance will complicate the calculation of base money and therefore the money mutliplier. This will be the complicating factor for a central bank (such as the ECB) that targets monetary aggregates in conducting monetary policy. And it will complicate the "indicator" properties of multiplier analysis even for a central bank that uses aggregates as leading indicators rather than targets.

As the Bundesbank has already started to add e-money balances to the coverage of monetary base, a general agreement for the nature of e-money may come closer. The main influence may be reflected on central banks balance sheet because as e-money replaces currency in circulation, the balance sheet may shrink. The BOE balance sheet is almost ideal to analyse such a phenomenon, because it separates Issue and Banking Departments and it lets to analyse central banking and money printing business differently. Below is the last version of Bank Return, which is published weekly on the Internet:

TABLE 7.2.1: THE BOE' S BANK RETURN: ISSUE DEPARTMENT	
Notes In Circulation..... 26.568.995.005	Government Securities.....13.493.719.965
Notes in Banking Department .11.004.995	Other Securities.....13.086.280.035
Total.....26.580.000.000	Total.....26.580.000.000

Source: http://www.bankofengland.co.uk/bankreturn/001011.pdf as of 12th Oct 2000.

It may be argued that e-money may mainly influence Issue Department's part of the BOE's balance sheet. As a central bank that is targeting the inflation rate directly instead of favouring intermediate monetary targets, Banking Department part of the balance sheet may still support monetary policy instruments. The next table shows the Banking Department part of the balance sheet.

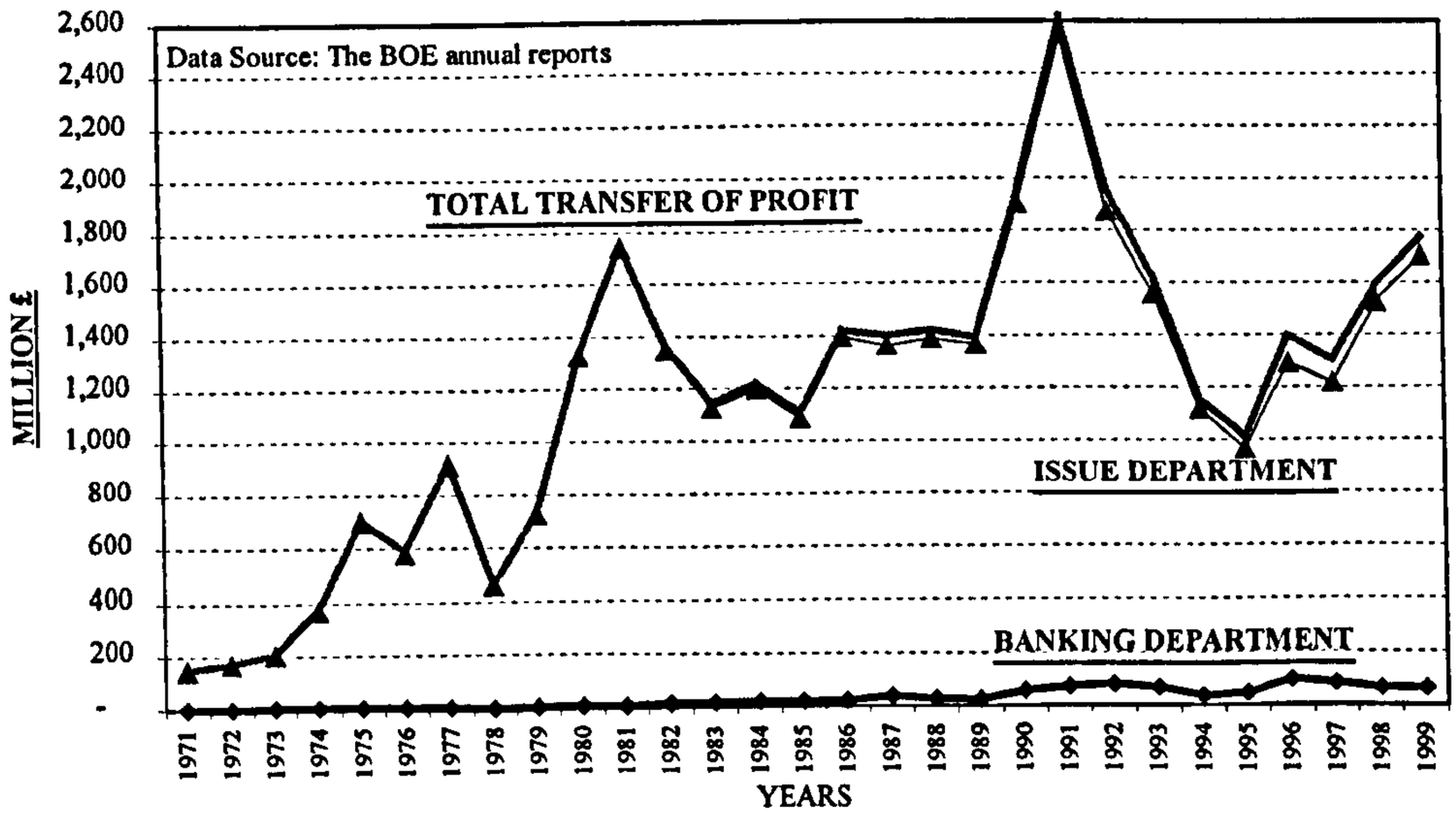
TABLE 7.2.2: BOE'S BANK RETURN: BANKING DEPARTMENT	
Capital.....14.553.000	Government Securities.....1.501.752.573
Public Deposits.....400.833.591	Advances.....37.714.681.204
Banker's Deposits.....1.443.175.360	Premises & Equipment.....2.635.536.249
Reserves.....40.004.448.880	Notes & Coin.....11.040.805
Total.....41.863.010.831	Total.....41.863.010.831

Source: http://www.bankofengland.co.uk/bankreturn/001011.pdf as of 12th Oct 2000.

Under normal circumstances, total daily intervention of the BOE in the open markets seems not to exceed £2 billion. On average, it may be argued that it stands around £1 billion. As a result, even if e-money replaces all the banknote and coins in circulation, the Bank may be able to conduct monetary policy without any serious difficulty.

It may be worth looking at the operating expenses of the BOE here in order to analyse the sustainability of a central bank without currency circulation by looking at the profitability of banking and issue departments of the BOE separately:

CHART 7.2.4: THE BOE PROFIT TRANSFERS TO HM TREASURY



Above chart exhibits the total profit transferred by the BOE to HM Treasury. In general, all the profit from issuing department has been transferred without any deduction but this is not the case for banking department as some of the profit (agreed in advance with the consultation with HM Treasury) has been retained. Even so, the amount of profit transferred to the Treasury from banking department has reached to a level more than £10 million in 1982 and recently it is £70 million for 1998 and 1999 both. These numbers may be interpreted as the reality that central banks can make profit without issuing currency and still afford to finance their operational expenses.

In this respect, it seems that multiplier analysis approach to the conduct of monetary policy may be ignored under representative issuance of e-money. This is because central banks can set interest rates as an alternative to monetary base control. This is important given that the definition of base money would be complicated by e-money issuance. That said, the impact of e-money on the monetary base and therefore the money multiplier may complicate the "indicator" properties of money supply so that central banks may place even less weight on monetary indicators to gauge inflationary pressure on the economy.

In addition, central banks through their activities in their banking departments are able to generate enough revenue to sustain their financial independence. This suggests that fears that central banks will lose their operational independence because of the shrinkage of their revenues (leaving them dependent on government support) is unfounded.

7.2.3. VELOCITY IMPLICATIONS OF E-MONEY

Anna J. Schwartz defined the income velocity of money in Foreword to Bordo and Jonung (1987) as the ratio of the money value of income to the average money stock that the non-bank public holds in a given period. Velocity is in general calculated on a yearly basis. Different money stock definitions (monetary aggregates) need different calculations.

The importance of velocity in monetary policy arises from the fact that unless velocity is calculated correctly, successful monetary targeting in order to reach a particular level of inflation is impossible because as velocity changes, money base necessary for a particular level of output and inflation fluctuates. In this section how e-money issuance may complicate the calculation of velocity and therefore the conduct of monetary policy will be considered.

Bordo and Jonung (1987) discussed the long-run behaviour of the income velocity of 'broad' money showing that velocity has exhibited a secular U-shaped pattern over the past century prominently in the US, Norway, Canada and Sweden. The monetisation process consisting of two interrelated developments reflecting the spread of money economy was given as explanation of the downward trend: the growing use of money as medium of exchange in expense of barter and the rise of a commercial banking system supplying the public with banknotes. Upward trend of velocity was explained by financial sophistication referring to the emergence of money substitute and the developments of methods of economising on cash balances and to improved economic stability. The institutional variables used by Bordo and Jonung (1987) were:

- As a measure of monetisation process, the share of labour force in non-agricultural pursuits.
- As a measure of the spread of the commercial banking, the currency-money ratio.
- As a measure of financial development, the ratio of total non-bank financial assets to financial assets.
- As a measure of the influence of growing economic stability, a six-year moving standard deviation of the annual percentage change in real per capita income. As an alternative, total government expenditures both including and excluding defence expenditures as a share of the national income.

Capie and Wood (1986) contributed to the literature with three possibilities that have to be kept in mind in a study of the behaviour of velocity over the longer term. First one was that any apparent path might be chance –the accidental by-product of changes in tastes. Second one was that the 'trend' may be the result of movements in the variables, which normally enter the

demand function –income and interest rates and finally, institutional factors might have exerted a systematic long run influence. They found no evidence to support a secular U-shaped velocity pattern for the UK, a result that is the same as Bordo and Jonung (1987). The explanations to this result were given as because banking was well advanced in the UK before 1870 and because explanations to the behaviour of velocity in the UK between 1870 and 1980 must be sought along the conventional money demand lines. Institutional factors that were taken into account in this study were, urbanisation, the currency/deposit ratio, the number of bank branches, bank deposits per head, the number of cheque clearings per head, the growth of building society deposits, life insurance premiums and pension funds, the growth of the amount of government securities, the growth of credit finance companies, six yearly moving average standard deviation of the annual percentage change in national income per head and the percentage of GNP spent on social services.

A very important aspect of velocity was pointed out by Capie and Wood (1986) by noting that the emergence of money substitutes is likely to impinge rather more sharply on the velocity of the narrow aggregate. It was argued that it is quite possible that substitution affect may be too small to be seen for broad aggregate. As a result, it may be concluded that e-money will first of all have an influence on M0 for the UK. Consequently, velocity analysis in this study will concentrate on narrow money namely M0 from then on.

There is more than one research and working papers among the BOE publications on the analysis of M0 in the last couple of decades. For example, Trundle and Temperton (1982) investigated changes in the use of cash in the UK and argued that the total level of cash balances held by the public is demand-determined and only insignificant amount of cash held overseas[84]. The authors concluded that cost of making non-cash payments would be the main determinant for demand for cash and the sections of the population with a bank account would be a barrier for a potential cash-less society.

Breedon and Fisher (1993) confirmed the leading indicator properties of M0 for inflation and investigated the trend in velocity describing that since the Second World War, it has been rising. Rising trend was explained within two stages: First, as the fall in the cash-

[84] They named the factors that influence demand as high nominal interest rates to economise on cash balances, rising unemployment with decreased earnings through unemployment benefits, the exchange rate to effect speculative demand for foreign currencies and the use of banking services reflected in the increasing proportion of wages and salaries that are paid directly into bank accounts. Factors like the introduction of cheque guarantee cards, credit cards and cash dispensers to decrease the amount of cash to meet unexpected transactions were addressed, too.

financed part of the economy due to the increases in national output and second as the payment systems technology developments to decrease demand for cash for transaction purposes.

Janssen (1996) discussed the downward trend in M0 velocity that became a new trend since 1990. The new trend was explained by a slowdown in cost-saving financial innovations in payments technology in recent years and by the move to a lower inflation in the 1990s[85]. Janssen (1998) discussed the effects of the switch away from salaries being paid in cash, easier access to cash from financial institutions, the increase in the proportion of the population with bank accounts and the introduction of non-cash payment mechanisms like credit and debit cards on M0 velocity and reached similar results to Janssen (1996)[86]. The author assumed that after 1992 with direct inflation targeting, the UK economy became a lower and less variable inflation and lower nominal interest rates economy.

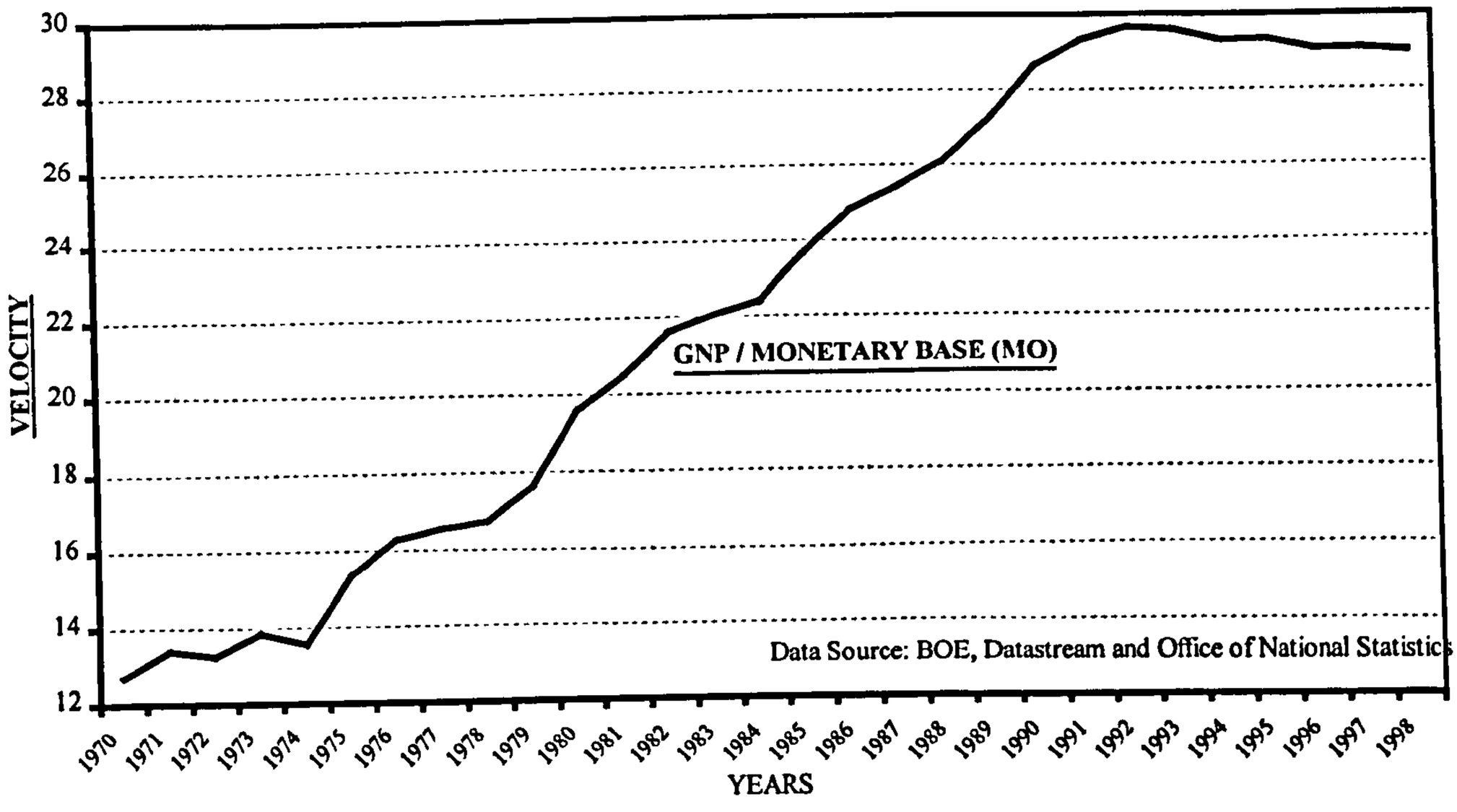
Some of the implications of the above literature for the analysis of e-money may be seen as quite helpful. First of all, M0 velocity seems to be affected by many factors other than transaction demand for money and recent level of payment technology may have reached to its potential. Secondly, the effects of e-money on M0 velocity may not be so strong at the beginning stage of the technology as it was observed in other financial innovations. Lastly, M0 velocity is still expected to increase in the long run due to further financial innovation both excluding and including e-money due to, for example, cash-back transactions in more outlets other than supermarkets.

