Information flow in virtual organisations

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Information Flow in Virtual Organisations

By

Saleh Ismail Alhalalat

A Doctoral Thesis

Submitted in partial fulfilment of the requirements for the award of

the degree of Doctor of Philosophy of Loughborough University

(May 2005)

Research School of Informatics, Department of Information Science,

Loughborough University

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Abstract

The main aim of the study is to investigate the flows of information and the impact and added value of Information and Communication Technologies (ICTs) on the integration of information flows. This concept is related to the optimal design of organisational (and other) systems that allow the right decision to be made by the right person at the right time in an appropriate location. Clearly, information that is often distributed needs to come together in an efficient way to allow the best use of resources to maximize the information value.

The virtual organisation (VO) is a new style of working that allows completion of tasks across time and location. The use of ICTs is viewed as a facilitator of these tasks and their application provides good examples to extend their use. The most common types of VOs are home offices, teleworking centres, mobile offices and 'hotelling'. Teleworkers still face several problems, such as managing their work, lack of appropriate communications to complete their work efficiently, and isolation. This study applied an information-driven approach to investigate the current problems in the teleworking environment, and solutions are proposed to improve the flow of information in the VOs.

The data required were collected by questionnaire survey, semi-structured interviews, and document analysis. Members of the Telework Association (TCA) in the UK were invited to take part in this survey, and 153 out of 800 respondents came from this source.

From subsequent analysis of the data collected, there is indeed an issue with the use and integration of information flows in VOs. An in depth study of six individual cases revealed a lack of information sharing, poor understanding of information needs, and low rates of access to online information. Soft solutions can be achieved through understanding information needs, developing information policy, and training. Hard solutions can be achieved through using online information, using workflow software, upgrading the speed of Internet connection, using information sharing systems, and arranging more open access to information.

Some indicators of future research can be mentioned, particularly in conducting the second generation of information audit in teleworking practice, to study knowledge management (KM) practices in teleworking, to develop information policies to enhance teleworking practices, to focus on the information needs of teleworkers, to evaluate the impact of software applications (such as workflow software), to implement information sharing systems, and to study the impact of training on information retrieval and use.

Key Words: Information Flow, Information Mapping, ICTs, Virtual Organisation, Teleworking, Information Audit Model
Dedication

I dedicate this work to my parents, who support and wait

To my wife, with greatest love and devotion

To my brothers and sisters and their families, who stand behind me from away

and to Omar, my son, who I love
Acknowledgements

In the Name of ALLAH, Most Beneficial, Most Merciful

I would like to show my appreciations to all of my contacts during my PhD journey, both here in the UK, and abroad, in Jordan, USA, Australia, and Saudi Arabia. Throughout this journey I have gained valuable experience.

My supervisor, Prof Ron Summers, has been a source of my enthusiasm, progress and willingness. In fact, he was my innovated source of progress to achieve my goals. I would like to say, I have derived many lessons from networking with him. His serious support and patience are the main engines behind my progress. Furthermore, I would like to add that if I complete another opportunity to get another PhD, I will choose him again.

I thank my Director of Research (DOR), Professor Cliff McKnight, who supported my study during the field study, and also for supporting the cost of networking with teleworkers around the UK.

I thank all participants in my survey in the UK, teleworkers in different locations around. Predominantly, I would like to thank Alan Denbigh, the Executive Director of the Telework Association in the UK.

I thank the staff and colleagues in Information Science Department, who were very helpful, particularly Sheila Price, Prof. Cliff McKnight, Dr. Ashok Jashapara, Dr. Mark Hepworth, and Dr. Rachel Hardy. Others in the university like Frank Parry from the Pilkington Library and Claire Creaser the Deputy Director & Senior Statistician in LISU for help with the statistical analysis.

I thank Sue Henczel, the Training and Consortia Manager at CAVAL (Australia) for her serious support during applying the IA Model. I have gained crucial experience from her, thanks. Also, I thank Professor Richard Lowery (Vassar College, USA) for his support and confirmation for definition of the Conceptual Inventory during applying IA Model.

I thank my old and the serious supportive friend, Prof. Sultan Abu-Tayeh (Dean of Economics & Business Administrative Sciences in the Hashemite University in Jordan), who has supported me since attended the BA course, and also during MA and PhD courses. Also, Dr. Mansoor Alshehri, who supported me during my PhD Study.

The sponsors of my PhD study also needs special thanks for their support during my study. Al-Balgä Applied University in Jordan provided the financial support, which gave me an opportunity to pursue my PhD study.

To my wife, I thank you for all your efforts during the PhD course; it was imperative to my progress. Sorry for any stress that was caused by giving a priority to the research. In fact, your efforts should be sustained, thanks!!!

Last but not least, I would like to thank all of my family members in Jordan and also here in the UK. I apologize for any stress that was caused while I was studying the PhD. Moreover, I would like to thank my friends in different countries, who supported me as well. Thanks for every thing!
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</tr>
<tr>
<td>AMA</td>
<td>American Management Association</td>
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<tr>
<td>ASLIB</td>
<td>The Association for Information Management in the UK</td>
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<td>CAPI</td>
<td>Computer- assisted Personal Interviewing</td>
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<tr>
<td>CATI</td>
<td>Computer-assisted Telephone Interviewing</td>
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<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
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<tr>
<td>CSF</td>
<td>Critical Success Factor</td>
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<tr>
<td>D&amp;ECC</td>
<td>Distributed &amp; Enhanced Call Centre</td>
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<tr>
<td>DMS</td>
<td>Document Management System</td>
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<td>DTI</td>
<td>Department of Trade and Industry</td>
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<td>DTP</td>
<td>Desk Top Publishing</td>
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<td>ECSs</td>
<td>Electronic Communication Systems</td>
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<td>EDI</td>
<td>Electronic Data Interchange</td>
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<td>EOSs</td>
<td>Electronic Office Systems</td>
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<td>ETO</td>
<td>European Telework Online</td>
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<td>EU</td>
<td>European Union</td>
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<td>FAO</td>
<td>Food and Agriculture Organisation of the United Nations</td>
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<td>GCSE</td>
<td>General Certificate of Secondary Education</td>
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<td>GPs</td>
<td>General Practitioners</td>
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<tr>
<td>HND/C</td>
<td>Higher National Diploma</td>
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<td>HR</td>
<td>Human Resource</td>
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<td>HTML</td>
<td>Hyper Text Markup Language</td>
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<td>Information Audit</td>
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<td>Information Centre</td>
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<td>Information and Communication Technologies</td>
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<td>Institute of Employment Studies</td>
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<td>IF</td>
<td>Information Flow</td>
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<td>IFD</td>
<td>Information Flow Diagram</td>
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<td>Information Retrieval</td>
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<td>Information Resource Centre</td>
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<td>ISDN</td>
<td>Integrated Services Digital Network</td>
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<td>ISP</td>
<td>Internet Service Provider</td>
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IT Information Technology
ITAA Information Technology Association of America
ITAC International Telework Association & Council
JLP John Laing Property
Kbps Kilobytes Per Second
KM Knowledge Management
LAN Local Area Network
M/M/S Multiple Channel Model
OMSs Office Management Systems
PFS Personal File System
PSTN Public Switched Telephone Network
RATS Regression Analysis of Time Serious data
RNIB Royal National Institute of the Blind
SAS Statistical Analysis System
SPSS Statistical Package for the Social Sciences
SSADM Structural Systems Analysis And Design Method
SSM Soft System Methodology
TCA The Telework Association
TSP Time Serious Processor
UC Use Case
UK United Kingdom
VC Videoconferencing
VMT Vehicle Miles Travelled
VO Virtual Organisation
VPN Virtual Private Network
VSM Value Stream Map
WAN Wide Area Network
WFM Workflow Management
WG Workstyle Group
WISDM Web Information Systems Development Methodology
WWW World Wide Web
XML Extensible Markup Language
Definition of Key Terms

1. **Information and Communication Technologies (ICTs):** are the technologies, which process information through its lifecycle stages (create, store, and retrieve). In this research, ICTs were divided into three parts; Electronic Office Systems; Electronic Communication Systems; and Office Management Systems.

2. **Information Audit:** the Association for Information Management in the UK developed the following definition. IA is “A systematic evaluation of information use, resources, and flows, with a verification by reference to both people and existing documents, in order to establish the extent to which they are contributing to an organisation's objectives” (Orna, 1999, p 69).

3. **Information Flow:** Henczel stated that “information flow is the movement of information between departments and individuals within an organisation, or between organisations and their external environment” (Henczel, 2001a, p 259).

4. **Information Mapping:** It displays the flow of information from sources to the destinations. This flow comprises the information resources, significance of information resources, and the frequency of access to information resources. Also, it shows the relationship between entities and the sequence of flow itself. Some kind of visualisation techniques can be used to support this display.

5. **Integration of Information Flow:** This term is concerned with the timely integration between receiving (sending) information from/to a trusted source (recipient) through the appropriate channels.