Regarding to the current trends in velocity in the UK economy, below chart may help to enrich the analysis:

[85] The percentage of employees paid in cash in the UK was around 60 percent in 1976 and it decreased to around 20 percent in 1988 but from that time, there was no real change in that proportion. The same trend was observed for the percentage of adults with a current account, which was slightly above 40 percent in 1976, around 70 percent in 1988 and since then it only reached to a level of 80 percent. According to 1994 figures, it was found out that the number of credit, debit and cheque cards in UK is equal to the number of adults. However, some adults may have more than one card. Two observations according to above trends were summarised by the author. One is that financial innovation takes a long time to reach full market coverage. The other is that recent pace of financial innovation slowed significantly. It was concluded that the proportion of adults being paid in cash could fall further and access to a current account facility may be available to more customers, but new proposals such as e-money are unlikely to have much effect in the near future. Janssen (1996).

[86] Janssen (1996) gave three additional channels to lead to an increase in the demand for M0. The first one was given as lower nominal interest rates lead to an increase in the demand for narrow money by reducing opportunity costs of holding cash balances relative to interest-bearing money. The second one was given as lower inflation and interest rates may increase the interest semi-elasticity of narrow money demand. The third one was given as lower and less variable inflation may also affect the demand for M0 separately by reducing the opportunity cost of cash relative to real goods.

CHART 7.2.5: MO (MONETARY BASE) VELOCITY IN THE UK



As the chart indicates, the increase in the velocity seems to have stopped after 1990. On the literature cited on this section, many different reasons were given. Cash has been used for so and so many different transactions from supermarket shopping to a single egg in a very small village at the top of nowhere and digitalisation of all but only all potential transactions can make cash-less society a reality. As a result, it may be concluded that exaggerations on the assumptions for the monetary base velocity should be avoided.

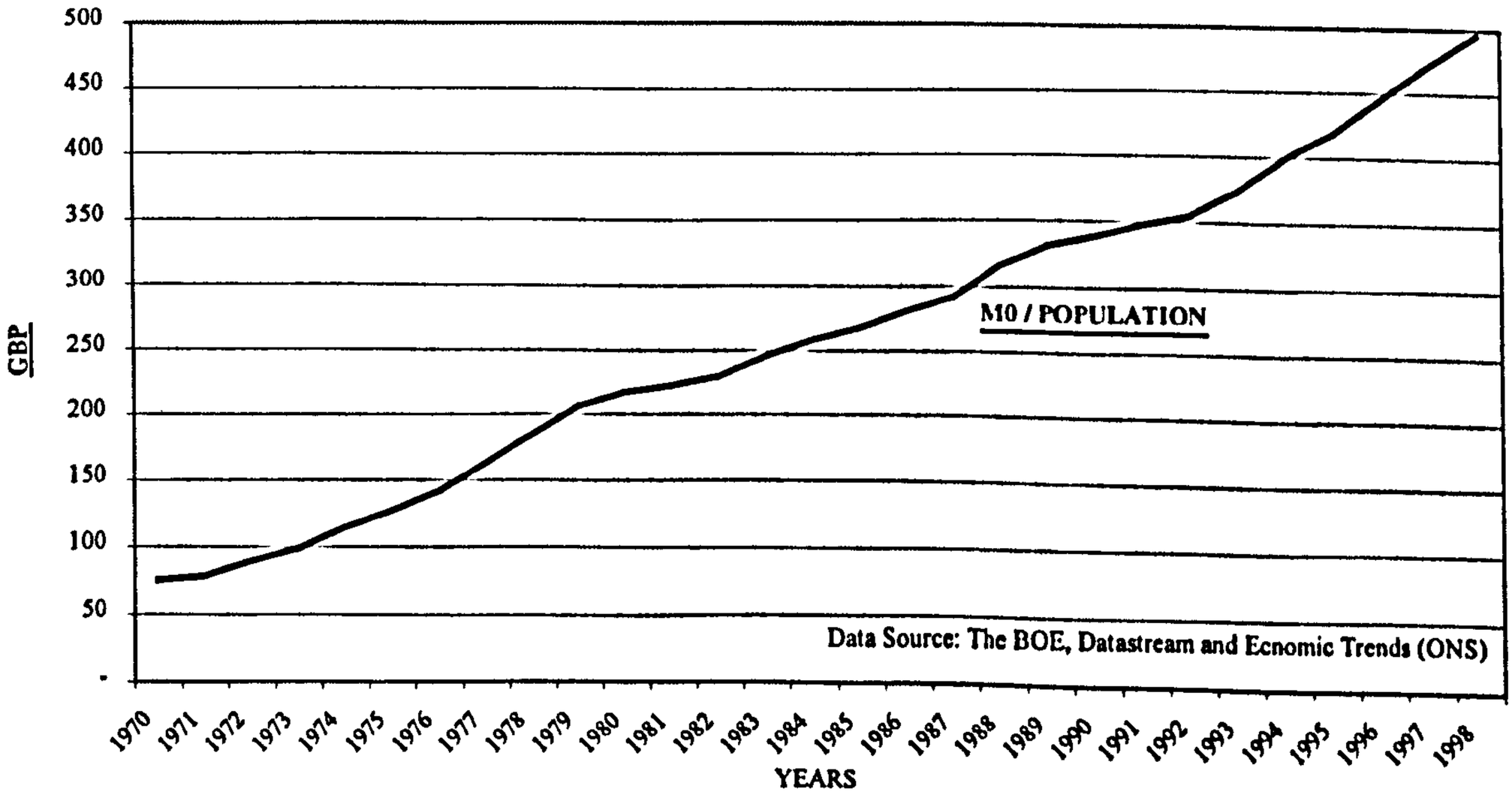
With e-money added to this picture, there are different possibilities under different definitions. If e-money only replaces currency in circulation, then there may be no direct influence when e-money balances is added to the monetary base. Because this only means a perfect substitution of banknotes and coins in circulation for electronic bits and bites presenting exact purchasing power of conventional money that was being replaced. In this scenario, it is obviously assumed that e-money does not create an alternative medium of exchange (not independent or competitive) but it represent national (or international in case of Euro) conventional money (representative) without creating no further purchasing power into circulation.

If e-money not only replaces banknotes and coins in circulation but can also replace deposits, especially demand deposits held for transaction purposes, then; it may even decrease velocity when e-money balances is added to the monetary base. The reason for this is that demand deposits are not traditionally added to monetary base in most cases. When e-money

can provide perfect substitutes for demand deposits for transaction purposes, then, a part of total money supply will be covered by monetary base aggregate and as a result monetary base weight in total money supply will increase. Consequently, velocity will show a downward trend as soon as e-money starts to replace demand deposits held for transaction purposes. This analysis does not cover potential currency hoarding and demand for banknotes from unregistered economy, so called shadow economy.

On the other hand, if financial authorities do not add e-money balances to monetary base calculations, then as conventional monetary base goes close to zero with full replacement, velocity goes closer to infinity. This option may be regarded as a very low probability as Bundesbank has already started to add e-money balances to monetary base calculations. The main mistake here may arise when monetary authorities fail to realise alternative medium of exchange entering to their economic zone. If e-money does not represent conventional money already in circulation but comes as a competing or alternative medium of exchange, then; monetary authorities should think about how to calculate real level of monetary base in the given economic zone with implications on free banking (Section 7.1) Below chart shows

CHART 7.2.6: MONETARY BASE PER PERSON



current level of banknotes per person in the UK since 1970.

The chart indicates that average holding of banknotes and coins in circulation per person in the UK has reached to a level of £500. The number may seem quite high as average household is expected to hold around £50 to £100 at any time. But, this latter range ignores

commercial and retail holdings of banknotes such as corner shops and pubs. There may be demand for idle cash for liquidity reasons from small companies and there may be currency hoarding. In one way or another, there seems to be an abnormal level of currency in circulation per head. In the UK economy, Trundle and Temperton (1982) found only insignificant amount of cash held overseas, opposite of a significant overseas demand for US dollar. There may also be a kind of demand for banknotes from unregistered economy but when there is a technology such as e-money, central banks may not be allowed to provide medium of exchange for unregistered economic activities as most of them may be accepted as illegal in the first place.

It may be concluded that velocity may be effected by e-money developments but the direction of this potential influence seems directly related to accounting techniques that will be implemented on e-money balances. It may not be right to argue whether velocity will be increased or decreased by e-money replacement of conventional money. Because the final effect totally depends on the aggregation techniques and on the potential of e-money to replace only banknotes in circulation, or replace both currency in circulation and demand deposits.

7.2.4. MONETARY POLICY, E-MONEY AND THE BOE

It may be worth mentioning some current developments on monetary policy with regard to money multiplier and velocity implications of e-money by looking at the current monetary policy framework in the UK. First of all, without predictable velocity, conduct of monetary policy may not be successful under monetary targeting. The Bundesbank of Germany with a predictable velocity has implemented a successful monetary targeting in order to control inflation in the economy even missing targets many times whereas the BOE became unsuccessful on the control of inflation by using monetary targeting alternative during 1980s.

Until the mid-1970's, monetary policy in UK was based on a subsidiary supportive role to fiscal policy. Demand management techniques were used to 'fine-tune' the economy. It was after the 1976 international payments problems and pressure from International Monetary Fund (arising from the substantial amounts of foreign currency borrowed) that more positive role was adopted for monetary policy in this country. In 1979, primary policy objective became the defeat of inflation through a strict control of money supply growth. The Medium Term Financial Strategy was introduced in 1980 with an aim to reduce inflation, the proportion of national resources taken by for public sector use and the burden of taxation on income in order to boost entrepreneurship and encourage long-term economic growth (Goacher, 1993).

Monetary aggregate targeting started in 1979-80 as £M3 was targeted to grow within a range of 7-11 %. A year later, a projection was given for the following four years updating the ranges every year. In 1982, two more aggregates were targeted as being M1 and PSL2 just for two years. In 1984, M0 was included in targets as M1 and PSL2 were excluded. £M3 was not a target after 1986 leaving only M0. Lipsey and Chrystal (1995) provided a summary of targets and actual growths in aggregates: The two years that £M3 target was achieved were in 1982/83 and in 1983/84, which were the only success relating to monetary targeting[87] for £M3, M1 and PSL2. M0 growth, on the other hand, was in the targeted ranges almost every year.

Although monetary targeting was still announced after the mid-80s; during the second half of the 1980s, sterling exchange rate movements became more influential in monetary policy decision making process with an ultimate step in October 1990 being the placing of sterling in the Exchange Rate Mechanism (ERM). Until 1992, the objective of the monetary policy was to achieve a pre-determined exchange rate leaving money supply growth as just observed indicators. The aim, although never announced, was to keep sterling exchange rate around 3 Deutsche Mark at most, and lock in to Germany's enviable record of sustained low inflation. (Goacher 1993) (George, 1997a).

In September 1992, sterling was withdrawn from ERM and in October 1992, direct inflation targeting without any intermediate targets became the new framework of monetary policy. The target range was chosen as 1% - 4 % for RPIX with the further objective of being in the lower part of that range by the end of the Parliament. It was revised in June 1996 as '2.5 % or less' again measured by RPIX. This objective was valid until the recent changes in the monetary policy framework. On the evolution of policy framework, it was argued that during 1980, there was no stable short-term relationship between money growth and nominal income or inflation. (George, 1997a).

[87] Definitions of monetary aggregates targeted during the period were defined by the BOE (1982): **M1** = Notes and coin in circulation with the public + Private sector non-interest bearing sterling sight bank deposits. + Private sector interest bearing sterling sight bank deposits. **Sterling M3** = M1 + Private sector sterling time bank deposits-original maturity of up to two years + Private sector holdings of sterling certificates of deposits. + Private sector sterling time bank deposits- original maturity of over two years.+ Public sector sterling sight and time bank deposits. **PSL2** = M1 + Private sector sterling time bank deposits- original maturity of up to two years + Private sector holdings of sterling certificates of deposits + Private sector holdings of money-market instruments (bank bills, Treasury bills, local authority deposits) and certificates of tax deposits + Private sector holdings of building society deposits (excluding term shares and SAYE) and national savings instruments (excluding certificates, SAYE and other longer-term deposits) - Building society holdings of money-market instruments and bank deposits etc. This item is excluded from the summation of the all items listed above.

The table below looks at the monetary aggregating targeting in the UK and the actual results.

TABLE 7.2.3: MONETARY TARGETS UNDER MEDIUM TERM FINANCIAL STRATEGY

TARGET YEAR	1979	1980	1981	1982	1983	1984	1985	1986	ACTUAL
£M3									
1979/80	7-11								16.2
1980/81		7-11							18.4
1981/82		6-10	6-10						12.8
1982/83		5-9	5-9	8-12					11.1
1983/84	4-8	4-8	7-11	7-11					9.5
1984/85			6-11	6-10	6-10				11.9
1985/86				5-9	5-9	5-9			16.3
1986/87					4-8	4-8	11-15		18.7
1987/88					3-7	3-7			
1988/89					2-6	2-6			

M1 AND PSL2	1982	1983				M1	PSL2
1982/83	8-12					12.3	11.5
1983/84	7-11	7-11				14.0	12.4
1984/85	6-10	6-10					
1985/86	5-9						

M0	1984	1985	1986	1987	1988	1989	1990	ACTUAL
1984/85	4-8							5.4
1985/86	3-7	3-7						4.1
1986/87	2-6	2-6	2-6					3.5
1987/88	1-5	1-5	2-6	2-6				6.4
1988/89	0-4	0-4	1-5	1-5	1-5			6.8
1989/90			1-5	1-5	1-5	1-5		5.0
1990/91				0-4	0-4	0-4	1-5	3.2
1991/92					0-4	0-4	0-4	1.2
1992/93						-1-3	0-4	5.1
1993/94							-1-3	6.8

Another option for monetary policy framework may be direct inflation targeting without relying on intermediate targets. This may be accepted as the current trend among central banks as more banks leave monetary targeting in favour of inflation targeting. This may be assumed as in-advance preparation for a world of e-money. Additionally, as central banks become more successful on direct inflation targeting, their reaction may soften against e-money as they get convinced that inflation control is possible without clear monetary targeting and without a predictable velocity.

The New Bank of England: It was argued that 1998 is a year of the most important after the nationalisation of the BOE in 1946 (Rodgers, 1997). There have been a lot of changes both in the governance of the Bank and the framework of monetary policy. Here, the developments in 1998 will be summarised, and the new monetary policy framework including the monetary transmission mechanism will be addressed. The aim of this section is to understand the recent functions of money and its place in monetary policy framework in the UK and to find out the influences of e-money developments in this framework.

Changes with the new BOE Act, which received Royal Accent on 23 April 1998 and came into force on 1 June 1998, were summarised by Rodgers (1998) as:

1. A statutory basis for the functions of the Monetary Policy Committee (MPC).
2. Transfer of the responsibility for the supervision and surveillance of banks from the BOE (BOE) to the FSA but the Bank still remains responsible for the *overall* stability of the financial system.
3. Changes in the governance of the BOE as the new Act reforms the constitution, composition and duties of Court and the Bank's Board of Directors.
4. New Provisions relating to the funding, the accounts and the profits of the Bank. Cash Ratio Deposits (CDRs)-money that commercial banks place interest-free with the Bank to finance its operations by investing in money markets- became statutory and covers institutions authorised under the Banking Act 1987, European Bank Branches and Building Societies. The Bank's dividend to the Treasury is determined as 50 % of post-tax profits for the previous financial year or 'such other sum as the Treasury and the Bank may agree'.
5. Collection of the monetary statistics by the Bank is backed by legislation for the first time.
6. Transfer of debt management from the Bank to the Treasury. (Including Government's cash management).
7. Publication of the Bank's Inflation Report each quarter became a statutory requirement as a means of setting out and justifying the Bank's analysis of the economy, and of explaining how the Bank intends to meet inflation target and support the Government's economic policy.

Among above changes, maybe the most influential one is the formation of the MPC as a decision-making mechanism for the **short-term interest rate**, which is recently the **single instrument** for monetary policy (George, 1998b). With the creation of the MPC, the Bank has full operational independence. Core purposes of the BOE, according to the 1998 Annual Report and Accounts, are:

1. Maintaining the integrity and value of the currency: This involves above all maintaining price stability, as defined by the inflation target set by the Government, as a precondition for achieving the wider economic goals of sustainable growth and employment.
2. Maintaining the stability of the financial system, both domestic and international. In exceptional circumstances, in consultation with the FSA and HM Treasury as appropriate, the Bank may also provide, or assist in arranging, last resort financial support where this is needed to avoid systemic damage.
3. Seeking to ensure the effectiveness of the UK's financial services.

The aim of above mentioned core purposes is to achieve the main objective of the BOE as defined by the Act 1998:

(a) to maintain price stability, and

(b) subject to that, to support the economic policy of Her Majesty's Government, including its objectives for growth and employment.

The definition of price stability is left to the Government and needs to be confirmed at least once in every period of 12 months. This requirement confirms that the BOE has no goal independence. For 1998, the Bank was given a price stability target of 2.5 %[88] for retail price inflation excluding mortgage interest payments (RPIX) measured by the 12-month increase.

The MPC is required to achieve above-mentioned target for which it will also be accountable by adjusting short-term interest rates accordingly. The MPC meeting process has been continuing to shape but recent process is explained by George (1997b, 1998a, 1998b), Rodgers (1997, 1998) and Budd (1998). The MPC members are presented a detailed information (generally by economists of the Bank working on monetary analysis and markets area) about; monetary conditions, demand and output, labour market, prices, financial markets, prospects for inflation. The MPC members are supported by the whole range of the Bank's monetary, economic, statistics and market expertise, supplemented by the intelligence from the Bank's network of twelve regional Agencies (Rodgers, 1997).

The meeting results are expected being announced as soon as practicable with a statement as to whether it was decided at the meeting that the Bank should take any action. The

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[88] No range was given for this target and if it moves away from the target for more than 1 % in either direction, the Governor is required to write a letter to the Chancellor explaining; why inflation has moved away from the target by more than 1 percentage point; the policy action being taken to deal with it; the period within which inflation is expected to return to the target; how this approach meets the Government's monetary policy objectives. (Budd, 1998). The letter would refer to Inflation Report, too. The measure of the Bank's success will be how close RPIX

MPC normally (with a few exceptions) meets every month on Wednesday and Thursday following the first Monday of each month and announce the decision reserving the right to delay announcement of a decision to intervene in financial markets if it is believed that the announcement may negatively effect the success of a possible intervention. (Budd, 1998). The MPC is required to publish minutes of its meetings within six weeks. The publication is expected to include the voting reference of members who took part in the vote on the decision. Recently, it is published two weeks after the meeting.

The BOE Act 1998 makes a statutory requirement to prepare and publish a quarterly Inflation Report as a means of explaining the Bank's intentions to meet the inflation target and support the Government's economic policy. The report is expected to contain (i) a review of the monetary policy decisions published by the Bank in the period to which the report relates, (ii) an assessment of the developments in inflation in the economy of the UK in the period to which the report relates, and (iii) an indication of the expected approach to meeting the Bank's objectives. The inflation report legally needs the approval of the MPC, as it is the responsible committee for inflation rate objective.

Accountability of the MPC and the BOE: The BOE is accountable to the House of Commons through Treasury Select Committee, that can also hold hearings on the appointments of the MPC members. The accountability is measured by the reports and evidence given to House of Commons through Treasury Select Committee. The Chancellor lays the annual report of the Bank (it is a legal requirement to be published by the Bank including the balance sheet and profit and loss account) before the Parliament for a debate (Rodgers, 1997 and 1998).

Economic entities measure the accountability of the Bank through the transparency of the monetary policy discussed and published on Minutes of the MPC Meetings and Inflation Report. It may be argued that it is easier to monitor the performance of the Bank after the clarification of the inflation target with an operational independence. King (1997) argued 5 ways of the Bank's accountability. Firstly, the MPC announces a decision after every meeting and minutes of meetings are published within six weeks. Secondly, the Inflation Report gives information to outsider commentators to judge the MPC explanations. Thirdly, after the publication of each inflation report, a member of the MPC may be asked to appear before the Treasury Select Committee (TSC) which makes it possible for the TSC to hold the Bank to

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comes to 2.5 % on average over time as the Treasury said that it expected the same target to remain in force for at least the current Parliament (Rodgers, 1998).

account for its own actions. Fourthly, the MPC is required to reveal in public its proposed reaction to large shocks, which is measured by 1 % changes in inflation rate in either side of the main target. Finally, the Court of the Bank is required to report annually to Parliament on the conduct of the MPC and Parliament debates the Annual Report of the Bank.

Monetary Transmission Mechanism in the UK: Another issue about monetary policy and e-money is the transmission mechanism analysis within a given economy. In economies such as Germany with a strong relation between money and economic activity especially in the short and medium run, monetary aggregates may fully provide leading indicators for the control of inflation. But, in countries such as the UK with technological development and financial sophistication, the relationship between money and economic activity may be unreliable and alternative techniques may be needed for the successful control of inflation. Currently preferred option for this is to define monetary transmission mechanism within the economy. Three broad mechanisms through which an increase in interest rates might operate were named by Easton and Stephenson (1990) as:

1. The *cost of borrowing* by affecting the relative attractions of spending today and spending later. As saving becomes more attractive, present expenditure on consumption and/or investment goods falls.
2. The *effects on incomes and wealth* depend on the balance between holding of interest-bearing assets and liabilities, and on the sensitivity of the relevant interest rates to the market conditions. The difference between interest receipts and interest payments determine the final affect. There is another mechanism that comes from the influence of interest rates on the value of certain assets such as housing, equities and government stocks. As values of these assets tend to fall because of an interest rate rise, the reduction in wealth may tend to reduce personal expenditures.
3. The last mechanism is that a rise in interest rates relative to other economies may lead to an *exchange rate* appreciation. As a result, import may increase while export may start to decrease depending on the level of relative price changes. The exchange rate mechanism is less clear when compared to cost of borrowing and income and wealth mechanism.

It was suggested by Britton and Whitley (1997) that a change in interest rates would have a greater short-term output cost in the UK than France and Germany.

From discussion in this section, general conclusions may be summarised as follows:

1. In the UK, inflation targeting shapes the new monetary policy framework.

2. Money and monetary aggregates still play an important role in the economy but not as much as a target but only as a leading indicator complementary to several other indicators as discussed in the Inflation Report.
3. The Bank has a limited (to overall stability) responsibility in supervision of financial sector and payment systems as this was transferred to the FSA. As a result, regulation of e-money products and services will be under the responsibility of that Authority, which informs the Bank about its activities in general.
4. The influence of e-money may be observed on M0 as it is generally expected that currency in circulation will be the main target of e-money products to replace in order to get a float earning. But, it may also influence M4 as the potential of e-money products develops. Because some of the components of M4 provide transaction services that may be replaced by those products.
5. As the Bank is divided into two as Banking and Issue Departments, it may be easy to calculate a potential decrease in seigniorage revenues from banknote issue, as it can be calculated as the amount of profit that is gained by the Issue Department and transferred totally to the Treasury. It was above £1 billion for 1998.
6. The potential influence of e-money on monetary policy seems to be analysed by the Bank when it is thought that it has a potential to influence decisions of Monetary Policy Committee. It will be up to the Committee Members to decide whether there is a need for policy action against e-money or not.

Under the above mentioned monetary policy framework, the Bank does not take money into account as the **only** variable to be used in monetary policy judgements. As being experienced on financial deregulation and innovation since 1980s, it may be argued that the Bank may approach e-money developments relatively more liberally as compared to many other central banks such as the ECB with monetary targeting policies around the world.

This is the analysis of how interest rate changes effect economic entities and different sectors. Once, monetary transmission mechanism is correctly found out, it may be easier to find out equilibrium level of short-term interest rates for the desired level of inflation, which is 2.5 % in the case of the UK. The MPC prefers to analyse very different sets of data from all parts of the economy in order to decide on the level of short-term interest rate. Instead of relying on monetary aggregates, almost all economic data is put on the econometric models for simulation of data to reach reliable results on the conduct of economy. In fact, money does not have an exogenous (i.e. independent) role in the Bank's macro-econometric model. The new Bank Act

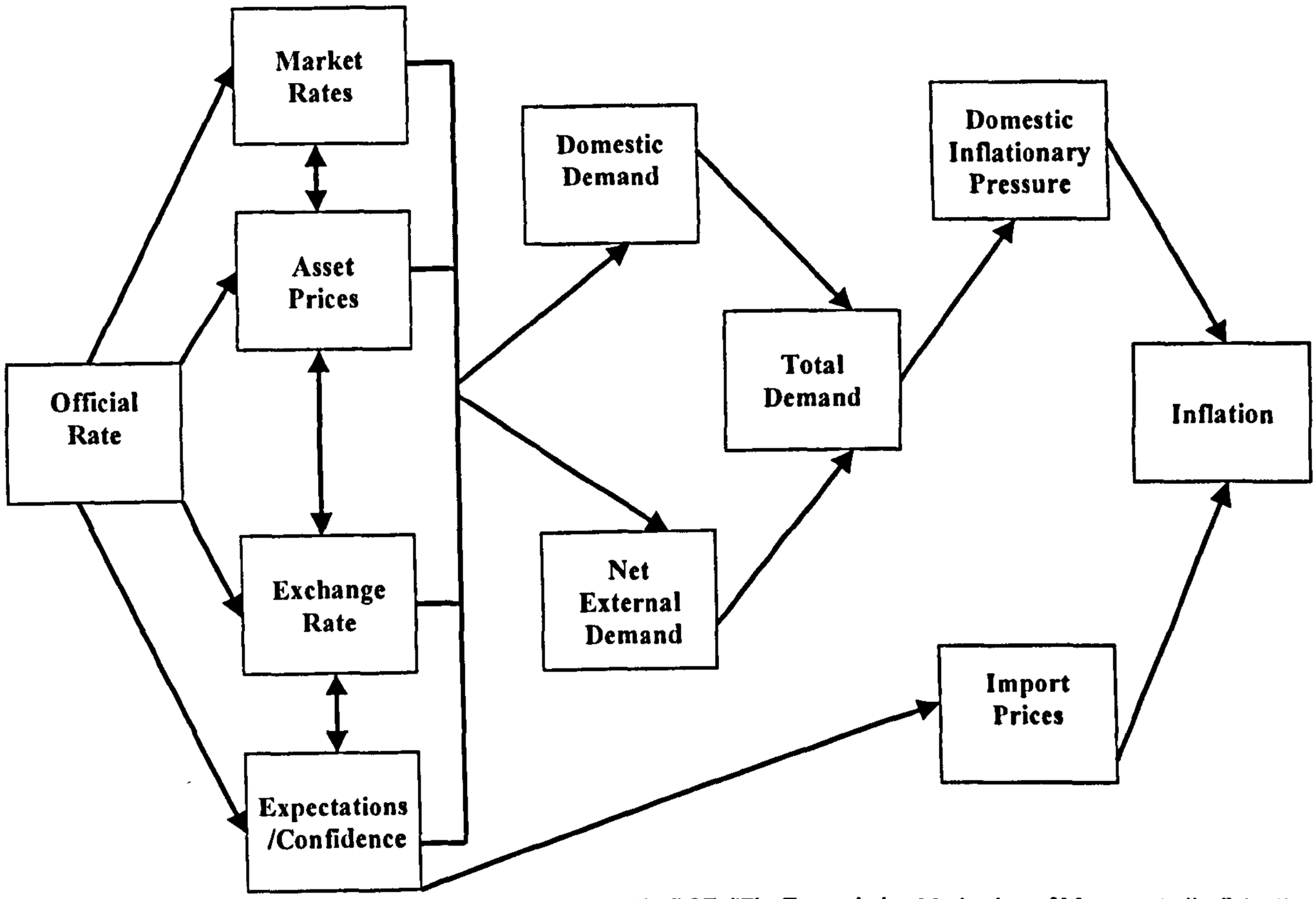
allows the BOE to reach to any kind of economic statistics that is believed to be relevant for the conduct of monetary policy. The Bank has legal support for data collection.

It may be argued that e-money may allow extremely sophisticated data analysis techniques to develop. As electronic in nature, e-money may allow to create perfect sets of data and to eliminate unreliable data analysis that may mislead the settlement of short-term interest rate. It is not only macroeconomic data that e-money may increase both quantity and quality but even microeconomic data may enter to the picture in order to increase reliability of monetary transmission mechanism techniques on the conduct of monetary policy.

On the shrinkage of central bank balance sheet, it may be argued that currency in circulation is not the only open market operation tool available to a central bank. Daily liquidity management may be conducted with very different instruments like increasing or decreasing reserve requirements, buying or selling foreign exchange and buying and selling bills and bonds. Under normal circumstances, total amount of daily operations has no big impact on the total balance sheet, as daily operations constitute only a small amount of total assets. Under abnormal circumstances, even the strongest balance sheet may not support the control of a financial crisis. It may as a result, be concluded that e-money is no threat for the conduct of monetary policy because even without e-money, central banks such as the BOE has already implemented a successful monetary policy by directly targeting inflation. By using monetary transmission mechanism techniques, it has become possible to support sustainability of financial and monetary stability. Money multiplier analysis may still be a very helpful tool to analyse monetary aggregates' behaviour and it may be worth looking at the developments on the velocity; but; their role on the conduct of monetary policy seem to have diminished in any case regardless of the introduction of e-money.

In the current analysis of the monetary transmission mechanism in the UK, the BOE argued that, even the money supply play an important role, it is not a monetary policy instrument. But monetary aggregates are still important indicators especially for the long run analysis because, sustained increases in prices cannot occur without accompanying increases in the monetary aggregates. The Bank successfully conducts the monetary policy through the short-term interest rate as the private sector is due to pay money to the Bank at the end of every each day. They have to borrow. The shortage is almost guaranteed by the operations in the weekly or ad hoc Treasury bill auctions by the Debt Management Office as part of cash management transactions. The way interest rate influences other economic variables in the UK is summarised in this figure:

FIGURE 7.2.1: THE TRANSMISSION MECHANISM OF MONETARY POLICY IN THE UK



Source: The BOE; "The Transmission Mechanism of Monetary Policy" April 1999

The next section will provide the official respond of the BOE to e-money in the form of an answer to a questionnaire that was sent to the Bank:

7.2.5 APPENDIX: A QUESTIONNAIRE FOR THE BOE ON E- MONEY

Submitted to: Christopher J. Bailey, Deputy Secretary, The BOE; Responded by: Jill Paterson, Market Infrastructure Division and Edward Nelson, Monetary Assessment and Strategy Division HO-2; December, 1999)

Question 1: How does the Bank of England (BOE) define electronic money (e-money)?

Answer: *The Bank refers to 'electronic money' as stored value or pre-paid products which allow customers to make small-value transactions using chip or smart cards, or over computer networks such as the internet: products which are intended to be used as a general, multi-purpose means of payment, rather than single-purpose schemes.*

Question 2: How does the BOE define an 'e-money institution'? What type of institutions will the BOE monitor or impose surveillance and/or regulation on, with regard to the issuance and/or operation procedures of e-money products?

Answer: *The FSA is monitoring e-money developments and is considering how it would treat e-money issuers, how the proposed EU legislation to be carried into UK law. In the meantime, where a bank is involved in an e-money scheme, the FSA takes into account the overall effect that this involvement has on the bank's risk exposures.*

Question 3: What is the legal framework for the regulation of e-money and e-money institutions in the UK? Which current laws and regulations apply to them? What future changes and amendments may be at the legal enforcement agenda?

Answer: *Proposers of schemes which were not to be operated by banks are advised to approach the Bank of England and the FSA supervisors at an early stage. They would be encouraged to take their own legal advice on the question of whether their particular product fell within the 1987 Banking Act. As the law currently stands, issuers of products which do not represent deposit-taking (within the meaning of the Act) are not subject to supervision, except where they are owned by commercial banks and thus subject to consolidated supervision. It has been established that the issue of electronic money does not contravene the 1844 Bank Charter Act, which made the new issue of notes in England and Wales a monopoly of the central bank.*

Question 4: Did the BOE ever supervise and/or regulate an e-money institution up to now?

Answer: *Since 1 June 1998, the Bank of England has no longer been responsible for the prudential supervision of banks. The statutory responsibility for supervision passed to a new body, the Financial Services Authority (FSA), which is responsible for the regulation of all financial services activities including insurance, securities trading, investment management and building societies.*

Question 5: What kind of supervisory and/or regulatory role with regard to e-money and e-money institutions is left to the BOE after the establishment of the FSA?

Answer: *The Bank of England retains its role in monitoring overall systemic stability. The Bank and FSA co-operate closely on electronic money policy.*

Question 6: Which of the currently existing e-money trials and/or institutions have been (or will be) monitored or supervised by the BOE? For example, are Mondex and Visa Cash treated as e-money institutions and monitored or regulated accordingly?

Answer: *The Bank has collected monthly data on e-money issued by banks since September 1997.*

Question 7: Is there any limits on the type of institutions that can issue e-money in the UK? Can supermarkets and/or insurance companies and/or telecommunication companies and/or digital television service providers issue e-money?

Answer: *The Bank will arrange to collect data on issues by non-banks if/when the amounts become material. The ECB's 1998 report on electronic money (*ECB, 1998*) recommended that the activity of issuing e-money should be restricted to credit institutions. The Bank of England does not accept that the regime for regulating credit institutions would necessarily be appropriate for all issuers of electronic money; the risks presented by this activity are of a different character to those encountered in general banking business. Such issues are under discussion in EU forums considering proposed EU legislation on this issue and the Bank has been involved in these discussions.*

Question 8: What is the division of responsibility and authority between FSA and the Bank of England on the regulation of e-money and e-money institutions?