6. **Teleworking:** The operational definition of this term refers to any work undertaken outside the 'traditional' office location; it could be home or client site or designated telework centre, or while travelling between sites. However, both teleworking and telecommuting are used interchangeably in this research.

7. **Virtual Organisation (Office):** This term is defined in this study as the connection of teleworkers to Information and Communication Technologies (ICTs) across locations and time. Virtual Organisation is used as synonymous word of teleworking. Wherever one of them mentioned, they have the same meaning.
Chapter One

Introduction

1.1 Background

This study investigates the information flow in virtual organisations (VOs). A measure of organisational performance relates to the measurement of flow and information flow is related to the optimal design of organisational (and other) systems that allow the right decision to be made by the right person at the right time in an appropriate location. Clearly, information that is often distributed needs to come together in an efficient way to allow the best use of resources. Much has been made of the paperless office in the literature. The VO is an extension of this idea using state of the art Information and Communication Technologies (ICTs). De Meyer and Loh (2004) stated that: “with the rapid development of ICT, the greatest challenge to policy makers today is whether it will have a fundamental and structured impact on the way economies function and its sustainability on people's standard of living”. Also, Perez, Sanchez and De Luis Carnicer (2003) stated that teleworking as an integration of ICTs with human resource management reflects a new paradigm of working in the new economy. Moreover, the role of technology nowadays extends to provide more flexibility in completing tasks in the teleworking environment and the use of ICTs to facilitate the exchange of information to/from teleworkers. On this subject, Lamond (2000, p 108) added that: “the manager needs to monitor the interactions closely with a view to ensuring that teleworkers get not too much or too little, but sufficient information and interaction”.

However, this new style of working enables workers to complete their tasks outside their physical locations, for example, at home, in a telecentre, while travelling, in a hotel, or at a client’s site. Connectivity is an essential component of these technologies which can be thought of as bringing together information channels that contribute to decision making.

The organisation should be actively in connection with other people (customers, suppliers, teleworkers, etc.) if its ability to communicate is to be efficient. Communication refers to methods of sending and receiving information as well as what kind of information is being sent and received, and whether the information flows efficiently. Studying information flow is considered an important factor in enhancing the improvement of processes. Nowadays, the World Wide Web (www) is an important tool
involved in this process and the Internet, as opposed to other forms of technology, may have lots to offer in the designing process. According to the U.S. Department of Commerce (1998), 15 million people logged onto the Internet worldwide in its first four years of being available to the public. It took 38 years for radio and 13 years for television to achieve this level of acceptance; furthermore, one billion people worldwide may be online by the year 2005. This new method of communication is likely to be the main method of sending and receiving information.

Organisations are moving fast because they operate under totally different principles and work rules in the digital economy (Lee, 2001). Today, the business environment has seen many changes in customer demand. In addition to this change, there are technological changes. Decision makers and takers have their own responsibility to balance both customer demand and technological change. So, the right information should be presented to the right person through appropriate channels at the right time, and then the quality of services will be maintained.

This research study investigates the flow of information using members of the UK Telework Association (TCA) as a resource to present a clear description of information flow in their offices; it also provides some solutions for improving information flow.

1.2 The Concept of Information Flow (IF)

According to information theory, information consists of data that have been processed. Information should flow from its source to the recipient and through its life cycle of creation, searching and utilisation, according to the targets of performance and standards. In fact, “face-to-face interaction within the workplace is central to information flow” (Pentland, 2004). However, the advancement of ICTs allows workers to complete their tasks in external locations. The most specific definition of information flow in the study belongs Henczel. Her definition of IF states that: “information flow is the movement of information between departments and individuals within an organisation, or between organisations and their external environment” (Henczel, 2001a, p 259). The Workflow Management Coalition presented the following definition of workflow management:
"The automation of business process, in whole or part during which document, information or tasks are passed from one participant to another for action, according to a set of procedural rules" (Bocij et al., 2003, p 244; Lawrence, 1997, p 385).

So, information flow is anchored as a part of the workflow. Information has many aspects such as internal and external information, formal and informal information, use in and for high levels (or mid and low levels) of management, and structured and unstructured information (or systems). Also, its flow could be through organisational levels such as internal and external, horizontal and vertical, top-down and bottom-up flows. Integration of information flow means getting the right information from/to the right source (recipient) at the right time through the right channel. These four elements of integration of information flow are presented above to reflect the meaning of flow integration. The relationship between each job description and information need reflects the relationship between designing the information systems and their ability to satisfy the employees' needs for information. Therefore, information should flow in an integrated way to satisfy the needs of workers and to let them work and complete their tasks in an efficient way. On the subject of behaviour, the Chartered Institute of Bankers (1988, p 130) added that:

"Information should be communicated to the managers who need to use it to control action. The structure of information flow - i.e. how information is transmitted, from where and to whom - is an important consideration in management information systems".

What is the relationship between information flow and networking? It can be deduced that information is sent through networks (whether electronic or otherwise), seeking to achieve an organisation's goals, such as customer satisfaction, systematic organisation, organisational learning and cost saving. Consequently, the information flow concept mimics the way people communicate, with sender and receiver being transformed into the customer and the performer(s) in an organisation. More clearly, the connection of materials goes through a series of transactions using powerful computer programs. Each communication network has two directions: up-down (or down-up) and left-right (or right-left). So, information flows through these levels and directions.
1.3 The Concept of the Virtual Organisation: The 'virtual organisation' is a development of the traditional organisation. No one can deny that the new style of organisation is more flexible than those in the past. It means that some workers can complete their tasks outside of their physical offices; they can complete these tasks across locations and also across time. All of these developments are based on a virtual approach to working and the use of advanced ICTs.

Concerning the historical roots of the virtual organisation, Baruch (2000) stated that this style of working is not a new phenomenon: large numbers of people worked at home in the pre-industrial era. Also, Baruch and Yuen (2000) produced a literature concerning the teleworking term, they found that during the 1950s, the combination of telecommunications and computing technology enabled work to be relocated away from the traditional location. In fact, the practical roots began to emerge at the beginning of the 1990s and the virtual organisation has become almost synonymous with companies trading via the Web. In 2000, Furnham provided a forecasting to the work in 2020, the study stated that "Changes in the workforce, the hours of work, but more particularly technology, means that fortunate workers of the future may have more choice, flexibility and certain benefits than those of today" (Furnham, 2000). However, This approach to doing work is considered to be a new style that enhances the flexibility of completing tasks.

No one can deny that automation refers to the electronic completion of the tasks that were previously done manually. This definition does not equate to the work performed by the employees as becoming totally redundant, but rather refers to the development and conversion of their tasks from a manual form to an automated form, thus resulting in an overall reduction of tasks. However, the main intended beneficiary of automation is the end user, as the end user needs the right information at the right place in order to perform the task efficiently. This means that some tasks can be done via a connection with Internet networks to access the source of customer demands. The World Wide Web (WWW) has become the information source commonly used by those who work in the virtual office (Lanier, 1998). Furthermore, most users can be connected via the Internet network to satisfy the customers’ demands. The Internet is a public phenomenon. As one telecommuter said, for example, “I live on the web” (McInerney, 1999, p 149). The development of Internet technology is considered a major milestone in the widespread adaptation of the virtual organisation.
Henczel (2005) stated that “In order to establish what products and services are required, we must know not only what information products and services our clients need to do their jobs, but also what they do with the information we provide to them and how that contributes to organisational success”.

However, this study aims to investigate the flow of information between teleworkers and others (for example, the company centre, customers, suppliers, competitors and information sources). This ‘virtual organisation’ is mainly based in an electronic environment, for example, e-commerce, e-bank, e-government, e-health, e-conference and e-business. This can be seen diagrammatically in Figure 1.1 below:

As seen above, there is an interaction between teleworkers and others throughout the communication channels. In fact, many organisations are currently forced to collaborate with others in renewing their products and processes to stay competitive, to enter new or to retain their current markets, or to get easy access to new knowledge (Wognum and Faber, 2002).

Basically, each company has two kinds of customers: internal (its employees) and external. Knowledge should be available for both of them. This availability of knowledge can be achieved from learning from experience, learning from others and from tools for transferring knowledge (Skyrme and Amidom, 2002). Moreover, organisational knowledge leads to organisational learning. Therefore, capturing information flows can lead to improvements in organisational learning.

Today, companies are making huge efforts to establish ICT infrastructures. The point here is to establish this infrastructure while maintaining high standards. For example, e-mail, teleconferencing, videoconferencing (VC) and the ability to reach people via cellular phones and two-way pagers help employers keep in touch with teleworkers from all locations (Cooke, 2002, p 48). These standards are actually helping to cut costs, one method being optimising workflow processes and their consistent information flow. So,
this study seeks to investigate ICTs that are related to information flow in the virtual organisation by relying on the perception of the teleworkers themselves.