Answer: *The Bank of England retains its role in monitoring overall systemic stability. The Bank and FSA co-operate closely on electronic money policy.*

Question 9: Which BOE Act declares pound sterling as 'legal tender' and how is it being preserved?

Answer: *The 1844 Bank Charter Act made the new issue of notes in England and Wales a monopoly of the central bank. However it has been established that the issue of electronic money does not contravene the 1844 Bank Charter Act.*

Question 10: Does the BOE treat e-money balances as 'bank deposits' that would be, as a result, subject to insurance protection?

Answer: *With regard to the Banking Act 1987, which restricts the taking of deposits to authorised institutions, the position of e-money schemes in general is not clear. Schemes set up in a certain way might fall under the Act, but many schemes are sufficiently unlike deposit taking to escape the Act's scope. At present, the Government is reviewing financial markets and services legislation as part of the process of transferring regulatory responsibilities from various organisations to the FSA. The position with regard to electronic money schemes will also be affected by forthcoming EU legislation.*

Question 11: How does the BOE co-operate with the ECB on the regulation of e-money? Does the BOE agree to the ECB requirements for the issuance of e-money, especially those concerning redeemability and reserve requirements?

Answer: *The ECB's 1998 report on electronic money recommended that the activity of issuing e-money should be restricted to credit institutions. The Bank of England does not accept that the regime for regulating credit institutions would necessarily be appropriate for all issuers of electronic money; the risks presented by this activity are of a different character to those encountered in general banking business. Such issues are under discussion in EU forums considering proposed EU legislation on this issue and the Bank has been involved in these discussions.*

Question 12: Does the BOE have any initiative on the international co-operation for creating an internationally acceptable set of rules on the regulation of e-money and e-money institutions?

Answer: *The Bank agrees with the conclusions of the G-10 study on monetary policy undertaken during 1996. The Bank fully supports the conclusions of the G-10 Task Force on Security of Electronic Money. Issues* (ECB 1998 Proposals) *are under discussion in EU forums considering proposed EU legislation on this issue and the Bank has been involved in these discussions. Features that would make e- money products particularly attractive for money laundering include unlimited transferability (including via telephone or the Internet), a high or no limit on the value stored on cards, and anonymity of users. Strict adherence to "know your customer" criteria, and suitable "fit for purpose" limits will help to overcome the risk of money laundering on a significant scale. The provisions of the Money Laundering Regulations 1993 - which implement the EU Money Laundering Directive - apply to all forms of e-money. A second EU Money Laundering Directive is expected in the future and this is likely to make specific reference to e- money schemes. The FSA encourages prospective scheme providers to contact relevant law enforcement agencies. The Bank fully supports the conclusions of the G-10 Task Force on Security of Electronic Money. An assessment of technical security and of systems and controls should be part of a banking supervisor's examination of an e-money system (possibly undertaken by external consultants specialising in the field). Products developed abroad could give rise to further issues if regulatory/security standards were lower.*

Question 13: Does the BOE collect any data on the issuance of e-money in the UK? If yes, since when?

Answer: *The Bank has collected monthly data on e-money issued by banks since September 1997. The Bank has, to date, considered that, question of interoperability, standardisation and contracts with cardholders are best determined by market forces, but part of its monitoring role is to watch for evidence of market failure.*

Question 14: How does the BOE evaluate e-money in the case of cash-ratio deposits? May e-money balances be subject to cash-ratio calculations?

Answer:

Question 15: Does the BOE include e-money balances into any monetary aggregate, especially M0? If not, are there any future plans to do so?

Answer:

Question 16: What may be the influence of a successful launch of a 'network-based' e-money scheme such as Digicash on national regulatory approaches to e-money institutions (arising from the fact that a network-based e-money scheme is by definition international)?

Answer: *As yet no significant cross-border activity involving UK institutions or customers is taking place, although this may change in the future. In the case of EEA institutions using a passport to offer such services, supervision would largely be the responsibility of the home state regulator, once the proposed EU legislation comes into force. Any other foreign scheme being offered in the United Kingdom would be subject to the same treatment as domestic schemes.*

Question 17: What is the BOE's view on the alternative payment instruments, other than e-money, that may challenge 'medium of exchange' function of money? For example, what may be the BOE's reaction to electronic gold in the UK?

Answer: *The Bank is in favour of developments, which increase the efficiency and convenience of payment systems, including electronic money. There may, however, be implications of such schemes for monetary policy, systemic risk, consumer protection and law enforcement, and this need to be considered in detail. The Bank does not undertake detailed oversight of retail payment systems, and has no formal statutory power to do so. It is improbable that, in the short or even medium term, e-money systems will present greater concerns for the efficiency of payment systems than those presented by conventional retail systems such as the cheque clearing. However, the Bank will continue to monitor the potential risks posed by e-money settlement systems to the stability of other payment systems, notably in the case that counterfeit e-money were to be discovered. In a world of electronic transactions in real time; financial assets and real goods and services would be priced in terms of a unit of account. The choice of a unit of account (perhaps a commodity standard, which would produce broad stability in the price level) would be a matter for public choice and regulation, along the lines of existing weights and measures inspectors. Final settlement could be made without any recourse to the central bank. Only if the unit of account was managed would there be a role for a body such as*

central bank. Whether unit of account should be determined by a mechanical rule, as other weights and measures, or managed in a discretionary way depends on some deep issues about the nature of 'nominal rigidities' in such an economy.

Question 18: What may be the implications of e-money for the conduct of monetary policy in the UK? Does the Bank of England expect any necessary modifications to the monetary policy instrument because of a potential replacement of monetary base by e-money?

Answer: Refer to the answer to Question 21.

Question 19: What is the expectation of the BOE on the potential influence of e-money on the velocity of (monetary aggregate) M0? Might e-money also affect the velocity of M4?

Answer: *In so far as e-money reduces the fraction of transactions mediated through base money, the influence of e-money would be to raise the velocity of M0. However,* ***e-money is only one possible*** *factor that could affect M0 velocity. M0 velocity rose by approximately 50 per cent in both the 1970s and 1980s, but was basically flat over the 1990s as a whole. This suggests that, if there has actually been any upward pressure on M0 velocity from greater influence of e-money, it has so far been dominated by factors such as lower interest rates and lower inflation in the 1990s, which have tended to reduce M0 velocity.*

Question 20: What might be the money multiplier implications of e-money? Does the BOE expect any changes in the monetary policy transmission mechanism because of e-money?

Answer: Due to the relationship between money multiplier and velocity, refer to answer to the Question 19.

Question 21: What may be the implications of a full replacement of currency in circulation by e-money with regard to the conduct of monetary policy? May there be a need to change monetary policy instrument to sustain price stability?

Answer: *Electronic transactions in real time (*with the help of technological innovation*) hold out the possibility that advances in technology will mean that the arbitrary assumptions necessary to introduce money into rigorous theoretical models will become redundant, and that the world may come to a pure exchange economy. There is no reason, in principle, why final settlements could not be carried out by the private sector without the need for clearing through the central bank. The practical implementation of such a system would require much greater computing power than is at present available. But, there is no conceptual obstacle to the idea that two individuals engaged in a transaction could settle by a transfer of wealth from one electronic account to another in the real time. Eligible assets would be any financial assets for which there were market clearing prices in real time. Without a role in settlements, central*

banks, in their present form, would no longer exist. The need to limit excessive money creation would be replaced by a concern to ensure the integrity of the computer systems used for settlement purposes. A regulatory body to monitor such systems would be required. Existing regulators, including central banks, would no doubt compete for that responsibility. Moreover, in just the same way as the Internet is unaware of national boundaries, settlement facilities could become international. The key to any such development is the ability of computers to communicate in real time to permit instantaneous verification of the creditworthiness of the counterparts, thereby enabling private sector real time gross settlement to occur with finality. Any securities for which electronic markets exist could be used as part of the settlement process. There would be no unique role for base money, and hence the central bank monopoly of base money issue would have no value. Central Banks would lose their ability to implement monetary policy. The successor to Bill Gates would have put the successors to Alan Greenspan out of business. Societies have managed without central banks in the past. They may well do so again in the future.

Question 22: What may be the influence of e-money on the BOE's balance sheet?

Answer: *The effect of e-money on monetary policy and on seigniorage revenues is likely to be negligible during its initial stages.*

Question 23: Does the BOE have any plan for the future to issue e-money, which may result in a direct competition with the financial service providers?

Answer: *No.*

8. REGULATION OF ELECTRONIC MONEY

In this chapter, regulation of e-money will be analysed. As it is a new financial phenomenon, it may be expected to be one of the most challenging issue for regulatory agencies as they seem to be at the middle of a transforming stage as independent regulators has been created other than central banks. In the UK, for example, FSA has been given supervisory power, as the regulatory function of the BOE is limited to overall stability of the financial system. At the same time, international financial bodies such as the BIS seems to provide ever increasing proposals in addressing financial regulatory issues around the world.

In the first part, there will be a summary for the arguments to regulate financial services, especially banks including the criticisms and counter arguments. In the second part, the separation of regulatory affairs in the UK among the FSA, the BOE and HM Treasury will be analysed. Section third will overview current approaches and trends to the regulation of e-money in different countries including current proposals relating the regulation of e-money. Section four will explore the FSA's analysis of e-money in the UK and its role in the European regulation regarding e-money including questionnaire and interview results. The final part will discuss whether e-money can technically be regulated or not. The end of the section will provide questionnaire and interview notes to explore the FSA's respond to the questions raised.

8.1. REGULATION OF BANKS AND FINANCIAL SERVICES

It may be argued that there is no generally agreed literature on the regulation of financial services. In this section, some of the basic arguments will be summarised with the help of recent literature. Lastra (1996) summarised general grounds to justify regulation of banking industry by a government. Seven different grounds were named by the author to justify government regulation of banking industry including first of all acceptance of general governmental responsibility for a stable and sound financial system resulting in an aim to control risk in banking business and in overseeing the payment systems. The second ground was named as the acceptance of governmental responsibility for the conduct of monetary policy resulting in a special treatment of deposits. The third ground was argued to be concerns relating to the safety and confidence of individual depositors and investors resulting in a special treatment of bank creditors. The fourth ground was mentioned as aims to limit concentration of financial resources and economic power. The fifth ground was underlined as concerns with the credit allocation to different sectors of the economy. The sixth ground was given as aims to

sustain national autonomy from international corporations and the final ground was put as historical interest in preserving particular types of financial institutions. Not all of these quantifications may directly be relevant but it may be generally agreed that regulation of banking arises basically from at least one of above. Consequently, those grounds may influence regulation of e-money as well.

Lastra (1996) also gave an analysis of the characteristics of banking business, which is worth taking into account in this section. Because without understanding banking, it may be difficult to explain the reasons to regulate it at all. Additionally, these arguments are generally agreed within the central bank advocates although they are highly criticised by the free banking supporters. There seems to be three common characteristics in a typical bank's balance sheet in this sense: (i) *The mismatch between assets and liabilities.* (ii) *Low capitalisation*: Capital adequacy has even become an international issue nowadays as BIS renewed its directives with an aim to create an internationally accepted regulatory framework to be accepted in both national and international banking. (iii) *Risky asset portfolios,* banks might need to take into account the total amount of risk when deciding their desired level of return and regulators may need to check whether banks take excessive risk to disrupt safety and soundness of the financial system a whole.

Bank supervision, which may be defined as the process of establishing rules both relating to acts of the legislator and statutory instruments or rules of the competent authorities, may be analysed in four stages namely licensing, supervision, sanctioning, and crisis management and bank regulation (Lastra, 1996). Maybe, licensing would be the critical issue in the regulation as it determines who will be allowed to do business in banking and when adapted to e-money, licensing will most probable play the critical role in determining the future. Because, licensing will determine whether e-money will strictly be restricted to financial institutions or non-bank institutions will be allowed for explorations of its potential as well. Prudential supervision may be executed through individual reports provided by the financial institutions. Ratings may be useful instrument as well both internal and/or independent external. The last two options for supervision named by the author are in-house surveillance and consultations with senior management and reporting from independent external auditors.

Sanctioning part of supervision may also play a critical role especially against e-money because if e-money is accepted as a threat, different sanctions may be imposed to e-money operators even if they are licensed in advance. For example, full redemption of e-money balances against a national currency may function as a sanction as it may be used by regulators

as a treat as historical examples of free banking proved this kind of acts to be used in order to attack rivals. Relating to crisis management phase of supervision Lastra (1996) named (i) lender of last resort function of central banks, (ii) deposit insurance schemes and (iii) bank insolvency procedures. Lender of last resort doctrine was based upon four pillars by the author:

1. Lender of last resort is expected to prevent illiquid but solvent financial institutions from going bust just because of a temporary liquidity mismatch in the short-run.
2. The lending should be free but with a penalty charge.
3. Accommodation of financial institutions should be with good collateral and valued at pre-panic-prices.
4. The readiness to lend freely should be declared in advance clearly.

Two more operating principles were added to above four pillars as (i) lender of last resort function should not be mandatory but it should be discretionary and (ii) the lender of last resort should assess systemic risk potential in an operation in order to keep solvent banks from failing.

According to the author, once a bank went bust, it may either be rescued by an agreed package or open bank assistance or it may be taken over or merged or it may be liquidated. Relating to a systemic problem in banking, alternatives were given to deal with the problem. They included direct government injection of capital, liquidation in a large scale of banking business, debt restructuring techniques, mix of government assistance and private assistance, and finally creation of a centralised agency in order to dispose assets of aided institutions (Lastra, 1996).

Above analysis may be accepted as a general framework for financial regulation but dynamic analysis when thinking of financial regulation is more preferably. In a current study, Goodhart *et al* (1998) gave three reasons for public sector regulation including the protection of customers against monopolistic exploitation, to protect small and less informed clients against adverse selection and to sustain systemic stability of the financial system. Four main considerations were listed as being traditional rationales for bank regulation. The first consideration was named as banks critical position on clearing and payment systems. The second consideration was given as systemic risks namely bank runs. The third consideration was mentioned as term mismatch in bank contracts with short-term deposits to long-term lending and the final consideration was put as the risks of adverse selection and moral hazards arising from the lender of last resort executions and consumer protection schemes such as deposit insurance.

The answer to the question why banks are so special to attract more regulatory attention from the public sector was explained with a comparison of non-financial sector activities to banking activities. It was argued by the authors that non-banking financial services do not deserve so much regulatory pressure from central authorities because; (i) systemic risk does not arise in non-financial services; (ii) there is no contagion risk in non-bank businesses; (iii) payment systems are not at risk because of the non-bank activities; (iv) as there is generally no lender of last resort execution in non-bank business, there is no risk for moral hazard problems and (v) the main difference between security firms and banks in a regulatory perspective is that security firms may liquidate their assets easily in secondary markets (Goodhart *et al, 1998).*

There may be some counter arguments to above reasoning according to current developments. For example, payment system risk may arise from telecommunication companies, as especially electronic payments are totally dependent on well functioning of telecommunication services. Even those companies are not banks, their functioning may have systemic characteristics. Additionally, LTCM operation of the FED may be a case for situations to create a systemic risk to financial system out of banking business practices as LTCM was not a bank but a hedge fund.

Goodhart *et al* (1998) listed 27 policy conclusions relating to financial regulation. There are some conclusions that may have implications for the regulation of e-money. For example, if regulation is demanded because of market imperfections and failures arising from externalities and asymmetric information and if technology including e-money can decrease or even eliminate them, then; objectives of regulation may not be clearly defined and circumscribed. In other words, improvements in technology and risk management techniques may eliminate the demand for regulation. As the authors' first policy conclusion was to clearly define and circumscribe the objectives of regulation, e-money may make it difficult to identify them clearly.

Second policy conclusion was limiting expectations about regulation to a realistic level and increasing consumer awareness about financial transactions. This conclusion may imply that e-money should be allowed to develop on its own initiative with regards to consumer protection, mainly insuring policies for e-money schemes. As regulation is expected not to impede competition, which is the third policy conclusion, e-money initiatives may be better to be allowed to develop on their own nature without disrupting competition through 'early' regulatory measures without having a proven business case. The following policy conclusion was also about market discipline as regulation is expected not to reinforce or replace it. The

fifth policy conclusion asked for practitioner input into the regulation, which indicates that regulatory authorities should not try to impose regulation on e-money without discussing the issues with operators and innovators. The problem may arise here as some of the operators and most of the innovators seem to be non-banks. Another policy conclusion was to limit deposit insurance coverage. With regard to e-money, which seems to be developing mostly through private initiatives, it may be better to wait for private solutions for insurance coverage of purse balances at the first place.

Goodhart *et al* (1998) also mentioned substantially changing financial service industry and changing behaviour of financial intermediaries which may even gain speed through e-money technology supported by mobile telephony, personal computers connected to the Internet and digital television as they all create new distribution channels for financial intermediary services. They concluded that the cost of regulation might not be disregarded. Relating to the cost of regulation, e-money may decrease especially data collection and processing cost as it could provide on-line real-time data available anytime and anywhere. Data analysis and risk management techniques may gain more importance compared to data collection process.

Other than these contributions to the discussions of financial regulation, Llewellyn (1999a) analysed the potential benefits of efficiently framed regulation in a currently published occasional paper. The author named six main routes of regulation. The first route was reduced transactions, information and monitoring cost for consumers to the extent that the cost of regulation does not offset the reduction as the data collection, processing and analysis is centralised. The second route was efficiency gains through ameliorating market breakdown or gridlock. The third route was enhanced consumer confidence. The fourth route was the possible generation of positive externalities. The fifth route was removal of hazardous (solvency and conduct of business) firms through efficient authorisation procedures and the route named was enforced disclosures, which enhance the ability of consumers to make informed judgements, and increase the transparency of contracts.

The author investigated the economic rationale for regulation and supervision in banking and financial services mostly agreeing some of the arguments mentioned in the earlier section of this chapter but also added that there is a demand from consumers for regulation in order to gain a degree of assurance and lower transactions costs. It was noted that there is a clear need for monitoring financial firms, an activity that creates economies of scale when organised by a single institution.

Regulation of financial services is not a totally agreed area in the literature. Despite above drawn general framework, there have been different approaches as well. For example, Benston (1998) agreed to consumer protection from the loss of investment, fraud and misinterpretation, unfair treatment, and insufficient information and concerns about negative externalities[89] (defined as costs borne by people other than those who deal directly with financial institutions that fail and perform poorly) as justifications of regulation but added three different reasons that were not mentioned so often. These reasons and justifications for subjecting financial services to governmental regulation were (i) benefits to government and those in power from direct and indirect taxation of financial institutions and services; (ii) benefits to popularly elected officials to appear to have taken measures that benefit consumers and 'solve' (brackets in the original text) serious problems and (iii) benefits to the regulated financial institutions, including greater efficiency and consumer confidence and protection from competition by alternative sources of financial services.

Two comparative advantages of governments in producing money were named by the author as the power to declare government money as legal tender and the power to punish counterfeiters. These advantages may decrease competitive power of alternative e-money proposals.

Benefits of the regulated financial institutions from regulation were listed by the author as (i) greater efficiency from government-imposed standardisation; (ii) enhanced consumer confidence in the safety of their investments and (iii) the quality of financial products and protection from competition by alternative sources of financial services. All these benefits mentioned here are relevant to e-money discussions. The European Committee for Banking Standards, for example, has already started to impose standardisation in almost every aspect of e-purse applications including the technical equipment. The ECB, on the other hand, proposed

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[89] Benston (1998) listed these externatilies as: 1)The failure of a financial institution might impose costs on non-contracting third parties. 2) The failure of a financial institution might result in runs on other solvent institutions, which would be costly to them and might cause them to fail. 3) Failures of financial service firms might result in the collapse of the payment system, security markets and other important aspects of the financial system, with the result that there could be a serious adverse effect on the economy generally. 4) The failure of an institution with deposits explicitly or implicitly insured by the government or of the insurance companies might impose cost on taxpayers. 5) Concerns about the solvency of financial institutions and the terms and risk of financial instruments might impose unnecessarily high information costs on potential users and result in financial instruments being used less than is optimal. 6) Poor performance by financial service providers might result in potential borrowers in the providers' market areas being badly served, with negative effects on other people and businesses in these areas. The author argued that only four and fifth aspects provide economically valid reasons for financial service regulation.

that 'only banks' should be allowed to issue e-money, which might have decreased the chance of other companies.

Relating to the cost of financial regulation, Benston (1998) made a distinction between intended (operating expenses of regulatory agency including direct salaries financed through general tax receipts, fees imposed on regulated institutions, seigniorage and required reserves) and four unintended cost namely: (i) Instability of the financial system because financial institutions are prohibited from diversifying their activities effectively. (ii) Costs that have escalated beyond the level originally intended. (iii) Costs to financial institutions of regulations that once were beneficial to them, but now primarily increase their costs and prevent them serving customers effectively and finally. (iv) The cost to consumers and the economy from the absence of less costly products because some suppliers were prevented from competing with established firms.

Especially the last unintended cost may be overruled because e-money may create a chance for non-bank institutions especially telecom companies to compete with financial service providers. Some insurance companies and supermarkets may also provide financial services as in the UK.

Despite all the criticism, Benston (1998) is not against the regulation of financial services and instead made some proposals on the optimal regulation aiming to reduce or even eliminate the cost of negative externalities in (i) government provided deposit insurance, (ii) government mandated third-party liability insurance and (iii) lower-than-optimal use of life insurance and annuities. The author agreed that regulation could be effective for monitoring financial institutions' solvency and consumer protection especially from fraud, unfair dealing and invidious discrimination but mentioned that consumer protection may also be sustained by private initiatives. The optimal regulation of financial services covered high relative capital requirements including subordinated debt, structured early intervention and resolutions imposed on depositories and insurance companies.

Alternative approaches to regulation in general and financial services regulation in particular is not limited to Benston (1998). An interesting contribution came from Blundell and Robinson (1999) as they approached regulation as a voluntary industry initiative that is imposed by the service providers and relied on independent examiners when conflicts arise. The authors did not go against the need to regulate but because of clear reasons such as (i) the tendency of regulatory agencies to expand continuously, (ii) the risk that established firms may use regulation as a barrier to entry, (iii) the risk that regulated may capture regulator, and (iv)

the popularity of regulation for politicians; they argued that regulation should not be imposed by the state. Instead, they stated, private initiatives might sustain beneficial values of regulation in order to sustain consumer confidence and in order to increase creative solutions to industry problems by using private skills that may be limited by state regulation.

This approach may find a very useful place for the regulation of e-money without government involvement because in order to gain consumer confidence, any independent e-money operator such as e-gold may need to declare clear business rules and code of conduct in order to convince consumers about the efficiency of the product. As there seems to be a relative non-regulatory approach from many countries for regulation of emerging e-commerce and e-business industries, voluntary regulation by any industry on its own may also find a chance to be tested for efficiency and effectiveness. The main trend here is to limit central banks regulatory responsibilities to the overall stability of financial system and leave the prudential supervision to an independent authority with direct information-sharing arrangements with the central bank and the treasury. Obviously, there will never be a 100 % guarantee for the endless stability of the financial system. The argument here is that, individual responsibility of end users put on the scene for the control of financial integrity of service providers might increase the efficiency and social gains of regulation. In this chapter, the perception for regulation is closer to private initiatives driven regulation that has been observed by a societal regulatory institution to increase the efficiency.

In the next section, the general framework for the financial regulation in the UK by the FSA will be investigated in detail.

8.2. FINANCIAL SERVICES AUTHORITY AND REGULATION IN THE UK

The first stage of the transformation of the regulatory framework in the UK was completed in June 1998 as responsibility of prudential supervision has passed to the FSA from the BOE. The second stage was the Financial Services and Markets Act, which was published as a first draft in July 1998 and submitted by the Government to the Joint Committee of the Commons and Lords for pre-legislative scrutiny that reported in April and June 1999. Final stage started as the Bill was introduced to the House of Commons in June 1999 and it received Royal Assent on 14 June 2000. On 18 July 2000 the Economic Secretary announced a target of about a year's time for the coming into force of the Financial Services and Markets Act. According to Her Majesty's Treasury, there will be a further announcement on timing before

Christmas. Within this time horizon, the Treasury, the FSA and the financial industry are expected to complete the preparations for the new regulatory framework[90].

The FSA acquired its full range of powers as the single statutory regulator for all financial business (FSA, 1999b). Four statutory objectives of the FSA are named as follows: (FSA, 1999a),

1. Maintaining market confidence in the UK financial system including reducing systemic risk, monitoring high business conducts and preventing market abuse.
2. Public awareness meaning to promote public understanding of the financial system including to promote financial literacy.
3. Consumer protection meaning to secure the appropriate degree of protection for consumers including to take enforcement actions against firms in order to protect the interest of investors, policyholders and depositors, to develop arrangements for single compensation and Ombudsman schemes and to guide regulated firms to protect consumers' interest.
4. Reduction of financial crime meaning to reduce the extent to which it is possible for a business carried on by a regulated person to be used for a purpose connected with financial crime including to combat money-laundering.

The FSA declared to bear in mind the need to be efficient and economic in the use of resources, the responsibilities of regulated firms' own management, the desirability of facilitating innovation in the financial sector and the value of competition between financial firms.

One of the important questions in the creation of an independent regulatory authority such as the FSA was to clearly identify the relationship among the central bank, regulatory authority and the treasury. This was done by signing a Memorandum of Understanding (MOU) among three institutions in the UK and announced in 27 October 1997. According to this MOU, the BOE's responsibility was limited to the overall stability of the financial system involving (i) stability of the monetary system; (ii) financial system infrastructure, in particular payments systems at home and abroad; (iii) broad overview of the system as a whole (iv) being able in exceptional circumstances to undertake official financial operations, in order to limit the risk of problems in or affecting particular institutions spreading to other parts of the financial system and finally (v) the efficiency and effectiveness of the financial sector, with particular regard to international competitiveness including promoting the City (FSA, 1997).

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[90] http://www.treasury.gov.uk/fsma/wayahead.html

The Memorandum identified the FSA responsibilities as:

1. The authorisation and prudential supervision of banks, building societies, investment firms, insurance companies and friendly societies.
2. The supervision of financial markets and of clearing and settlement systems.
3. The conduct of operations in response to problem cases affecting firms, markets and clearing and settlements systems within its responsibilities like (but not restricted to) changing of capital or other regulatory requirements and the facilitation of a market solution involving, for example, an introduction of new capital into a troubled firm by one or more third parties. One condition for this responsibility is to inform the Treasury in advance in order to give the Chancellor of the Exchequer the option to refuse support action and inform the BOE about any major policy changes. The operations should also not fall within the ambit of the BOE responsibilities.
4. Regulatory policy in these areas: The Financial Services Authority advises on the regulatory implications for firms, markets and clearing systems of developments in domestic and international markets and of initiatives, both domestic and international, such as EC directives.

According to the Memorandum, the FSA and the BOE try to avoid separate collection of the same data and they fully share all the data collected, which is relevant to financial stability. As the Financial Services and Markets Act has Royal Assent now, it will replace the Memorandum mentioned above as soon as it is brought into force, which is expected to happen within a year.

The relevance of this Memorandum and the above mentioned Act to e-money is to clearly identify by whom e-money developments will be followed and to make a division of responsibilities on the policy-making about e-money regulations. The role of the Financial Service Authority in the regulation of e-money will be analysed further in the following parts.

8.3. CURRENT TRENDS IN THE REGULATION OF E-MONEY

The first official report known on the regulation of e-money was written by Working Group on European Union (EU) Payment Systems (EMI, 1994) on a request by the Committee of Governors of the EU central banks. The aim of the report was to improve the understanding of the functioning of multiple purpose prepaid cards also named as electronic purses which were accepted to have a potential to reduce the use of coins and banknotes significantly in retail transactions. The consequences of the electronic purse for central banks were analysed. It was

concluded that the creation of electronic purse must be evaluated carefully, because if it develops, it might affect central banks in the long run (i) as overseers of their countries' payment system; (ii) as the authorities in charge of monetary policy, and (iii) as issuers of banknotes.

According to EMI (1994), all EU central banks are concerned with the integrity, stability and efficiency of their countries payment systems. This concern was argued to cover not only the wholesale (large-value) payment systems but also retail payments and payment media because of the systemic risks involved. As a result, two main problems relating to the overseeing payment systems were named. The first one was the soundness of the issuer (which makes the card available to the user, is the beneficiary of issued value and is responsible for clearing or reimbursing). The second one was the soundness of the electronic purse instrument (which should maintain public confidence in retail payments by preventing the possibility of counterfeiting and fraud risks).

The money received by the issuer of an electronic purse was, in economic terms, assumed by EMI (1994) to be the same as bank deposits and indicated that if non-credit institutions issue electronic purses, banking regulations that aims to protect customers deposits and deposit guarantee schemes may not be applied. This may threaten the money transmission system stability and banks may have difficulties in competing with unregulated non-credit institutions.

In the name of monetary policy implications, e-money was considered as a substitution of one form of money for another and not a serious impact on monetary policy was expected in the short run. However, it was argued, with a widespread use of prepaid cards in the long run, three implications were expected for the conduct of monetary policy. First is the need to include the amount of prepaid value to the narrow money aggregates as this value may be accepted as a perfect substitute for notes and coins and sight deposits up to a certain extent. Second is the potential influence of prepaid value on the velocity of money. Third is an accelerating shrinkage of central bank balance sheets, which may result in a decrease in the ability to influence interest rates by conducting market operations. EMI (1994) provided five scenarios for central bank action, which has been evaluated in section 6.3.2 at which the different perceptions towards e-money has been analysed.

The second regulatory proposal came as Opinion of the EMI Council on the issuance of e-money and was published in EMI 1997 Annual Report. These opinions are mostly covered by the ECB (1998). It was mentioned that a majority excluding Denmark, Sweden, the United

Kingdom and Luxembourg adopted the opinions mentioned. The ECB published a new report in 1998 on e-money and proposed further regulations relating to e-money including software-based products. A regulatory approach was defended to e-money arising basically from concerns relating to, first of all, the need to preserve price stability and the need to preserve the unit of account function of currency. Especially the second concern seems inconsistent with the historical experience, where the unit of account function of money was preserved under free banking areas around the world, especially in France, which was discussed under section 7.1.

ECB (1998) argued that if e-money is issued as a consequence of credit, the interest charged on the credit extended for the provision of e-money may be equal to the credit risk premium plus the cost of payment service. As the risk premium and cost of service falls, the interest rate may also decrease. It was concluded from this assumption that lowering the level of interest rate by the above-described mechanism could endanger the maintenance of price stability which seems doubtful as this approach seems to ignore a similar process caused by credit cards without endangering the price stability. The risk of over-issue was addressed, and it was argued that redeemability requirement will be more important than a competitive environment undervaluing the invisible hand argument which was especially successful in Scottish free banking experience.

Six additional concerns has been indicated by ECB (1998) included first of all the efficient functioning of payment systems and confidence in payment instruments as float mismanagement, intrusion of counterfeit value, major and/or ultimate technical failures that may cause a lack of confidence in payment systems. The second concern was given as the protection of consumers and merchants. The third concern was named as stability of financial markets relating to the avoidance of systemic risk. The fourth concern was mentioned as protection against criminal abuse as e-money schemes may be vulnerable to counterfeit and fraud including money laundering and tax evasion. The fifth concern was addressed as implications for monetary policy strategy as e-money is likely to affect the behaviour of monetary aggregates by mainly three effects including (i) creating a close substitute for central bank money, (ii) increasing velocity and (iii) sustaining a potential for interest bearing financial assets for transaction purposes. Final concern was underlined as operational target implications as e-money implies a reduction of base money and the shrinking of the central bank's balance sheet making it more difficult for a central bank flexibly absorb a liquidity shock, and decreasing the ability of the central bank to control a short-term money market interest rate as its operational target.

After declaring above mentioned arguments relating to the reasons behind the regulation of e-money, ECB (1998) regarded it as essential seven minimum requirements that needs to be fulfilled by e-money issuers as being investigated in section 6.3.2. ECB clearly declared its intention to monitor future developments and to reassess monetary policy and payment system implications of e-money to identify new policy conclusions *including the issuance of e-money by the European System of Central Banks (*ESCB*) itself*, if it is believed necessary.

The ECB (or EMI) is not the only European institution that display opinion on e-money. European Commission showed interest as well. The aim and mandate of the European Commission was explained in Explanatory Memorandum for the Commission Proposal for European Parliament and Council Directive (EU, 1998) on the taking up, the pursuit and the prudential supervision of the business of e-money institutions. According to the memorandum, the aim and mandate in relation to e-money was to build and help unfold the single market in financial services with a focus to remove barriers for carrying on financial business activities across borders and to follow developments of new techniques and products. The Commission seemed conscious of the regulatory and supervisory issues associated with e-money issuance. It was argued by the memorandum that the financial integrity and the operations of e-money issuers and the stability and soundness of issuers *must be secured.* It must also be ensured that the failure of any one individual issuer does not result in loss of confidence in this new and developing means of payment. It was believed that the proposal would create a harmonised single market in the provision of e-money in the European Union and will reinforce stability and substantially eliminate the associated prudential risks.