1.4 Preceding Studies: The survey findings from the literature review and the discussions carried out during the exploratory study did not cover a wide range of issues relating to the information flow in VOs. However, in general, the most important areas of these studies are the following:

**Studies concerning Virtual Organisations:** The study most relevant to this research is McInerney's PhD study (1999) entitled "Providing Data, Information, and Knowledge to the Virtual Office: Organisational Support for Remote Workers". The findings of this work show that managers are providing more data and information electronically, as well as codifying organisational knowledge and making it available through World Wide Web technology. However, serious barriers to information access for remote workers still exist (McInerney, 1999, pp 162-169). In fact, this study did not provide a clear map of information flow in the virtual offices and did not provide clear solutions for the discovered problems. Regarding staffing, the milestone of a VO is basically concerned with using technology. So, teams can collaborate through using ICTs. Johnson, Heimann and O'Neill, 2001) have a study deals with aspects of virtual teams. The study presents some facets of a successful virtual team, such as human resource policies, training, organisational culture, and managing support.

Teleworking has disadvantages as well as advantages. Al-Adhaileh (2000) presented an investigation of the problems encountered by UK teleworkers. The main finding of this study was that 95% of respondents identified that 'social isolation' presents a negative aspect of teleworking while 71% of the respondents identified 'managing teleworkers' as a very important problem. Most respondents mentioned that the technical training offered by their organisation was insufficient.

This new style of working has an environmental impact. Regarding the impact of teleworking, Hopkinson and James (2001) studied the impact of BT OPTION 2000 in the BT company. They found that both conferencing and commuting saved travelling a

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(1) BT OPTION 2000 is the teleworking programme launched by BT in the UK in 1993. It deals with promoting the homeworking approach.
considerable amount of miles which means a decrease in the impact on the environment. Also, Hopkinson, James and Maruyama (2002a) reported a further stage of this study, which summarises an on-line survey of staff registered with Workabout (previously OPTION 2000). 5,128 respondents were asked to complete a questionnaire from which 1874 responses were received. The majority felt that they had a better quality of life because of teleworking than if they commuted to an office. The study also revealed that BT teleworking, not only creates private benefits, but also public ones in the form of greater involvement in community and voluntary activities, and perhaps also greater use of local services. Choo, Mokhtarian and Salomon (2005) examined the impact of telecommuting on passenger vehicle miles travelled (VMT) through a multivariate time series analysis of aggregate nationwide data spanning 1966 to 1999 for all variables except telecommuting, and spanning 1988–1998 for telecommuting. The proposed models suggested that telecommuting reduces VMT with 94% confidence. Also, the results suggest a reduction in annual VMT in the order of 0.8% or less. Thus, telecommuting appears to be far more cost-effective in terms of public sector expenditure.

On the subject of Telework Research, teleworking studies, as well as others, face fluctuating changes in their development. As mentioned before, the practical start of teleworking occurred in the 1990s. Wright (1990) stated that, for behavioural researchers, the use of computers to complete work at home would increase during the 1990s. This result was estimated considering from seven small groups of behavioural researchers, totalling less than 200 respondents spread across the USA, the UK and the Netherlands. In 1997, Luukinen stated that the major issues in the agenda for telework research from the Finnish perspective were: management and economics of telework, social and psychological aspects of telework, technological environment for telework, future planning, and the employment effects of telework.

Another study investigated the slow adoption of teleworking in Japan (Higa and Wijayanayake, 1998). The results from 1134 respondents indicated that there were some differences in the adoption pattern of telework types in Japan (e.g. the satellite office, telecommuting and mobile workers). The study found that although certain social and cultural barriers existed, workers were ready to do telework. It implies that Japanese workers (particularly the younger generation) prefer to opt for a better quality of life than previously.
The last five years have seen dramatic changes in enhancing teleworking programmes. Bailey and Kurland (2002) said that the field of telework studies range from transportation and urban planning through to ethics, law, sociology and organisational studies. They suggested three steps for future research which may provide richer insights: considering the impacts on group and organisational levels to understand who is affected by telework, reconsidering why people telework, and emphasizing theory-building and links to existing organisational theories.

**Studies concerning Information Flow:** The field of information flow is covered in some of the previous studies but it seems it is rare for them to involve the VO environment. However, Optura (2004) confirmed that there are organisational and structural barriers that hinder the flow of information because employees, suppliers, customers and partners need to collaborate and information needs to flow across disparate systems. Theobald (1996) confirmed this by describing the current information systems that are based on controlling access to information and knowledge flows. This reflects the need for everybody to find the knowledge that they want at the time they need it in a medium which they find attractive and at a level they can comprehend. To initiate this change, four areas need to be taken into account: communication skills, collaboration, commitment and will.

Broady-Preston and Hayward (2001) also found in their study that: (1) information gathering and analysis activities are viewed increasingly as an element of all managers' work within retail banking; (2) one of the original objectives of their study was to ascertain the information flow between business units and the corporate centre; (3) 86% of managers believed that a bottom-up input existed in their organisations, with such a process being largely participative; (4) managers were eager to emphasize a strong bottom-up informational input in which direction clearly came from the top; (5) if the information they required was dispersed throughout the company, the solution was believed to be the development of a corporate intranet.

Regarding the differences in teleworking environments, there are two recent studies that are relevant. First, Nortje (2003) tried to investigate the differences in the information environment between teleworkers and knowledge workers in South Africa. The results show that the information environment of the teleworker was somewhat similar to that of the knowledge worker. Secondly, Pe'rez et al. (2005) analysed the differences between teleworking adopters and non-adopters regarding the use and impact of ICTs in a sample
of 479 small and medium-sized Spanish companies. The findings of the interviews indicated that teleworking companies have adopted more equipment (per company and per employee), and the differences are statistically significant for all types of information equipment except personal computers. Firm size is not an explanatory variable for the equipment used in the adopter companies.

More specifically, information flows in virtual organisations are not covered sufficiently by the literature. According to Strader, Lin and Shaw (1998), the framework of the information infrastructure for the management of virtual organisation provides a flow of information between the virtual organisation and others. Bakkeren, Köthe and Schulz (1997) found that one of the key problems of the virtual enterprise is the sharing of information among the different companies. They tried to indicate the reasons behind this by stating that this problem includes the need for the neutral specification of information, the distribution of information, the control of information flow, and the security of information. Hanhike and Gareis (2004) stated that according to the results of the FAMILIES project: the reasons given for the poor performance of permanent teleworkers refer to the lack of social and informal interaction with colleagues, which resulted in a loss of motivation and insufficient access to intra-company information flows.

On the subject of communication channels, advanced ICTs enable employees to complete their tasks abroad. This means sacrificing full or partial face-to-face contact. The question revealed here is: Are the ICTs used sufficient to enable teleworkers to communicate with their contacts (e.g. customers, companies and/or suppliers)? According to Greenspan (2002), the factor that makes employers resistant to a telecommuting workforce is the inability to hold spontaneous meetings and the traditional notion that employees must be on site to serve customers and perform other important tasks. Moreover, Dr. Mark Hale stated that: "the fundamental challenge today is when you move assets from one place to another, you lose all the information and business processes that go with them" (Serva, 2004).

Furthermore, ITAA surveyed 1,000 individuals in April 2002. The results indicated that employee concerns are more minimal: only 20% of respondents feared that they would not have enough contact with their fellow workers. However, 60% of those with this concern said they would be more likely to telecommute if, through technology, they could have immediate face-to-face contact. The researchers also found that 54% of U.S.
employees thought that telecommuting would improve the quality of their lives (Greenspan, 2002).

Others, like Daft and Lengel (1986) also argued that the channel capacity decreases from face-to-face to telephone to computer-based systems and memos. That is, the medium becomes less rich, which reflects the need for face-to-face meetings. The belief that face-to-face interaction is more powerful than mediated interaction continues to exist in popular writing on virtual organisations. Others found that this kind of contact could be improved by using special ICTs. See Sengupta and Zhao’s study (1998) entitled: “Improving the Communicational Effectiveness of Virtual Organizations through Workflow Automation”. This work explores the communicational effectiveness of virtual teams. An analysis of the email messages between team members shows that the team adopted a “hub-and-spoke” communication pattern. The findings underpin a proposed set for a workflow-based solution to improve the functioning of the team.

One vital role of ICTs is to connect teleworkers with others (company centre, customers, suppliers, etc.). To achieve integrated contact, information should flow according to the goal of the organisation and according the teleworker’s need for information. Previous studies of ICTs are mainly concerned with the following issues:

1. A study carried out by Palmer and Speier (1997) found out that the use of old technologies is significantly higher than the use of modern technologies such as e-mail or the Internet. Perhaps this reflects the importance for virtual teams to use tested technologies because the connections are so critical.

2. Gardner, Lepak and Bartol (2003) stated that investment in IT has a significant impact on human resources (HR). They found that IT enables HR professionals to access and disseminate information more efficiently while it also influences what is expected of them.

3. Gupta, Karimi and Somers (2000) found that the backgrounds, employment, residential and occupational characteristics of telecommuters constitute the main patterns of usage of computer and communication technologies. This result was based on a sample of 375 responses. It was intended that these factors would help in the selection of ICT tools.