The memorandum declared basic requirements for e-money institutions as (i) prior authorisation; (ii) minimum capital requirements not less than ECU 500.000 (e-money institutions were also required to have at all times own 'funds equal to or above 2% of the higher of the current amount or the average of the preceding 6 months' total amount of their financial liabilities related to outstanding e-money); (iii) fit and proper management (iv) sound and prudent operation and initial and ongoing owner control. The proposal also required that funds received in exchange for issued e-money should only be invested in highly liquid assets. This requirement aimed to impose a relatively low-risk investment policy to help to ensure the stability and soundness of the issuers in order to protect the e-money system and consumers in general.

It may be argued that, one of the basic aim of the memorandum was to define an e-money institution as a credit institution, which is defined as an undertaking whose business is to receive deposits or other repayable funds from the public and to grant credits for its own account. The reason for this aim is that the ECB can only apply reserve requirements to credit institutions within the Euro-system and as clearly declared by ECB (1998), reserve requirement for e-money is an intention.

Even there is no proven business case on e-money other than many national and international trials around the world, regulation has created two different approach between EU and USA, which has been analysed in depth in section 6.3.2. Issing (1999) even argued that e-money is seen by ECB as a threat for the unit of account function of money and full redeemability is required for purse balances (ECB, 1998). In another initiative against e-money, ECB submitted its opinion on the potential European Parliament and Council Directive on the Taking up, the Pursuit and the Prudential Supervision of the Business of Electronic Money Institutions in January 1999 (ECB, 1999). According to the Opinion, the ECB asked for the exclusion of all other institutions other than banks and e-money institutions (they were not even allowed to issue credit or debit cards or use the term 'bank' in their trade names) being prohibited from issuing e-money. Guarantees, loss-sharing and insurance schemes were advised to protect consumer and free redemption was asked to preserve the unit of account function of Euro. The ECB asked for redeemability for all size of e-money schemes without any exception. Additionally, a minimum level of regulation at the Community level was asked and the possibility of imposing minimum reserve requirement on e-money institutions including statistical data collection was addressed to be added to the potential Directive.

After two years of discussion throughout the European directive making procedures, the EU Directive on e-money has been finalised in October 2000 and within 18 months of publication in the Official Gazette, all the EU countries are legally responsible to adjust the national acts and laws accordingly. According to the final version of the Directive 2000/46/EC of the European Parliament and of the Council on the Taking up, Pursuit of and Prudential Supervision of the Business of Electronic Money Institutions, Member States shall prohibit persons or undertakings that are not credit institutions from carrying on the business of issuing electronic money. The business activities of electronic money institutions other than the issuing of electronic money is restricted to: (a) the provision of closely related financial and non-financial services such as the administering of e-money by the performance of operational and other ancillary functions related to its issuance, and the issuing and administering of other

means of payment but excluding the granting of any form of credit; and (b) the storing of data on the electronic device on behalf of other undertakings or public institutions. Electronic money institutions are not allowed to have any holdings in other undertakings except where these undertakings perform operational or other ancillary functions related to electronic money issued or distributed by the institution concerned.

The Directive imposed heavy redeemability requirement for e-money issuance at par value in coins and bank notes or by a transfer to an account free of charges other than those strictly necessary to carry out that operation. The contract between the issuer and the bearer are required to state clearly the conditions of redemption. The contract is only allowed to stipulate a minimum threshold of not exceed EUR 10 for redemption.

The directive also imposed initial capital and ongoing own funds requirements to electronic money institutions to have an initial capital, of not less than EUR 1 million. These institutions are demanded to have at all times own funds which are equal to or above 2 % of the higher of the current amount or the average of the preceding 6 months' total amount of their financial liabilities related to outstanding electronic money. Their investment strategies have been regulated as well, which is expected to an amount of no less than their financial liabilities related to outstanding electronic money in the following assets only: (a) asset items which are sufficiently liquid; (b) sight deposits held with certain credit institutions (c) debt instruments which are sufficiently liquid.

Finally, electronic money institutions are to have sound and prudent management, administrative and accounting procedures and adequate internal control mechanisms. The directive even addressed the financial and non-financial risks to which there might be an exposure including technical and procedural risks as well as risks connected to its co-operation with any undertaking performing operational or other ancillary functions related to its business activities and the management is expected to be capable of handling these risks. The waiver, which has been addressed in section 6.3.2 was the item where the EU directive went against ECB demands to not to allow any kind of exemptions on the issuance of e-money.

Most of the above-cited literature might seem to treat e-money as a financial instrument that should be covered by financial regulation as soon as possible. There have been alternative contributions as well. For example, Good (1997) argued that payment system is recently a complex set of instruments, processing infrastructures, laws, rules and regulations and institutions and stated that future payment system will provide more choices, be more high tech and become more complex. The author suggested payment systems would be a challenge for a

policymaker who must find a fine line between providing safety and stifling innovation. Good (1997) is not alone in taking a liberal approach to the regulation of e-money. Solomon (1999) investigated the relation between national and international consolidations of banks and concluded that technological innovation such as e-money has contributed to the current consolidation trends. The author advised a *grey* approach to the regulation of e-money instead of *black* or *white* in order to support current innovations even further, to allow banks to create joint ventures with telecommunication, encryption and the-like firms relevant to e-money technologies and to create private initiatives for e-money insurance.

Additionally, Good (1998b) reached six conclusions for the future prospects relating to e-money systems in the US; which has been summarised in section 6.3.2. The accelerating acceptance of innovation is exhibited in the following table:

TABLE 8.3.1: ACCELERATING ACCEPTANCE OF INNOVATIONS

DATE	INVENTION	YEARS BEFORE MASS USE
1873	Electricity	46 Years
1876	Telephone	35 Years
1886	Gas Automobile	55 Years
1906	Radio	22 Years
1926	Television	26 Years
1953	Microwave Oven	30 Years
1975	Personal Computer	16 Years
1983	Mobile Phone	13 Years
1991	The Web	6 Years

Source: Good, 1998b.

According to the author, regulators should observe and monitor the evolution of e-money systems in order to prepare themselves to make recommendations unless regulation becomes vitally important. Regulation demand was expected to come from the e-money industry as the market develops. The US government involvement was also mentioned to be limited to broader policy issues, similar to the position taken on tariffs and taxes on Internet commerce.

Greenspan (1997) argued in a parallel line of opinions that significant part of safety and soundness of regulation should come from market forces and institutions and government regulation may be an add-on to try to identify presumed market failures for creating official rules to fill in the gaps. It was mentioned that as financial system gets more complex, detailed rules and standards become burdensome and ineffective or even counterproductive and as a result concluded that e-money should not be regulated in order to foster financial innovation by letting it develop without rules. In-advance regulation of e-money was also criticised because

of illusions of government interference to resolve the uncertainty through standards, regulation or other government policies as only consumers and merchants can ultimately determine what new products are successful in the marketplace. This last description is almost exactly reflecting what has been happening in the EU as banking standards have already been imposed on electronic purse products and there is a strong incentive to regulate e-money almost as soon as possible.

One additional view on the regulation of e-money from the FED came recently. Gramlich (1999) who is a member of FED Board argued that government intervention on e-money is both economically unwise and politically unlikely.

Among these rich literatures, the final outcome seems to reach to an end as the EU directive on e-money has been finalised and the FED still prefers to collect data on the emergence of e-money.

It may be generally agreed that one of the main arguments for the regulation of financial services is the risky nature of financial services in general and banking in particular. Risks in e-money business gain a lot of importance at this sense and deserve a closer investigation. The risks surrounding e-money business has been analysed in detail in current publications. For example, the BIS (1998) investigated risk management techniques for electronic banking, which referred to the provision of retail and small value banking products and services through electronic channels and e-money activities. Potential operational risks were named as unauthorised system access, employee fraud, counterfeiting of e-money, service provider risk, obsolescence of systems, outdated staff and management expertise, inadequate customer security practices and customer repudiation of a transaction. According to the BIS (1998), reputational risks in e-money activities may be named as significant and widespread system deficiencies, a significant breach of security and problems with or misuse of same or similar systems or products by another institution.

Legal risks were given by the BIS (1998) as uncertain or ambiguous applicability of laws and rules, money laundering, inadequate disclosure of information to customers, failure to protect customer privacy, problems with a linked Internet site, certificate authority risk and exposure to foreign jurisdictions. Default of borrowers who applied for credit via remote banking and default of an e-money issuer were named as credit risks. Other risks identified by the BIS (1998) were illiquidity of e-money issuer as liquidity risk, unanticipated interest rate changes for the instruments in which an e-money issuer invests as interest rate risk, foreign exchange risk arising from acceptance of foreign currencies in payment for e-money as market

risk and transfer risk arising from foreign-based service provider, and finally foreign participants in an e-money scheme as country risk.

Cross border issues were also investigated as well by the BIS (1998) arguing that different national authorities may expose banks risk with non-compliance with different national laws and regulations including consumer protection laws, record-keeping and reporting requirements, privacy rules and money laundering laws. Relating to the management of above-mentioned risks, the BIS (1998) advised a process that includes the three basic elements: assessing risks, managing and controlling risks and monitoring risks.

Some of these risks seem to be common to financial services in general but there are also unique risks that may need special treatment in e-money business. However, any e-money operator may be expected as keeping an eye on these risks just from the beginning of the business as money needs user confidence at the first place and no e-money may be issued unless end-user is fully satisfied about the quality and non-risk characteristic of the product. As these risks need to be identified and managed carefully, then; e-money may find more users to gain wide-acceptance, which is one of the basic requirements of being money in general.

Other than risk management techniques relating to e-money business, money laundering has been an issue in financial services as well. Its popularity seems to be increasing recently as it has even become an international issue. Financial Action Task Force (FATF) on Money Laundering, which is an inter-governmental body whose purpose is the development and promotion of policies to money laundering, investigated some of the e-money schemes in 1997. FATF (1997) argued that e-money has a potential to make it easier for criminals to hide the source of their proceeds and move those proceeds without detection. On the other hand, it was stated that it is premature to consider prescriptive solutions to theoretical problems as e-money schemes are still in their infancy. FATF has forty recommendations on money laundering relating to customer identification and record-keeping rules, increased diligence of financial institutions and measures to cope with the problems of countries with no or insufficient anti-money laundering measures (FATF, 1996). It may be better to indicate here that even money laundering may find new ways through e-money technologies, it may also be prevented with additional analytical channels that may be constructed by using e-money technology. Because e-money is electronic in definition and it may be easier to monitor money movements by using advanced database management techniques with increased computer power. One of the most effective way is obviously to limit the maximum amount of e-money that can be downloaded to

any individual e-money instrument. From the user's point of view, this may not be a big issue as the main target of e-money is to address micro-payments.

8.4. THE FSA APPROACH TO THE REGULATION OF E-MONEY

Although there is no official guidance on the regulation of e-money in the UK published by the FSA, its chairman defined a strategy for e-regulation. (Davies, 1999). First of all, Internet-based financial services including e-money was described as beneficial for consumers by bringing cheaper transactions and bringing good quality of information for investors and savers. The chairman described the general framework as going against some other regulators, whose instinct is to seek to constrain or even ban new entrants to financial service industry as they (European regulators) argue that only banks should be able to issue e-money. This approach was refused, as it would disrupt the more imaginative new approaches to payment methods, approaches, which could well bring important benefits to consumers. The attitude was explained as to find a way of adapting the regulatory environment to new technology, not adapting the new technology to the old regulatory rules. This approach seems closer to the US approach as it disagrees the EU applications explicitly. Internet-based financial services was especially addressed by the chairman as it was argued that Internet will help regulators by providing more and fast real time data about the market and by allowing regulators to communicate with the investors directly. The proposed strategy composed of five components:

1. *Surveillance* meaning to obtain information through FSA staff, industry, consumer associations, the public, the police and the media.
2. *Education* of investors to promote consumer understanding of newly emerging financial services including e-money.
3. *Co-operation* on the international issues on the regulation of emerging technologies and their implications for the financial markets both national and international.
4. *Security* checks on the financial transactions.
5. *Enforcement* to protect investors where appropriate.

As e-money is an emerging phenomenon, the FSA did not yet address e-money developments directly through official publications. As a result, alternative sources of information collection were preferred and a questionnaire was sent to the FSA, which is presented in the Appendix at the end of this chapter. The aim of this particular questionnaire

was to get the first hand information from the FSA about its approach to the regulation of e-money.

According to the responses given to the questionnaire by the FSA, the general framework of the regulation of e-money in the UK will inevitably be shaped by the European Parliament and Council Directive regarding e-money and e-money institutions. As the FSA has no veto right on the shaping of the Directive, the only influence is to express the official views during the working group discussions to advice the final draft of the Directive. The final decision is taken on a democratic voting and all the members are expected to respect the outcome. The result of this mechanism is that the FSA may need to take regulatory steps on the regulation of e-money and e-money institutions even if there is no intention to do so with regards to the UK financial markets and services.

In accordance with above mentioned legislative restrictions, the FSA defines both e-money and e-money institutions as the final version of the European Directive defines them and the current definition is given as the latest version of the Directive proposal puts them. Until now, no single e-money institution was supervised or regulated by the FSA but e-money developments have been followed within the banking system as a whole as banks and other financial institutions have been supervised and regulated. One reason for that is because e-money issuance is not an authorisable activity in the UK at the moment and there seems no immediate intention to impose any kind of regulation. The initiative was left to European Directives, as even a different approach may not be sustained due to European Treaties. The major aim of the FSA seems to get involved in the discussions, to follow the developments and to analyse all the examples of e-money activities, which can be executed by banks, non-banks, in short by any company that may find an interest in e-money potential.

Licensing e-money institutions is within the responsibilities of the FSA but as e-money business is not regulated at the moment, the FSA can only apply to the Court if a company refuses to be treated as a deposit taker when there is a conflict. But it may not be a common expectation to see an e-money institution to challenge the regulatory powers of the FSA in order to operate in the UK. If there is a demand for an opinion whether an activity is involved in deposit taking or not, then the FSA is expected to give a reply. Sometimes the FSA publishes Guidance for developing regulatory issues as it was done on 'Treatment of Material on Overseas Internet World Wide Web-sites Accessible in the UK but not Intended for Investors in the UK'. It may be expected that if there is a demand for opinion before the European

initiatives reach a conclusion, then the FSA will provide help for the clarification of the problems arising from the e-money activities.

Regarding the ECB proposals, it may be argued that the FSA is not willing to be pro-active on the regulation of e-money but it is worth noting that the final decision-maker on the regulation of e-money in Europe is not the ECB. The European Parliament and Council approve the final Directive.

The details of the FSA approach to the regulation is questioned and analysed in dept in the appendix. Before finalising this section, it may be worth mentioning that the FSA argued that e-money and e-money institutions could be regulated if there is a strong incentive to regulate under normal circumstances.

8.5. CAN E-MONEY BE REGULATED?

When discussing the regulation of e-money, it is quite important that recently all the available e-money trails around the world are almost all at the beginning stage. There is an important case regarding Digicash. As it is analysed in the second case study, e-cash has been a mature scheme and found many participants in the implementation including six international banks. But, the company later declared bankruptcy and finally taken over by another e-money innovator. The problem here is that when EMI (1994) published its report on prepaid cards, the paper did not cover network-based money such as Digicash but when ECB (1998) included it on its report, the company went bust. This special case may show that in order for a sustainable regulatory framework for e-money, first of all, a stable scheme with a proven business case needs to be observed. Due to the collapse of the company, consumers did not have any trouble converting their e-cash balances to desired currencies at all because of the on-line real-time convergence opportunities.

Digicash is not the only case with special cases for the regulation of e-money. Defining e-money, even before regulating it, seems to be premature due to endless new technological developments and new trials around the world. For example, Beenz as the 'currency of the Internet' may not be regarded as money as it is not a generally accepted medium of exchange but so as cigarettes that were used as money during the German hyperinflation. There are other examples such as air miles by airline companies and supermarket shopping points. The importance of e-money technology here is that it creates an opportunity to issue 'a kind of purchasing power' in a technically secure and flexible environment. As not only wholesale payment systems but retail as well gets more and more digitised and gets more electronic;

issuing money, distributing and collecting through a payment infrastructure becomes cheap and sustainable. If the current predictions are realised relating to Internet, DTV and mobile telephony, then it may not be possible to imagine what kind of alternative payment instruments may be put on the market. May it be e-gold, for example? Or may it be kind of 'purchasing power indexed to FTSE 100? Or may it be index to Retail Price Index? Until a proven business case for e-money related technologies emerges, all the regulatory approaches may be ineffective. Because of the speed and unexpected nature of innovation, it may not be possible to adopt in advance regulation to rapidly changing alternative solutions supplied for economic units.

Current e-money trials around the world seems to develop as electronic presentations of national monies which results in a decrease in the circulation of banknotes and coins but e-money is not the only reason to decrease the circulation of national banknotes. The aim of the regulation should not be to defend Euro banknotes in Europe or dollar banknotes in the US because alternative developments in credit and debit card technology schemes have already been decreasing the circulation of money. Debit cards may be used just to buy a piece of chocolate for less than 30p especially in nation-wide supermarkets in the UK. As a result, if the aim of regulation of e-money is to support circulation of national banknotes and coins, it would not be delivering any success. Additionally, the developments in payment technologies (plus parallel developments in related fields) have decreased currency in circulation for a few decades in almost every developed nation. The potential of e-money here is to address the problem of micro-payments that only cash as a payment instrument is available in a world of digital payments. This potential may further decrease demand for banknotes and coins.

On the other hand, money is not only a short-term medium of exchange. It may be a bit imaginative to argue that an alternative medium of exchange can replace a stable national money within one or two years at least because of long-term contracts. Any money needs to prove itself in order, as a medium of exchange, as a store of value and as a unit of account [91]. As far as current monies around the world are sound and safe, then e-money's potential might be limited to create alternative payment instruments to challenge unit of account function of national currencies. As currency substitution in developing countries decreases the circulation of unsound national currencies, e-money may increase the degree of substitution. Even in

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[91] The only exemption for that could be gold, silver or other valuable metals that have been nationally and international accepted as unit of account and store of value items for so many years but had difficulties to reach to the end users as medium of exchange.

developed countries, economic units may be given additional options to decide on the type of money that they want to prefer as medium of exchange and store of value and unit of account with the increasing capabilities of e-money circulating channels including PCs, DTV and mobile phones. But, because of medium and long-term contracts such as mortgages and long term gilts, a challenge to a national currency by providing an alternative medium of exchange and followingly an alternative unit of account might be dependent on the failure of national currency in terms of safety and soundness deterioration.

A few years ago in 1997, Deutsche Bundesbank started to add e-purse (prepaid card loading amount) balances into the money stock M1 leading to the inclusion of e-money balances to all monetary aggregates. The Bank argued that if e-money replaces cash only, the final influence on broad money (M3) would be negligible. But in a recent report (Bundesbank, 1999), it was argued that there is a possibility of network-based e-money circulation to become independent of monetary policy. In the same report, it was given that the amount of e-money circulation is about 60 million Euro. However, as far as monetary policy is conducted on a safe and sound currency, what can create a demand for an alternative payment instrument such as a network-based e-money?

The implications of this analysis for Euro is that if there is a kind of financial crisis within Eurozone, then, it may be very easy for countries especially such as Belgium, Finland and Sweden to leave Euro. The transformation from national monies to a single currency in Europe has been taken many years but going back may not be so difficult with the help of electronic circulation of monetary base. The reason for that is the infrastructure that is needed for a successful e-money scheme. Once, there is a complete e-money structure in a country with a perfect combination of PCs, DTV, ATM network and mobile telephony (in short all kind of technical infrastructure to support full reliability) and once the circulation of banknotes and coins is not needed anymore because of the reliable e-money networks, then; it takes just a short time to change the type of money that circulates digitally in this network. Maybe this is the main reason for the heavy regulatory proposals from the ECB regarding e-money. But, such a network is not only supported by e-money technologies but a wide range of supporting technologies play the same role. For example, if mobile phone technology develops in such a way that the cost of mobile communications becomes so cheap, then the transaction cost through mobile phones may compete against the transaction cost of cash even for micro payments. More than that, there has been a lot of speculation about the digital age and if life

gets digital, then; money may need to follow the trend as well. It may be argued, as a result, that e-money is not avoidable.

Another problem with the regulation of e-money is that if some countries prefer to leave e-money developments to the market when other countries prefer to regulate in advance, then, there may be a comparative disadvantage in heavily regulated countries as regulation may limit alternative approaches for alternative solutions, in a sense further innovation. Consequently, because of in-advance regulation, some countries may loose the chance of leading the way to the digitalisation of money. This may result in digitally dollarisation (or any other currency) of national monies in these countries as e-money technology allows to circulate more than one currency in a single card (up-to five currencies may be downloaded to Mondex cards). This may be treated as an extension of currency substitution to the level of medium of exchange, instead of store of value, increasing the impact of substitution and decreasing the power of national monetary authorities to enforce the circulation of an unsound and unsafe currency.

On the regulation of e-money, another important problem is that Internet has been allowed to mature itself without any regulation arising from the new contract mechanism that is created by Internet-based business. Recently, Internet's full potential does not seem to be discovered fully. The critical potential here is that if Internet applications eliminate the cost of calculation and telecommunication, then; electronic circulation of money would almost be costless, creating a chance to eliminate transaction cost, which is one of the main reason to have money in the first place -to decrease transaction cost as much as possible to ease division of labour. In accordance with the free evolution of Internet, it may also be more appropriate to leave e-money to evolve itself. Because, one reason Internet is not regulated heavily is that, it is not known what may be imposed as regulation on Internet applications as there has been no information accumulation about it. Different applications have been allowed to develop itself, holding the regulation back but at the same time collecting data to be used for the possible future approaches on Internet issues. It may be argued that Internet applications and e-money have so much in common in the name of regulation.

On the other hand, there are alternative possibilities for the regulation of financial industry, which may automatically cover the development of e-money without disturbing its emergence with guidance-oriented regulatory proposals. In this framework, Llewellyn (1999b) proposed a *regulatory regime* instead of pure regulation and gave seven components including rules established by regulatory agencies and monitoring and supervision. He proposed an increased role for *market discipline and monitoring* and increased role of *corporate governance*

in financial firms. Such an approach may be a more appropriate way of introducing regulation into e-money business.

When the discussion is about the regulation of e-money, it may be worth to mention brave approaches from the central bankers and especially one of them deserves more attention. A member of Monetary Policy Committee and Deputy Governor of the BOE Mervyn King recently argued that technological innovation would put the central bankers out of money business technically but mentioned that it is a great matter of trust to get involved in money business as an alternative to central banking. As long as this trust is maintained by central banks, he argued, central banking could find a place for itself in the financial structure of the future. Otherwise, financial sector would manage itself without central banks as it happened during free banking eras in the past. (King, 1999). Before imposing regulation on e-money, this argument may need to be evaluated carefully as unless central bank money is safe and sound, the demand for alternative medium of exchange may not be expected to arise. But, if there is chaos and turbulence in the financial markets, especially such as hyperinflation, societies may have better options than cigarettes to be used as medium of exchange and followingly store of value and unit of account. During chaos, even the hardest regulatory frameworks may not be used efficiently. The basic difficulty in regulation of e-money lies on its technical potential to create a sustainable monetary regime with the help of technology and unless current financial system is reliable, there may be no demand for an alternative.

It is important in this regard that any regulatory framework will be effective as far as the integrity of money has been sustained with sound and stable monetary and fiscal policies. Once the integrity is endangered, e-money will help to increase 'the right to choose' from any alternative arrangements that might convince the end users as a better monetary framework. To give an example, the regulation of financial services during the far-east financial crises or the late Russian financial turmoil or the Turkish financial problems in 1994 failed to be effective totally because of the collapse of the integrity of the domestic currency. No amount of regulation at whatever form can stop people voting with their feet to substitute to a more stable currency.

8.6. APPENDIX: A QUESTIONNAIRE ON THE REGULATION OF E- MONEY

Submitted to: Rebecca Jones, The Financial Services Authority (Submitted: October 4th; Received October 15th, and Interviewed October 19th1999 and Interview update on 24th October 2000 with Dominic Peachey)

Question 1: How does the Financial Services Authority (FSA) define electronic money (e-money)?

Answer: The FSA uses the definition found in the most recent version of the draft Directive on the Taking up, the Pursuit and the Prudential Supervision of the Business of Electronic Money Institutions'.

Information: The definition is given in section 4.1.1.

Question 2: How does FSA define an 'e-money institution'?

Answer: According to the definition found in the aforementioned draft Directive.

Information: The Directive's definition[92]: 'electronic money institution` shall mean an undertaking or any other legal person, other than a credit institution, which issues means of payment in the form, of electronic money.

Question 3: What type of institutions will FSA monitor or impose regulation on, with regard to the issuance and/or operation procedures of e-money products?

Answer: If the draft Directive is agreed and its provisions are subsequently carried into UK law, then the FSA will monitor and impose regulations on electronic money institutions. It already monitors the electronic money activities of the banks under its jurisdiction as part of its ongoing supervision process of the risks undertaken by these banks.

Question 4: Did FSA ever supervise and/or regulate an e-money institution up to now?

Answer: No.

Interview Notes: The FSA mentioned that as banking system is under supervision, any banking service including e-money is naturally covered by the regulation process indirectly even if it is not directly.

Question 5: If not, when does FSA anticipate starting the regulation of e-money institutions?

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[92] Piia-Noora Kauppi, Finnish European Parliamentarian who is the secretary of the directive, mailed the final version of the Directive, which has been finalised now.

Answer: The FSA anticipates regulating e-money from the date that the issuance of e-money becomes an authorisable activity in the UK.

Interview Question: Does this mean the FSA prefers to wait for the EC regulation and to adopt UK's regulation in accordance with the EC Directives?

Interview Answer: As the general approach of the FSA is to adopt regulation to the technology but not to adopt technology to the regulation, there is no individual incentive to the regulation of e-money itself. But as part of European Union, once there is a Directive from the European Parliament and Council, then UK legislation needs to be adapted within 18 months after the publication of the Directive. As a result, the FSA is prepared for the regulation of e-money in accordance with the EU regulation.

Question 6: Which of the currently existing e-money trials and/or institutions have been (or will be) monitored or supervised? For example, are Mondex and Visa Cash treated as e-money institutions and monitored or regulated accordingly?

Answer: The FSA has attempted to keep abreast of all e-money developments, in order to improve its understanding of this nascent industry.

Interview Question: How does the FSA try to improve its understanding of e-money industry? Is it through interviews and product overviews or through direct co-operation with innovative companies?

Interview Answer and Notes: It may be worth to mention once again that as current e-money schemes are mostly within the banking industry at least through joint trials, even if there is no direct monitoring or supervision, it may not mean that e-money is totally out of regulatory framework. It was also mentioned that sometimes, innovative companies might come to the FSA in order to explain a project, which may in one way or another be related to the responsibility areas and ask for an opinion. It seems that, the FSA prefers to collect as much information as possible through formal and informal means about the current projects and to follow the developments with all means including personal applications by companies interested in e-money and individual interviews and group meetings. All the current channels for data collection and supervision may be used by the FSA when necessary.

Question 7: Is there any limit on the type of institutions that can issue e-money in the UK? Can supermarkets and/or insurance companies and telecommunication companies and/or digital television service providers issue e-money?

Answer: The issuance of electronic money is not generally an authorisable activity in the UK, therefore any firm may undertake such activity.

Question 8: Does an e-money operator need a **banking license** or any **other FSA approved license** in order to issue e-money in the UK? If yes, what would qualify an institution to obtain a license?

Answer: Whether a banking license is required is dependent upon the nature of the scheme. If the scheme involves deposit taking, as defined in the banking act, then authorisation is required.

Interview Question: Does the FSA think that e-money scheme involves deposit taking? What are the conditions to define e-money as deposit taking? If an e-money scheme is purely credit-based, does that mean the scheme does not involve deposit taking?

Interview Answer and Notes: Within the current regulatory framework, it is not fully clear yet how the definition of deposit will be clearly provided. However, account-based e-money proposals seem closer to the concept of deposit than unaccountable token specific e-money schemes. It seems that the FSA prefers a wait-and-see approach to the definition of deposit and if any e-money scheme seems to be involved in deposit but arguing that it is not, then legal action will be put forward. It will be a court decision whether the scheme involves in deposit taking or not according to Banking Act. There seems to be no hurry to adopt recent definition of deposit to emerging e-money schemes, as it may be difficult to evaluate the nature of the schemes due to their infantry.

Question 9: Does an e-money operator based in the UK need a **banking license** or any **other FSA approved license** in order to issue e-money in countries other than the UK? If yes, what are the basic requirements for the license?

Answer: The requirements in other countries vary considerably. However credit institutions authorised in the EEA have a 'passport' which allows them to conduct authorisable activities in other EEA countries without having to obtain authorisation in that country. Currently banks that issue e-money benefit from this. In the future, electronic money institutions will generally have the passport too.

Interview Question: What about non-EEA countries like African, Latin American and Asian Countries?

Interview Answer and Notes: As the FSA prefers to wait for the EU Directives, international issues are not officially addressed. It may be argued that the FSA's preferences on e-money issues are to judge every e-money scheme individually and commend accordingly. The FSA does not seem to be in a hurry to decide all the potential issues surrounding money unless there arise a time for immediate action.

Question 10: If e-money operators do not need a **banking license** or any **other FSA approved license** for e-money business, does that mean they do not need an approval from the FSA for e-money business?

Answer: Yes.

Question 11: Does FSA collect any data on the issuance of e-money in the UK? If yes, since when?

Answer: Not routinely.

Interview Question: How often?

Interview Answer and Notes: There is no direct decision to collect regular e-money data but as part of the banking supervision, all the required information regarding to banking services is collected. E-money is not treated as an important part of the banking services as it is only an emerging service yet. Once it gets widespread, the FSA has all means to collect all the information that is needed.

Question 12: Does FSA treat e-money balances as 'bank deposits' that would be, as a result, subject to insurance protection?

Answer: If the balances fit the definition of a deposit in the Banking Act then they obviously benefit from the deposit protection scheme. If the balances do not constitute a deposit then there is no such protection.

Interview Question: Which institution will decide whether e-money balances fit the definition of deposit?

Interview Answer and Notes: It is the FSA that will decide whether an e-money scheme fits the definition of deposit. In case of a conflict, the FSA will bring the case to a Court and the Court will take the final decision. It is up to e-money operator to argue that the scheme does not fit the definition of deposit and the FSA will defend its case accordingly.

Question 13: What is the legal framework for the regulation of e-money and e-money institutions in the UK? Which current laws and regulations apply to them?

Answer: There is currently no legal framework unless the scheme involves deposit taking.

Interview Question: What happens if the scheme involves deposit taking?

Interview Answer and Notes: As it was mentioned in other responses, there is no clear legal framework for the regulation of e-money in the UK but there is a legal process in the European entities which is expected to result in a legal framework for all EU countries. The FSA actively participates all the discussions and forums regarding the legal process, and defends its own

opinion on the regulatory approaches in a democratic decision-making process. As a result, there is no clear answer to this question because it will be responded by the EU regulation.

Question 14: What future changes and amendments may be in the legal enforcement agenda?

Answer: If the draft Directives are agreed then UK legislation will be amended accordingly.

Interview Question: Is there any possibility of conflict with the UK legislation and the Directives?

Interview Answer and Notes: It is legally impossible to have a conflict with the UK legislation and the Directives and the EU Treaties impose all the EU countries to adapt their legislation in accordance with EU Directives. As a result, once there is an e-money and e-money institution directive, the UK legislation needs to be adopted within the given time period as mentioned in every Directive individually.

Question 15: Is there any other institution other than the FSA that will be responsible for the regulation of e-money and e-money institutions?

Answer: The FSA will be the sole financial regulator in the UK once the Financial Services and Markets Act is completed.

Question 16: What is the division of responsibility and authority between FSA and the Bank of England on the regulation of e-money and e-money institutions?

Answer: The FSA is responsible for supervising individual institutions. The FSA therefore has the following objectives: protecting consumers of financial services, promoting public understanding of the financial system, maintaining confidence in the financial system and the reduction of financial crime. The Bank of England has responsibility for stability of the financial system as a whole i.e. stability of the monetary system, financial system infrastructure, broad overview of the system as a whole, official financial operations in exceptional circumstances, efficiency and effectiveness of the financial system.

Question 17: How does FSA cooperate with the European Central Bank on the regulation of e-money? Does FSA agree to the ECB requirements for the issuance of e-money, especially those concerning redeemability and reserve requirements?

Answer: FSA and ECB co-operate as fully as possible.

Interview Question: Are there any disagreements?

Interview Answer and Notes: A clear disagreement was not confirmed by the FSA but Davies (1999) clearly mentioned the existence of different approaches to the regulation of e-money. An important point here is that the legislative power of European Central Bank is limited to

send its opinion to the European Parliament and it is the Parliament's choice to decide whether to take these opinions into account or not. Currently, it may be argued that not all the ECB opinions may be adopted into the legislative framework regarding e-money and e-money institutions.