4. Sawin, Calcatera and Olka (2003) in their research found that battery use and communications setup were two of the most frequently cited frustrations.
5. Harris Miller, president of the ITAA, confirmed the vital role of a combination of broadband and e-work functioning together (Greenspan, 2002).

6. The development and diffusion of ICTs has had a great impact on the organisation of business and employment relations, even creating completely new kinds of work arrangements, such as virtual cooperation and teleworking (Euractiv, 2002).

Finally, few studies exist that are related to the impact of ICTs on information flow in the virtual organisation. Some studies attempt to investigate individual aspects and others try to investigate the organisational side of the question. Some issues are clarified below through a literature segmentation.

**Appearances of Problems:** According to the previous review, some teleworking problems were investigated, such as the impact of teleworking on the environment, the advantages and disadvantages of teleworking, and the interest in applying teleworking programs.

**Research Approaches:** Many approaches were used in the previous studies; environmental, managerial, technical and social approaches were commonly used. In contrast to this, the information-driven approach was rarely used.

**Research Location:** Concerning the area of research, most research studies refer to the USA and Europe; there are few studies which consider the rest of the world in any depth.

**Research Types:** There are two types of research: theoretical and empirical research. In theoretical articles, most researchers adapt their research according to the country itself or, in some few cases, the researcher adapts for special cases, such as kinds of teleworker like the disabled, or for business companies. The vast majority of applied studies are concerned with special cases. This means that there are many limitations, including:

- The population frame is not clear, and it is difficult to get it. Fulton (2002) stated that "the size of the population involved in working from home is difficult to estimate".
- Permission to examine the known cases is difficult to obtain.
- Studying the known cases, which agree to take part in the research, will need a lot of financial resources and time.
- Getting special business cases may be easy by joining a contract for that project.
Teleworking Case Studies: There are three sources of teleworking cases, as indicated below:

- **Employer cases:** Home Council, BT, Microsoft, BEA, British Gas, Nortel Networks, RNIB, John Laing Property (JLP), Asda, Bailey Postner, British Airways, British Gas, Business Space, Coca Cola/Schweppes, Davis & Co. Solicitors, Drake Beam Morin, Glaxo SmithKline, Glenigan (business info), ICI, Jupiter Tyndall Merlin, Lily Industries, Manchester TEC, Open University, Rank Xerox, Royal Mail, University of Wolverhampton, and WWF Regional organisers.

- **Telecentres of teleworking:** There are around 120 telecentres in the UK.

- **Teleworking Association:** TCA association in the UK. American Management Association offers many studies with its 1631 members. Some of these studies are concerned with staffing, telecommuting and/or workplace monitoring. The International Telework Association & Council (ITAC) has carried out many studies, projects and reports. The Travel Industry Association of America also been concerned with a few studies on teleworking issues. Examples of related studies in such associations are:
  
  i. The survey of the American Management Association (AMA) – Telework Practices (Fulton, 2002).
  
  ii. Al-Adhaileh studied the perception of TCA members concerning the problems of teleworking, such as social isolation, managing teleworkers and developing technical skills (Al-Adhaileh, 2000).

It was not possible to identify UK involved in teleworkers because there were no clear cut statistics on teleworking and it was difficult to find out from organisations whether or not they were employing teleworkers. As a result the Telework Association (TCA) were chosen as a population to study. The TCA were chosen because they allowed to access their membership data plus it had a broad membership.

1.5 **The Research Problem:** The success of each organisation is dependent on the management of its information. The VO, as it is currently structured, does not often make the best use of information resources, so supporting its functionality based on advanced ICTs is becoming increasingly important. That is not to say that there are no issues, for example, social isolation and difficulty in managing teleworkers, in introducing
ICTs (Al-Adhailch, 2000). There are also serious barriers to information access (McInerney, 1999); the technological environment for telework (Luukinen, 1997); and the sharing of information throughout the virtual enterprise (Bakkeren, Köthe and Schulz, 1997). All of these have been reported as barriers to progress. These issues still affect the progress of VOs in the UK, as well as elsewhere, and they require innovative solutions. Some solutions can be adapted to solve part of the stated issues, one of which is improving the information itself. The information should be distributed from a valid source, through appropriate channels, to the designated recipient at the right time. Therefore, this research study is mainly concerned with investigating the information flow in VOs and studying the impact of ICTs on information flow. Hopefully, improving information flow will help VOs to survive against their competitors, and to remain viable and sustainable. The research issue is to make recommendations that can be adopted for improving the flow of information through teleworker offices in the UK. From this, the two main questions that drive this research are:

- "Is the flow of information in the teleworkers' offices integrated and interoperable?"
- "What are the ICT tools that will effect an improvement of information flow in the TCA members' offices?"

It is these questions that will be addressed throughout the remainder of this thesis.

1.6 **Aims and Objectives of the Study:** This study investigates the information flow in virtual organisations. Four aims are presented below:

Aim 1: To provide a broad overview of teleworking

Aim 2: To demonstrate the teleworkers' opinions on the information flow in their organisations.

Aim 3: To investigate the impact of ICT on the information flow in the virtual organisations.

Aim 4: To map the flow of information in virtual organisations.

To achieve these aims, seven objectives were derived:
1. To inform the study by performing a critical literature review (Aims 2, 3 and 4).
2. To analyse the related documents (statistics) of worldwide teleworking, particularly in the UK (Aim 1).
3. To analyse the teleworker profiles collected via the questionnaire survey (Aim 1).
4. To identify current systems of information flow in the virtual organisations (Aim 2).
5. To identify current ICT systems in the virtual organisations (Aim 3).
6. To apply the Information Audit Model (IA) in auditing information flow (Aims 2, 3 and 4).
7. To apply the visualisation techniques (Information Flow Diagrams, Flowcharts, and Use Case Modelling) in mapping the flow of information in the virtual organisations (Aim 4).

1.7 Research Questions: The aims and objectives of the research can be translated into a set of pertinent research questions.

1. Is there any lack of teleworking statistics?
2. Are the teleworkers satisfied with the information flow at their virtual organisations? And are they satisfied with the usage of ICTs?
3. Is there an integrated information flow in the virtual organisations?
4. Is there a relationship between the ICTs used and the integration of information flow?
5. Are there any gaps, duplications, lacks, delays or bottlenecks in the flow of information in the virtual organisations?

By investigating these research questions it will be possible to address the aims and objectives of the study. Table 1.1 shows the formulation of the research problem, aims, questions and the methods used to collect the required data.
<table>
<thead>
<tr>
<th>Aims</th>
<th>Questions</th>
<th>Methods</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>To apply the visualization techniques in mapping the flow of information in the virtual organizations.</td>
<td>Are there any gaps, duplications, and redundancies between ICTs and the information systems in the virtual organizations?</td>
<td>Second phase of interview</td>
<td>Identify current ICT systems in the virtual organizations.</td>
</tr>
<tr>
<td>To apply the Information Architecture Model (IAM) in analyzing the information flow in the virtual organizations.</td>
<td>Is there a relationship between the ICTs and the information systems in the virtual organizations?</td>
<td>First phase of interview + Designed Questionnaire</td>
<td>Identify current ICT systems in the virtual organizations.</td>
</tr>
<tr>
<td>To inform the study by performing a Critical Literature Review.</td>
<td>Are the workers satisfied with the information they receive in the virtual organizations?</td>
<td>First phase of interview + Designed Questionnaire</td>
<td>Identify current ICT systems in the virtual organizations.</td>
</tr>
<tr>
<td>To analyze the Information Architecture Model (IAM) in analyzing the information flow in the virtual organizations.</td>
<td>Is there any lack of information in the virtual organizations?</td>
<td>Survey</td>
<td>Identify current ICT systems in the virtual organizations.</td>
</tr>
<tr>
<td>To provide a broad overview of the needs of the workers.</td>
<td>Satisfaction?</td>
<td>(workforce's profile) Designed Questionnaire</td>
<td>Identify current ICT systems in the virtual organizations.</td>
</tr>
<tr>
<td>To inform the study by performing a Critical Literature Review.</td>
<td>Information: How is the information delivered (LM)? In analyzing the information flow in the virtual organizations.</td>
<td>(documents and analysis) Designed Questionnaire</td>
<td>Identify current ICT systems in the virtual organizations.</td>
</tr>
</tbody>
</table>
1.8 The Plan of the Thesis: The structure of this thesis is based on a series of divisions and is divided into ten chapters.

Chapter Two (Research Methods): This chapter discusses the research methods used for problem solving. It includes a selection of research methods, their approach, type and model. Moreover, a convenient model is selected to build a proposed model for justifying the solution.

Chapter Three (The Information Flow): This chapter contains a literature review of information flow. It covers concepts of information, integration of information flow, auditing of information flow, mapping information flows, and the modelling of information flow by using visualisation techniques.

Chapter Four (The Virtual Organisation and ICTs Applications): This presents a literature review concerning the virtual organisation (office). This chapter is divided into two parts: Part One is concerned with the concepts of the virtual organisation (teleworking and telecommuting), teleworking types, and the implementation of VOs. Part Two deals with presenting the ICT tools that are usually used in the VO.

Chapter Five (Teleworking Throughout the World): This chapter is divided into two parts. Part One covers teleworking around the world (principally in the USA, Europe, Asia and Australia). Part Two gives a clear view of teleworking in the United Kingdom.

Chapter Six (Survey Management): This chapter presents the survey management of the data collection. It contains a description of the type and design of the questionnaire. Implementation details are also given. In addition, a description of different types of interview is included. The pre-test and pilot study of the questionnaire are presented and finally, the main survey procedures are illustrated.

Chapter Seven (Analysis of the Survey Data): Part One presents findings from the questionnaire analysis that are of benefit to the field of information flow and VOs. They address some of the research questions. Part Two is concerned with presenting the findings from the first phase interview analysis that supports the role of the questionnaire.

Chapter Eight (Auditing and Mapping of Information Flow): This chapter presents the proposed model which can be adopted in the case itself. It is concerned with using
the Information Audit Model to audit the information flow. Details of the information mapping exercise can also be found in this chapter.

**Chapter Nine (Discussion of Results):** This chapter brings together the logical strands of argument developed throughout the thesis thus far. The development of the argument includes reference to the literature and other secondary evidence, primary data and their subsequent analysis and interpretation, and the various models developed throughout the thesis.

**Chapter Ten (Conclusions and Recommendations):** This chapter provides the conclusions and recommendations that can be offered for decision makers and scholars in the field.

Figure 1.2 shows a plan of the activities which were performed in order to achieve the aims and objectives of this study.
Chapter Two

Research Methods

2.0 Introduction:

This chapter selects the research methods, including the philosophy, strategy, model, approach, type and tools, that are actually used for gathering data to solve the research problem. The selection of the research methods is the most important step in the problem-solving procedures, and the evaluation of the research normally relies on this selection itself in addition to the expected contribution of the research. This means that the selection of the research methods is considered to be one of the main criteria of the research evaluation. It is important, at this stage, to select the most convenient research methods that will be used in gathering data, data management, data analysis and in building the proposed model at the end. The kind of research method, research philosophy, research approaches, research strategies, time horizon, data collection methods and models of research methods are clarified in this chapter.

2.1 Kinds of Research Methods

There are three kinds of research method: quantitative, qualitative and mixed methods. Quantitative research is: "an empirical research in which the researcher explores relationships using numeric data. Survey is generally considered a form of quantitative research. Results can often be generalized, though this is not always the case" (Colorado State University, 2004). Regarding quantitative data, Arsham (2002) stated that quantitative data are always numeric and indicate either how much or how many. They are concerned with quantity rather than words. So, special statistical tools are actually used to analyse this kind of data. Qualitative research is defined as: "qualitative research is a process of enquiry that draws data from the context in which events occur, in attempt to describe these occurrences, as a means of determining the process in which events are embedded and the perspectives of those participating in the events, using induction to derive possible explanations based on observed phenomena" (Gorman and Clayton, 1997, p 23).

According to Spencer et al. (2003) "qualitative research aims to provide an in-depth understanding of people's experience, perspectives and histories in the context of their personal circumstances or setting".
Concerning the form of qualitative data, these are usually in the form of words rather than numbers. In qualitative research, collecting data is not a process separate from analysing data, which means that qualitative research discovers the situation (Morse and Richards, 2002, p 1). Furthermore, according to Mason (2002, pp 7-8) qualitative research should be: (1) systematically and rigorously conducted, (2) accountable for its quality and its claims, (3) involve critical self-scrutiny by the researcher, or active reflexivity, (4) produce explanations or arguments, rather than claiming to offer mere descriptions, and (5) produce explanations or arguments which are generalisable in some way, or have some wider resonance.

Mixed qualitative and quantitative research uses a combination of methods from both approaches. Creswell (2003, p 19) described the mixed approach as using both open-end and closed-ended questions, and both quantitative and qualitative data and analysis. Also, Fielding and Schreier (2001) argued over a combination quantitative and qualitative research together. In this research, a combination of quantitative and qualitative methods was chosen in order to solve the research problem. In fact, a combination of both of research methods can achieve the target aims.

2.2 Research Philosophy

There are two kinds of research philosophy: positivism and phenomenology. In positivism research, the researcher plays the role of an objective analyst, making independent interpretations about those data that have been collected in an apparently value-free manner (Saunders, Lewis and Thornhill, 2000, p 85). Also, the researcher is not part of the research itself; he/she presents the results without any intervention. Phenomenology, however, is a school of philosophy whose primary aim is to study the phenomena, or appearances, of human experience while attempting to suspend all consideration of their objective reality or subjective association (Grolier Encyclopedia, 2003). In this philosophy, the researcher could be a part of the research itself. In fact, phenomenology took its present shape at the beginning of the 20th century with the writings of Edmund Husserl (Grolier Encyclopedia, 2003; ConnectNet, 2003). Furthermore, this 20th century philosophical movement is dedicated to describing the structures of experience as they present themselves to consciousness, without recourse to theory, deduction or assumptions from other disciplines such as the natural sciences.
2.3 Research Approaches

Each research should be directed through at least one approach. There are two approaches of research. A **deductive approach** is a scientific approach, where the researcher is independent of the research. This method entails the development of a conceptual and theoretical structure prior to its testing through empirical observation (Gill and Johnson, 2002, p 34). A deductive approach works from the more general to the more specific, which is sometimes called a "top-down" approach (Trochim, 2000).

For analysing the relationship between two factors, a deductive approach is normally used. Purely deductive learning includes methods such as caching, building macro-operators, and explanation-based learning (University of Michigan, 1994). The figure below demonstrates the deductive approach.

![Deductive Approach Diagram](image)

**Figure (2.1) The deductive approach (Source: Trochim, 2000)**

**Inductive** approach works the other way, Trochim (2000) described it as: (1) moving from specific observations to broader generalizations and theories, (2) a "bottom-up" approach, and (3) the researcher begins with specific observations and measures, begins to detect patterns and regularities, formulates some tentative hypotheses that can be explored, and finally ends up developing some general conclusions or theories.
Saunders, Lewis and Thornhill (2000) presented the following comparison between the inductive and deductive approaches of research:

<table>
<thead>
<tr>
<th>Deduction emphasises</th>
<th>Induction emphasises</th>
</tr>
</thead>
<tbody>
<tr>
<td>• scientific principles</td>
<td>• gaining an understanding of the meanings human attach to events</td>
</tr>
<tr>
<td>• moving from theory to data</td>
<td>• a close understanding of the research context</td>
</tr>
<tr>
<td>• the need to explain causal relationships</td>
<td>• the collection of qualitative data</td>
</tr>
<tr>
<td>between variables</td>
<td>• a more flexible structure to permit changes of research emphasis as the research progresses</td>
</tr>
<tr>
<td>• the collection of quantitative data</td>
<td>• a realisation that the researcher is part of the research process</td>
</tr>
<tr>
<td>• the application of controls to ensure</td>
<td>• less concern with the need to generalise</td>
</tr>
<tr>
<td>validity of data</td>
<td></td>
</tr>
<tr>
<td>• the operationalisation of concepts to ensure</td>
<td></td>
</tr>
<tr>
<td>ensure the clarity of definition</td>
<td></td>
</tr>
<tr>
<td>• a highly structured approach</td>
<td></td>
</tr>
<tr>
<td>• researcher independence of what is</td>
<td></td>
</tr>
<tr>
<td>being researched</td>
<td></td>
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<tr>
<td>• the necessity to select samples of</td>
<td></td>
</tr>
<tr>
<td>sufficient size in order to generalise</td>
<td></td>
</tr>
<tr>
<td>conclusions</td>
<td></td>
</tr>
</tbody>
</table>

Table (2.1) Characteristics of inductive and deductive approaches to research

(Saunders, Lewis and Thornhill, 2000, p 91).
Combinations of inductive and/or deductive reasoning are present in most cognitive architectures that utilize a symbolic world model and are described in the individual architecture document with more specific capabilities such as planning and learning (University of Michigan, 1994). The main point here is not to be insistent on using both methods but to select the most appropriate approach for solving the problem.

2.4 Research Strategies

There are two main strategies in research methods: Scientific and Interpretivist strategies.