Question 18: What is the FSA's view on the proposed 'European Parliament and Council Directive on the Taking up, the Pursuit and the Prudential Supervision of the Business of Electronic Money Institutions'? Is FSA's approach to the regulation of e-money and e-money institutions in disagreement with the Directive?

Answer: The FSA has been fully involved in the European Council Working Group handling the draft e-money directives.

Interview Question: Does this mean the FSA agrees all the outcome of the Directive?

Interview Answer and Notes: Decisions on the Parliament is taken on a democratic basis and after expressing its views on the Working Group level, the FSA is expected to respect the final outcome. The FSA has *no veto rights* regarding to e-money and e-money institutions Directives.

Question 19: What were the formal and informal ways in which FSA influenced the proposed 'European Parliament and Council Directive on the Taking up, the Pursuit and the Prudential Supervision of the Business of Electronic Money Institutions'?

Answer: The FSA attended all relevant Council Working Group meetings.

Question 20: Does FSA have any initiative on the international co-operation for creating an internationally acceptable set of rules on the regulation of e-money and e-money institutions?

Answer: The FSA is involved in discussions on e-money in Brussels and Washington.

Interview Question: Summary of the discussion results if possible?

Interview Answer and Notes: The international initiatives seem to gather around the Bank for International Settlement, which has published many publications directly addressing e-money. The FSA joins all the related discussions and actively participates on the developments around the world.

Question 21: What may be the influence of a successful launch of a 'network based' e-money scheme like Digicash on national regulatory approaches to e-money institutions (arising from the fact that a network based e-money scheme is by definition international)?

Answer: FSA has considered the development of network money in developing its general approach to e-money. The FSA co-operates fully with other national supervisors.

Interview Question: A short summary of the general approach?

Interview Answer and Notes: As the Internet is an open platform, the FSA believes that it can be justified whether a network-based e-money may threaten the mission of regulation. If it is believed that an action is required, then it may be possible to find enough space within the current legal framework or ask for the additional legal framework adjustments. It may not be so difficult to quantify and fully analyse a network-based e-money, as it has to be on an open platform, which is the Internet or alike.

Question 22: What is FSA's view on the alternative payment instruments, other than e-money, that may challenge 'medium of exchange' function of money? For example, what may be the FSA's reaction to **e-gold** in the UK?

Answer: Monetary issues are something that the Bank of England handles. Although the Bank is not a supervisor of institutions, and will therefore not take a detailed regulatory view on any such schemes, development of alternative payment instruments is obviously a matter of great interest to the Bank. This is made clear in a recent speech by Mr King, one of the Bank's Deputy Governors, entitled "Challenges for Monetary Policy: New and Old" on August 1999.

Interview Question: Can e-money be regulated?

Interview Answer and Notes: It is not impossible to regulate e-money. What is required is a full understanding of the nature of e-money schemes and related institutional framework. Financial regulation has been paying even greater attention on the nature of risks on financial services and what is needed is to clearly identify all the risk surrounding e-money and take the necessary steps under the light of general approach to regulation. On the final analysis, even the distribution channels of financial services may change, the basic framework may not be expected to change extremely. As a result, the FSA would be able to regulate e-money when it proves itself as a part of financial world.

FURTHER COMMENTS ON THE INTERVIEW: On the responses to the questionnaire, it may not be argued that the FSA defends an early action for the regulation of e-money but it seems clear that all the European initiative was shared and the final decision from the Parliament and Council as a Directive shapes the future of regulation of e-money in the UK. He next step is to adapt the Directive to the UK regulatory framework even the initial approach may best be summarised as the adoption of regulation to the technology but not the opposite.. Additionally, the FSA represents the UK approach to the regulation of e-money in the international forums.

9. CONCLUSIONS AND RECOMMENDATIONS

This thesis, first of all, addressed the issue of the definition of e-money with its expected functions, features, and potential. It also covered an evaluation of the demand for e-money including major problems and the basic implications for central banking. The ECB's definition is used by default but with caution. The reason for this was technological developments relating to e-money products that can have an influence on the definition as an unexpected innovation can change some basic features of e-money. On the other hand, there is a clear difference between just representative e-money (such as e-Euro or e-Dollar or e-Turkish Lira) and the electronic issue of independent e-money (such as e-gold). In the latter, the monetary value is held by the electronic device does not represent any given national or international currency. As a result, anything (such as time, stock indices or money market funds) can be circulated as money on an electronic environment with smart cards, the conventional and mobile Internet, PDAs, DTV and any other electronic instruments. There is currently at least one company that has been trying to circulate gold digitally as a medium of exchange. As a result, it is better to be cautious not to limit the definition of e-money to prepaid instruments as the ECB has done. Because, e-money is not limited to represent a given national monetary frameworks' medium of exchange. It may be an independent part of a competitive monetary arrangement (with parallel currency issuance).

The functions for e-money are regarded as no different than conventional money, but it is argued that medium of the exchange function will be the first that should be fulfilled, before other functions. The features that can empower e-money are described as acceptability, portability, divisibility, atomicity, consistency, isolation, durability, homogeneity, recognisability, and unforgability, economy on transaction cost, interoperability, conservation of the value, security, user friendly for simplicity, and preferably anonymity. On the issue of the demand for e-money, the thesis notes that micro-payments, virtualisation of life and followingly electronification of transactions to enable international micro-trade are the actual sources of demand not for the future but even for the current conditions.

The thesis, then, provided two case studies basically covering the card and software-based e-money schemes by analysing Mondex and Digicash (chapter 5). That also gave attention to operating system proposals for smart cards, because of their critical importance for the realisation of e-money's full potential.

Mondex can be seen as a close substitute for cash on a card-based e-money system, as it seems to be one of the rare projects to allow person-to-person transactions with a serious potential to replace banknotes and coins' circulation. It has an international character that has already extended to more than 70 countries. The Mondex scheme has its own clearing, and settlement mechanism to create alternatives to central bank controlled wholesale and retail payment systems. Once the circulation of Mondex e-cash is fully supported by conventional channels such as card readers and retail machines and the virtual channels such as the Internet, DTV, PDAs and mobile phones, anonymous circulation may be ensured with disposable cards that will carry e-cash. Those address privacy concerns from the general public.

In the second case study, the thesis realises that other than card-based e-money schemes, network-based solutions became quite mature even if they failed to prove a fully acceptable business case. eCash Technologies has taken over the payment solutions within the product portfolio of Digicash' s original e-cash with person to person payments. The company offers debit services with unique ability to transform traditional funds into electronic payments that can be offered globally with PCs and PDAs or mobile phones. With cash equivalent electronic payment method with a stored value, gift certificate, loyalty, and mobile e-money options, the intention of the company seems to address any kind of virtual payment that may emerge in the future.

The relationship between e-money and multi-application operating systems is related to the definition of money, which is generally and immediately accepted medium of exchange. Smart cards are accepted to have a technical power to create a natural infrastructure by enjoying multi-application potential to reach every economic entity including households and provide transactions using e-money, which is accepted in 'every' intention and 'everywhere' just like money. The operating system's importance is described as to support this infrastructure by creating a common platform for all e-money schemes to operate under any circumstances. The analysis on operating systems completes the argument because it may be expected for the future that all the e-money forms will, in one way or another, be similar to the cases that were investigated here as they cover almost all the potential aspects of e-money.

Chapter six investigated three sets of data that were collected with three surveys, two in the UK and the last one in the US respectively. The first survey reflected innovators' and operators' e-money perceptions in Europe. This was extended by the second survey. The third survey compared European findings to the US in order to find out whether different perceptions

between central banks on both sides of the Atlantic were supported by divisions between innovators and operators as well.

The first survey confirmed that e-money has the potential to replace central banks monies. Moreover, central banks or their replacements are expected by innovators and operators to regulate e-money business in advance. Innovators and operators did not regard the ECB proposals on e-money as an impediment to innovation in e-money technology nor to competition among different operators. Concerning the privatisation of money, the majority rejected the idea. However, the monopoly of central banks in issuing money as a medium of exchange is not totally unchallenged. Innovators and operators contest the banks' right to monopolise the e-money business and feel that e-money technology can reduce barriers to entry to the banking industry. They almost agree on a combined card and software base as the e-money infrastructure for the future. The main obstacles to e-money replacing central bank money are seen as the cost of technical infrastructure and interoperability.

In the second survey, innovators and operators named potential future access products for e-money applications as PCs, followed by mobile telephones and digital television. Regarding the choice of operating system, they believe that rather than a single operating system, the e-money environment will be shaped by two or even more operating systems (most likely interoperable). Smart cards are pointed as the most critical technology for the future success of proposed e-money schemes. The lack of co-operation with banks are underlined as the main reason for failures of earlier e-money proposals, probably because of the banks' comparative advantage, especially in payment systems. The survey results also confirms that despite a strong position, historically proven success, and adaptation to Internet payments, credit and debit cards can be driven out by e-money instruments. The potential impact of e-money on the financial services industry is expected to be an ease of barriers to entry to the financial service industry. Telecommunication companies are rated as the most competitive against banks. Regarding the issuance of e-money, innovators and operators are of the view that banks should not be given highest status as payment system experts. Moreover, less than half of the participants perceive banks as the main players in the financial service industry. Central banks are seen under threat to lose their power, at least to an extent, as sole providers of monetary base. The re-emergence of a free banking era that can be triggered by e-money is seen as a possibility. Regarding the creation of a world currency, nearly one-third of the innovators and operators in the EU felt it was a possibility as well. The final conclusion from

the second European survey is that respondents expressed opposition to central banks' monopoly of e-money issuance.

The third survey represents the difference and similarities between innovators' and operators' perception in the EU and the US. The first conclusion is the confirmation of the potential that e-money can replace central bank money. The American innovators and operators and their European counterparts were in agreement. Additionally, e-money innovators and operators guess that the replacement of banknotes and coins by digital bits and bites representing monetary value would happen sooner rather that later. The innovators and operators on the other side of the Atlantic are somehow relatively more concerned than their European counterparts about the negative impact of innovation and they are more involved in the discussion as they share the same belief with respect to competition. The main obstacles for e-money to replace central bank money are regarded quite differently in the US and the EU. Security and privacy are regarded as the leading problems for a successful e-money take-off in the US. The American side gave more support to ATMs and hand-held devices while the Europeans paid more attention to DTV technology in case of future access mediums for e-money schemes. Again, according to the third survey results, e-money 'infrastructure' for the future are perceived almost the same in primary preferences. However, with respect to secondary priorities; the US participants place less reliance on smart card-related common solutions, but they feel that virtual and conventional financial transactions might require a combined solution. The operators and innovators in the US feel that, instead of a single and dominant medium, e-money would be shaped by two or even more operating systems as they give even stronger support to this views, compared to their European counterparts. The US perception is almost totally different on another issue, as more of the participants gave clear support for banks to defend their positions in the future as the main players in the financial service industry.

The remaining part of the third survey showed closer perceptions among the EU and American innovators and operators. In sum, seven questions that are addressed here underline different perceptions, whereas the rest of 23 questions reflected closer opinions. As an overall conclusion, there seems not to be a clear consensus among innovators and operators in Europe and the US that can form the basis for explaining the differences between the e-money perceptions of the FED and the ECB. Similar thoughts, perception and approaches to e-money among innovators and operators clearly surpass the differences. The differences are mainly limited to the position of banks within the financial industry, access media for e-money,

operating systems, innovation and competition-related issues, the potential e-money issuers and the main obstacles to an e-money take-off.

The chapter following after the survey results looked at the implications of e-money for monetary policy. The first section considered free banking discussions and its relation to e-money; and the rest of the section looked at the relation between e-money and, payment system instruments, money multiplier, and monetary base velocity. The chapter provides the official response to e-money in the UK by the BOE with the help of a questionnaire.

In the first section of the chapter 7, the possibility of laissez-faire banking as an alternative for central banks is noted as some additional evidence has been put forward in favour of free banking even though full agreement has not been reached. The emergence of e-money products could play an important part. There seems a risk of underestimation of the potential of e-money products if e-money emergence is judged only as an elimination of banknotes and coins. The impact and effects of e-money should better be taken as broad ranging and far-reaching. First of all, there are two main reasons why e-money could lead to a new era for free banking practice: (i) Innovation in payment technology is reducing the fixed costs of banking business and (ii) the computing power of new generations of computers is increasing almost endlessly. These developments can decrease the special treatment of banks over against other firms, so that the argument about the private positions of banks in an economy may become even harder to defend. The development of e-money further implies structural changes with regard to money, banking, and finance due to the manner in which it supports market-based solutions to monetary problems. This includes financial regulation through its impact in terms of the lender of last resort function, currency backing, and multiple currencies would be especially powerful. E-money can decrease network externalities by both decreasing the fixed cost of networking (for example private clearing systems are already available) and by lowering the cost of switching from one local network to the other. It can facilitate currency competition by allowing economic entities to provide technically efficient and effective alternative monies to reach end-users.

E-money is seen as enabling anything - from gold to bread – to be distributed as electronic purchasing power within local or international networks. It can, as a result, bring good money in reach of anybody on earth as far as they have a network connection, and increases the awareness of the growing importance of stable currencies at the international as well as the national level. It can reduce imperfect information possibilities with increased data processing and risk management techniques, and to make easier portfolio selection procedures.

Emergence of e-money appearance suggests that, unless 'repackaged' in a contestable way, the future of central banking may become uncertain. However, central banks can be transformed in conformity with free banking philosophy and principles. Underestimation of e-money's significance can result in uncertainties on the future of central banks.

On the relation of e-money and payment instruments, the thesis obverses that payments have already been electronised and in many countries such as the UK and Finland where plastic cards per capita have risen above one showing that many people prefers holding more than one card. It is argued that e-money can be the final frontier for transaction demand for banknotes and coins in circulation.

The third part of chapter seven concluded that *e-money as representative of conventional currency* was not a threat to the conduct of monetary policy. Central banks such as the BOE have developed a monetary policy framework of directly targeting inflation. With monetary transmission mechanism analysis, sustainable financial and monetary stability seem a rigid adherence to money supply control. In a current analysis of the monetary transmission mechanism in the UK, the BOE argues that, while the money supply play an important role, it is not their primary focus. Though, monetary aggregates are still important indicators especially for the long run analysis. With regards operating expenses, a central bank without currency circulation seems still profitable through service charges for clearing and custody services. The BOE Banking Department has made no loss since 1970.

Chapter seven also considered implications of e-money to the velocity of monetary base. The thesis finds that velocity may be affected by e-money developments, but the direction of this influence will be determined by accounting techniques that will be implemented on e-money balances. It is not clear whether velocity will be increased or decreased by e-money replacement of conventional money. The final effect depends on the aggregation techniques and on whether e-money can replace banknotes in circulation, or replaces demand deposits as well.

The final chapter before the conclusions investigated reflections of e-money on the regulatory agenda. It overviews the current framework, discusses whether e-money can be regulated and gives the official views of the FSA on e-money matters, which have been collected through a questionnaire and interviews.

The thesis underlines that a regulatory framework can be effective as far as the integrity of money has been sustained with sound and stable monetary and fiscal policies. Under any critical collapse of money supply, e-money can help to increase 'the right to choose' from any

alternative arrangements that might convince the end users as a better monetary framework. No form of regulation can sustain effective power and people can substitute to a more stable currency that is easily available through e-money potentials.

With regard regulation of e-money in the UK, it seems that the EU directive will be shaping the future other than the influence during the decision making process within the EU law making rules and circumstances. This directive naturally assumes that independent issue of e-money can also be supervised, an assumption that might have no grounds in case of financial turmoil, a case where even the strongest currency may face substitution.

Direction of Future Research: There are many options for the future. One important issue may be an evaluation of why earlier versions of e-money schemes turned out to be unsuccessful. The failures may provide positive feedback for the success of future proposals.

Another possibility may be to look at the retail payment system interoperability all around the world and its relations to e-money. Local and national retail payment systems may be the main source of payment infrastructure for future national and international e-money rollouts. Compatibility among them may provide more ready-to-use retail machines and card readers. This research includes, for example, mass-transit payment projects and their influence on e-money proposals.

The relationship between technology and e-money seems to be endless. In this regards, the effect of third generation mobile networks may be searched in their potential of coming up with an almost cost-less mobile payment solution so as to ensure all kind of payments, (micro and macro) anywhere, everywhere.

Another direction may be to extend case studies and create a database for all kind of proposals and make comparative analysis. This research may compare the confusion between e-money and payment instruments as well.

More than that, a direction can also look at contestable central banking potential between the ECB and the FED from an independent e-money issuer point of view against each other. This research may investigate the implications of independent issue of e-dollars in the Eurozone and independent issue of e-Euro in the US.

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