2.4.1 Scientific Strategies: These include: laboratory experiments, field experiments, surveys, case studies, forecasting future research, grounded theory, and simulation (game/role playing).

i) Laboratory experiments: Experiment is a classical form of research that owes much to the natural sciences, although it features strongly in much social science research, particularly psychology. It will involve typically: the definition of a theoretical hypothesis; the selection of samples of individuals from known populations; the introduction of planned change on one or more of the variables; measurement on a small number of the variables; and control of other variables (Saunders, Lewis and Thornhill, 2000, p 93). Laboratory Experiments use a small number of variables that may be investigated intensively based on quantitative techniques, then the relationship between these variables is determined. These experiments have a view to making generalisable statements applicable to real-life situations. So, there are limitations in the attendant variables compared to the variables found in the real world (Galliers, 1992, p 150).

ii) Field experiments: This approach is also on the experimental side but has more extension into real life situations than the laboratory strategy. Coombes (2001, p 46) described this method as "a field experiment is when the study is carried out in the natural environment rather than in a controlled laboratory".
iii) Survey: This strategy is a particular view of time. It is considered as a cross-sectional view and so deals with a cross-section of the past, present or future, depending on which view is needed. From an analytical view, quantitative techniques are the techniques which most concern the environment and the data collection tools are the questionnaire and interview. A positive point in this regard is their ability to measure many variables and their relationships which the experimental strategy does not allow (Galliers, 1992, p 150; Kraemer and Dutton, 1991, pp 3-58; Gill & Johnson, 2002, pp 96-122). The researcher here must pay attention to being unbiased towards the respondents. The survey method is usually associated with the deductive approach; it is a popular and common strategy in business and management research (Saunders, Lewis and Thornhill, 2000, p 91).

iv) Case studies: Case studies have been become one of the most common ways to carry out qualitative inquiry (Denzin and Lincoln, 2000, p 435). Concerning the generalisation of the results, it is believed that case study is useful in studying human affairs because it is down-to-earth and attention holding but it is not a suitable basis for generalisation (Stake, 2000, p 19). According to Gill and Johnson (2002, p 21), the case study is mainly related to problem solving rather than the exploratory method. Coombes (2001) offered her own overview regarding the advantages and disadvantages of the case study. These are as follows:
<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
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<tbody>
<tr>
<td>• A case study can disprove or qualify a general statement</td>
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</tr>
<tr>
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<td>• Often sheds light on things that are unethical or impractical to study in other ways</td>
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<td>• Case studies are often based on qualitative and descriptive data, and are therefore more likely to focus on rich, detailed, individual analysis</td>
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</tbody>
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Table (2.2) Advantages and disadvantages of case studies (Coombes, 2001, p 44)

It is clear from the above comparison that the case study investigates one organisation or a group of organisations; each study investigates more variables and relationships than in the experimental and survey strategies (Galliers, 1992, p 150). The design of the case study is logical in that it links the data to be collected and the conclusions to be drawn to the initial questions of a study. Yin (1994, pp 38-53) and Yin (1989, pp 46-59) categorised the use of the case study into four types: single-embedded case design, multiple-embedded case design, single-holistic case design, and multiple-holistic case design. The single case study is an appropriate design under several circumstances. It can be related to studying just one case and this could be an individual, group or a company. Holistic means that the case study has a comprehensive, not a deep focus. Holistic strategy uses not more than one unit of analysis. Consequently, the first type focuses on studying one case using a comprehensive approach (a single unit of analysis). The second type of design is related to studying one case in depth (multiple units of analysis). The third type
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### Disadvantages
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of design is concerned with studying multiple-cases comprehensively (a single unit of analysis) while the fourth type is related to studying multi-cases deeply (multiple units of analysis). On the other hand, embedded case study designs are becoming more prevalent but they are more expensive and time-consuming to conduct. Furthermore, the use of multiple-case design should follow a replication, not a sampling, logic and investigators must choose each case carefully (Yin, 1994, pp 38-53; Yin, 1989, pp 46-59).

v) Forecasting Future Research: this is used for the prediction of events, changes, downsizing and impacts. It is also useful for building a future model. Regarding the field of information systems, forecasting research is very important for predicting the impact of the implementation of a new technology in an organisation, for individuals and society in general. Here, cross-section analysis and time-series analysis can be adopted as the strategy of forecasting research. The researcher in this approach must pay attention to the methods of collecting data because the model of the future behaviour relies on these data. The complexity of the definition of variables must also be solved before the beginning of the research. Past data must reflect future truth as much as possible.

vi) Grounded Theory: Grounded theory methodology is both deductive and inductive. Inductively, theory comes from observations and generated data. This theory can then be empirically tested to produce forecasts or predictions from general principles (Siegel, 1995). It is often thought of as the best example of the inductive approach, although this conclusion would be too simplistic. It is better to think of it as “theory building” through a combination of induction and deduction, and data collection starts without the information of an initial theoretical framework (Saunders, Lewis and Thornhill, 2000, pp 94-95). Siegel (1995) stated that: “the objective of grounded theory is the discovery of theoretically comprehensive explanations about particular phenomenon”. It can be summarised that theory which relates to the particular situation can be generated by using a grounded theory.

vii) Simulation and game/role playing: This strategy is used in a complex situation, where the variables in a situation are impossible to analyse. So, it is an attempt at copying the behaviour. Furthermore, it is similar to experimental research with regard to the difficulties associated with devising a simulation that accurately reflects the real world
situations (Galliers, 1992, p 150). In addition, Arsham (1995) added that: "simulation in general is to pretend that one deals with a real thing while really working with an imitation".

2.4.2 Interpretivist Strategies: These strategies include action research and subjective, argumentative strategy.

i) Action research: Zuber-Skerritt (1996, pp 3-4) described action research as follows: (1) It has been established as an appropriate research paradigm for educational, professional, managerial and organisational development; (2) It is applied research that relies on an attempt to obtain results of practical value; (3) It adds the results to theoretical knowledge; (4) In general, it is similar to case study research; and (5) There are three kinds of action research: technical action research, practical action research, and emancipatory action research.

ii) Subjective, argumentative approach (phenomenology, hermeneutics): This approach is based on the researcher’s opinion and his/her perspective. It is also used in a knowledge series, especially in building theory or in creative new ideas and insight. The main risk in this strategy is hidden bias (Galliers, 1992, p 150).

2.5 Time Horizon: Studies are actually divided into two sorts concerning the time horizon. Many Cross Sectional Studies may use quantitative methods; most of them are based on interviews conducted over short periods of time (Saunders, Lewis and Thornhill, 2000, p 96). "Cross-sectional designs may be appealing for reasons of economy of time and cost, however the design severely limits the researcher's ability to address developmental issues or offer causal interpretations" (King, 2001). It reflects a solution in a determined time, not over a long time. Regarding the Longitudinal Study, King (2001) stated: "that prospective longitudinal research designs are the most appropriate designs for developmental issues". This type of study is called a time series study, which is not related to a particular time, but related to a determined time consisting of a series of decades, years, quarters, months, weeks, days, hours or minutes. It is used for many purposes. For example, it could be used in studying the financial history of company. This kind of horizon is concerned with studying the development of historical behaviour.
2.6 Approaches to solving the research problem: In this regard, six approaches can be addressed. Selecting one or more should help in the collection, analysis and interpretation of the data. These approaches are Managerial, Environmental, Technical, Information-driven, Legal and Economic. Accordingly the research problem mainly uses an information-driven approach. This relies on presenting solutions that improve information flow in the virtual organisations.

2.7 Information Models

Olle et al. (1991, p 35) said that the term ‘model’ can be confusing if it is taken in isolation, and its concept of modelling is inherent in any information systems methodology. However, the reality can be understood throughout the modelling. Robinson and Prior (1995, p 3) stated that soft approaches of modelling emphasize the human and social aspects of information systems within their environment and may be directed towards problem solving without any reference to computerization, while hard approaches emphasize the application of technology and techniques in a systematic manner to produce a new (usually computerized) system. There are many models mentioned in the literature. The following are mainly related to the aims of study:

- SSADM: Structural Systems Analysis And Design Method (SSADM) is a way of organising the systems analysis and design parts of the UK’s government projects and departments, which aims to deliver a computer-based information system (Downs, Clare and Coe, 1992, p 1; Hares, 1990, p 1; The Government Centre for Information Systems, 1994, p 9). This approach reflects a structured method for producing logical and physical design specifications for computer system applications (Hares, 1990, p 5). According to Downs, Clare and Coe (1992, pp 19-83) and Hares (1990, pp 1-16), this model contains seven stages: feasibility, investigation of the current environment, business systems options, specification and definition of requirements, technical system options, logical design, and physical design.

- Multiple Channel Model (M/M/S): This model is most convenient in situating a large number of units in a system and mainly deals with finding the average time in the system and the average waiting time in the queue. On the practical side, this model is useful in large factories (Daellenbach, George and McNickle, 1983, p 439).
- Multi-view Model: The methodology exhibits five different views, all of which can be emphasized, reduced in scale, or even omitted, according to the circumstances. The stages of this model are as follows: the analysis of human activity systems; the analysis of entities and functions; the analysis and design of socio-technical systems; the design of the human-computer interface; and the design of technical subsystems (Wood-Harper, Antill and Avison, 1985, p 27).

- Information Audit Model: The simplest and most popular definition for the information audit is presented by Guy St. Clair, who defined an information audit as: "a process that examines how well an organisation's information needs and deliverables connect to the organisational mission, goals and objectives" (Henczel, 2001a, p xxii). There are seven stages for building this model: planning, data collection, data analysis, data evaluation, communicating recommendations, implementing recommendations, and the information audit as a continuum (Henczel, 2001a, p 17). It is relevant to the investigation of information flow.

- Soft System Methodology (SSM): This model was developed by Peter Checkland and his colleagues in the 1970s. It focuses on soft systems rather than hard systems to solve problems (Checkland and Scholes, 1999, p xiii). The main stages of SSM are: finding out, expressing the problem situation, building conceptual models, comparing models perceived by the real world, debating and defining changes, and taking action (Checkland and Scholes, 1999, p 62).

- WISDM Model: Web Information Systems Development Methodology (WISDM), this sort of model is a framework in which aims to facilitate the new innovated solutions with the certain benefits of the web. As Vidgen (2002) described this model, it provides a framework for bringing together traditional systems development methods with web-based techniques. However, he also added that "Web-based IS therefore require a mix of web site development techniques together with traditional IS development competencies, such as database design and program design".

2.8 Research Methods Selection

Due to the research problem and the aims and objectives of this study, the type, approach, philosophy, strategy and model for solving the problem needed to be
determined. Since the research problem is concerned with investigating the information flow in the virtual organisation, the most suitable methods are:

1. A combination of quantitative and qualitative methods to investigate the integration of information flow, information mapping and the impact of ICTs, and also to provide an overview of teleworking throughout the world. In fact, this combination reflects the nature of the research problem. Hence, it is then possible to determine the other methods that are needed. Using this combination was necessary to achieve the research objectives needs starting from quantitative methods to achieve the first aim, then moving to a combination between quantitative and qualitative together to achieve the second and the third aims. The last aim should be achieved by qualitative methods. As seen, this combination means moving from using a deductive approach to an inductive approach, and moving from a positivistic to a phenomenological philosophy. So, the key point was to use these kinds, approaches and philosophies to achieve the research aims.

2. Concerning the strategy of this research, the survey (questionnaire and interview) was selected because it supports the above selection of methods and helps in collecting the data required. The type, design and management of the survey are clarified later in Chapter Six. Recently, Choudrie and Dwivedi (2005) examined the range of methods used for studying technology adoption issues at an individual and organisational level. A review of 48 articles on technology adoption and usage revealed that in surveys (74%) and case studies (26%), employed in the organisational context and in studies related to individual users or consumers, the survey approach was favoured.

3. Because of the time horizon, a cross-sectional method appeared to be most suitable. To confirm that, this study was seeking to do just the first generation of the information audit, and the others could be done in the future.

4. The methods of data collection used were: secondary data were collected through reports, statistics, census and previous surveys, etc. Primary data were collected at first hand from the first phase interview, the second phase interview and the designed questionnaire.

5. The information-driven approach was used to solve the research problem. Then, the model used was the Information Audit, which was developed by Sue Henczel. Its main aim was to investigate and map the flow of information that currently happens in virtual organisations, compared to the ideal flow of information which should happen.
The figure above illustrates the usage of the information-driven approach in this research and also shows the different methods that were used in solving the research problem. Both quantitative and qualitative methods were used, together with four sources of data collection: documents, questionnaire, the first phase of interviews, and the second phase of interviews. For modelling the results of the current situation of information flow, the IA Model and other model representations were also used. However, the above figure sheds light on the importance of a clear methodology in solving the research problem.

**Summary:** This chapter has illustrated a clear view of a convenient methodology for solving the research problem. It contains a selection of different types of research methods: mixing quantitative and qualitative research, mixing positivism and phenomenology, mixing inductive and deductive. Documents (and questionnaires and interviews) were the methods chosen for data collection. The information-driven approach will be used to solve the research problem and applying the IA Model will help in visualising the flow of information in the virtual organisations. However, before achieving the first aim of this study, it is vital to provide a theoretical framework for information flow and the virtual organisation. The next two chapters cover this.
Chapter Three
Concepts, Auditing and Mapping of Information Flow

3.1 Introduction

"The proper flow of information is the "life blood" of any organisation" (Pojasek, 2004). The main aim of this chapter is to provide a background of information flow and its related aspects like definitions, integration, auditing and mapping of information flow. It has five sections. Section One is concerned with the concepts of information. The second section deals with the integration of information flow, the direction of information flow, and information flow through the organisational levels. The third section is concerned with the auditing of information flow. It covers the concepts of auditing, reasons for applying the Information Audit (IA), benefits of applying IA, scope of IA, and procedures for conducting IA. The fourth section is mainly concerned with mapping information flows (concepts of mapping, reasons for using information mapping, benefits of mapping information, scope of information mapping, procedures of information mapping). The last section is associated with the modelling of information flow by using visualisation techniques such as: Information Flow Diagram, Flow Chart, and Use Case Modelling. A summary is presented that brings together the various threads developed in this chapter.

3.2 Information Concepts

This section covers three topics: concepts of information flow (and data and knowledge), information context and the relationship between information and work. Information is defined in many aspects. The question of the overlap between data and information should be solved first. Some scholars argue that data and information are in fact synonyms, yet others draw a distinction between them. Kock, McQuen, and Baker (1996) stated that knowledge, information and data are concepts that are often confused. The main issue in this is to define information and data, then decide to consider both of them as interchangeable words or words that have a different meaning. Data are defined by Reitz (2004) as: "The plural of the Latin word datum, meaning "what is given," often used as a singular collective noun. Facts, figures, or instructions presented in a form that can be comprehended, interpreted, and communicated by a human being or processed by a computer". Data were considered
the first items in finding the truth. They lead to information that leads to knowledge, which leads to wisdom that is worth the truth itself (Jashapara, 2004, pp 14-17). Data are transferred from one user to another through channels like pieces of paper, data files on floppy disks, and network file transfers (Kock, McQueen and Baker, 1996).

On the other hand, information is defined by Middleton (2002, p 481) as; “Data that have been organized, or signs capable of interpretation within a context, that may be assimilated into knowledge”. Moreover, Bocij et al. (2003, p 5) stated that information is data that have been processed so that they are meaningful, data that have been processed for a purpose, and data that have been interpreted and understood by the recipient (information need). Furthermore, Reitz (2004) presented the following definition:

“Data presented in readily comprehensible form to which meaning has been attributed within a context for its use. In a more dynamic sense, the message conveyed by the use of a medium of communication or expression. Whether a specific message is informative or not depends in part on the subjective perception of the person receiving it. More concretely, all the facts, conclusions, ideas, and creative works of the human intellect and imagination that have been communicated, formally or informally, in any form”

Concerning the term Knowledge, it is defined as a human quality that builds on data and information together with experience, values and insight (Rafaeli and Raban, 2005). Concerning the relationship between knowledge and information and data, Boisot and Canals (2004) stated that: (1) some associate information with data and others associate information with knowledge, (2) but since none of them readily conflates data with knowledge, this suggests too loose a conceptualisation of the term ‘information’, (3) the difference between data, information and knowledge is in fact crucial, (4) knowledge and information are not the same thing. They also added that: “information is an extraction from data that, by modifying the relevant probability distributions, has a capacity to perform useful work on an agent’s knowledge base”.

Stenmark (2002) discusses the relationship between data, information and knowledge. As is known, the relationship is linear and the distance between data, information and knowledge is equal, but he argues that it is not be important for it to be equal and linear because sometimes we use knowledge to retrieve the information needed. He claims that knowledge is based on personal experience and cultural inheritance and is fundamentally tacit. Also, he concludes that information and knowledge are different but they affect one another.
However, information can be in different forms, like paper records, in computer databases, in libraries, in personal journals and business records. Recently, Orna (2004, p 7) described information as the “food of knowledge” and as what human beings transform their knowledge into when they want to communicate it to other people. In the case of business, information is produced from raw data to enable management to plan and control, which means that information to one level of management may be raw data to another (Chartered Institute of Bankers, 1988, p 124). Finally, Kock, McQueen and Baker (1996) summarised these definitions in describing information as data in context. So, information is considered a milestone of knowledge management, considered to be “a hot topic” nowadays.

The review of literature revealed that Peter Drucker, when describing the emergence of the information-based organisation, used the concepts of knowledge and information interchangeably (Kock, McQueen and Baker, 1996). On the other hand, although the terms data and information are often used interchangeably, stricter definitions would be that: (1) data are the “raw material” which is processed and turned into information. In other words data are collected but unprocessed information; (2) information is data processed in such a way as to be of some meaning to its recipient (Chartered Institute of Bankers, 1988, p 124). However, in this research study, data, information and knowledge are not used interchangeably. Information refers to data that have been processed and to the “food of knowledge” as Orna (2004, p 7) described knowledge.

**Information Context:** Information flows through the different layers of each organisation as the blood in a cell. Basically, “Information flow is necessary for life. It guides every action, molds every thought, and sustains the many complex interactions that make up any natural system or social organisation” (Barwise and Seligman, 1997, p 4). In fact, information flows in each organisation internally and externally. Before Chester Barnard presented his own view of the system approach, researchers believed that information flows down the organisation. Then, we were informed that information flows in the other direction. Regarding internal communication, information flows up-down and down-up through managerial layers via through workers while external flow is that which exists between organisations and their customers, suppliers and competitors, and more recently between organisations and their employees (teleworkers). These companies are called virtual enterprises (or virtual organisations).
The information lifecycle within an agency mainly consists of creation, searching and utilization. The figure below (Figure 3.1) shows a simple view of these stages: As shown below, the main and sublevels of the information life cycle are actually the source of information, the movement of information and its destination.

![Information Life Cycle Diagram](image)

Figure (3.1) Information Life Cycle (School of Information Management and Systems, University of California, 1998).

It is clear from the above figure that information flows from the sender to the recipient through a few stages which reflect the use of information. However, the point here is to share information through these stages, because information sharing saves time, enhances knowledge and shares experience. Rafaeli and Raban (2005) described information sharing as the act of providing a helpful answer to a request for information. The second point is concerned with the flow of information according the real needs of users to avoid a lack of information needs and/or an overload of information. Both problems cause delays in response and lack of progress.

The relationship between information and work: Workflow Management (WFM) is defined by the Workflow Management Coalition as: "The automation of business process, in
whole or part during which document, information or tasks are passed from one participant to another for action, according to a set of procedural rules" (Bocij et al., 2003, p 244; Lawrence, 1997, p 385). This means workflow can be defined as comprising documents, information and tasks. Henczel (2003) confirmed that information is the main part of workflow and managing information flow should lead to efficient workflow. According to Bocij et al. (2003, p 244), the operational definition of workflow is based on information rather than documents and tasks. Both documents and tasks are efficient while information is already efficient. However, Denning and Medina-Mora (1995, p 61) clarified that the movement of information and material is the consequence of work, and it supports work, but it is not the work itself. Moreover, Summers et al. (1998) investigated the discharge communications between the John Radcliffe Hospital in Oxford and its referring General Practitioners (GPs) in the community. A distributed computerised solution was provided to improve the workflow.

In each organisation, information flows in different directions. Coughlan, Lycett and Macredie (2005) confirmed that shortage of communication channels within the organisation is caused by a lack of information exchange. So, both formal and informal, and internal and external information should flow according to the needs to avoid a shortage of communication. However, each organisation has both internal and external functions. Information should flow to achieve both of them. Also there are two types of information systems: formal information systems and informal communication patterns. Bocij et al. (2003, p 8) stated the difference between them: formal communication involves presenting information in a structured and consistent manner. This is transmitted by formal communication and they are produced for specific purposes so that information is accurate and relevant. Informal communication describes less well structured information, which is transmitted by informal means, like casual conversations between members of staff. Moreover, the Department of Library and Information Studies, at the University of College Dublin (n.d.) added that studying information in any organisation means examining the problem of communication in organisations, analysing information flow and information networks within organisations, and comparing the character of formal information systems and informal communication patterns.

The target of each organisation is to achieve a high level of customer satisfaction. This study argues that the basic milestone for that is managing information. Serva (2004)

(1) Henczel S., 2003, Conducting IA in the teleworking studies, face-to-face interview, London.
pointed out that as organisations recognize the need to have better control over information, their strategies should be examined for having the capabilities to create it, access it, and keep it flowing. As was mentioned before, in order to manage information efficiently, organisations have to know that there are structured and unstructured systems. Reed says:

"There is a huge amount of it that is in structured systems, but also a lot of it that remains in unstructured formats. A lot of it lives in both the print and electronic world. Most people are just trying to find ways to capture, manage, store, track, and distribute information more efficiently" (Serva, 2004).

To sum up this section, it is vital to say that information is different from data and knowledge and these terms cannot be used in this research as interchangeable words. Information describes data in context, information also refers to data that have been processed and organized to give meaning. Information should flow efficiently from its source to the recipient, and through its life cycle of creation, searching and utilization. Information flow is the main part of the workflow and also has three aspects: internal and external information, formal and informal information, structured and unstructured information (or system).

The next section is concerned with providing in depth analysis, definitions and a model for the integration of information flow, which focuses on receiving (sending) the right information from/to the right source (recipient) at the right time through the right channel, and considers the flow of information through organisational levels.

3.3 Integration of Information Flow

In this section, a picture of the definition of information flow, the integration of information flow, and the information flow through the organisational levels are clarified.

3.3.1 Definition of Information Flow

The main related aspect of information, which is researched in depth in this research, is the flow of information. Nath [n.d.], provided the following definition of information flow: "The supply/availability of information within a society. Information flows may be ‘restricted’ in
some societies and "open" in others”. Henczel (2001a, p 259) presented her definition of information flow as: “The movement of information between departments and individuals within an organisation, and between organisation and external environment”.

Orna (2004, pp 114-115) confirmed that the behaviour values of information and their inter-relations are concerned with the integrity of information and the context of its use, formal information sources, information control, transparency and sharing of information. Completing each task requires a few processes which actually comprise of information need. Davenport (1993) confirmed: “information as something that enters into all business processes, and that is essential for integrating all the processes that make up an organisation” (Orna, 2004, p 11). In analysing this myth, Orna (2004, p 11) herself added that processes are series of activities devoted to creating output that reflects the vital role of information in completing each task by completing each process. Each process needs required information; information should be ready in an integrated way to complete this task in a cost-effective manner. So, there is a real necessity to improve organisational processes in order to save time and cost without sacrificing the achievement of the goals. According to Kock, McQueen and Baker (1996) in some cases, such as Ford, IBM Credit and Dow Corning, business processes have been obtained chiefly by the redesign of how information flowed, rather than how activities were carried out.

3.3.2 Integration between the right information, the right source (recipient), the right channel, and the right time

As was mentioned before, the improvement of information flow means finding an integrated information flow that could help in cutting costs and saving time. According to Marchand, Kettinger and Rollins (2002, p 102) information integration is:

"the foundation of good information use, guaranteeing that information is truthful, accurate and without bias, it sets "appropriate boundaries for ethical information behavior" and influence directly "the formal use of information within an organisation"."

Furthermore, improvement reflects the capability level of each organisation, optimising the work, which indicates that the organisation can reduce operating costs by improving current process performance or by introducing innovative services to maintain their competitive edge (Herndon et al., 2003). This level of optimisation cannot be achieved
without the timely sending/receiving of information from/to the right source (recipient) through the appropriate channel. So, integration of information flow is considered as a target level for each organisation nowadays. Hence, the proposed model of information flow should contain the right information, the right source (recipient), the right time and the right channels. Other aspects of the information context could be added such as the right price, the right format and the right cost.

Prac (2002) and Jones (2002) stated the following issues that are concerned with the statement of "right" information, "right" source (recipient) and "right" time: (1) It is a worthy goal to deliver adequate, appropriate information to the right people, at the right time, in the right place, to the right quality and at the right price; (2) Its relational nature may well enable us to understand how data, information and knowledge are deterministic; (3) the word “right” implies rules, and thus determinism; it does not exclude multiple roles within different contexts though it can be probably be exchanged with another, more conceptual, word such as correct or valuable or whatever would make sense within a particular context, when using databases, for example; (4) They are deterministic. Within the context of databases we could thus ensure that the right person gets access to the right information at the right time. In fact, it is part of the information economy of demand and supply, which is a deterministic relationship.

Information helps managers to make the right decisions so it is important in managing an organisation’s activities. This meaning of integration between the four elements of information flow is reflected in the words of the Chartered Institute of Bankers (1988, p 130) when they stated that: “Information should be communicated to the managers who need to use it for control action. The structure of information flow—i.e. how information is transmitted, from where and to whom—is an important consideration in management information systems”. In fact, a model of these elements of “right information”, “right source (recipient)\(^{(1)}\), “right channel”, and “right time” are clarified below in depth.

\(^{(1)}\) In fact, most of the previous studies used the “right person”, which does not comprise all of senders and recipients of information. For example, accessing an online database is not a “person”. So, the researcher used “source” to indicate to the source of information (receiving side) and a “recipient” to indicate to the seeker of information (sending side).
The four elements of the integration of information flow are clarified in more detail below:

**Right Information:** This refers to that sort of information which significantly contributes to achieving the goals (objectives) of an organisation. Another definition was provided by Sawin, Calcatera and Olka (2003), indicating that the “right” information is the most current information. Equally as important as defining the right information is to define the right format. It is vital for the analyser to find the most convenient way to understand the real needs of the customer. Both representatives of customer service and knowledge workers need access to the right and relevant data associated with a specific customer (Wonderware, 2003). Then they can understand the customer’s need. Another piece of research into customers’ frustrations gave insights into what should be the “right information” to maintain customer satisfaction (Sawin, Calcatera and Olka, 2003). It is clear that getting the right information is a milestone for managing business. In addition, Wonderware (2003) added that “getting the right information at the right time in the right context to the right person is the recipe for success in today’s manufacturing environment”. Broady-Preston and Hayward (2001) also added that:

“All managers need to appreciate the role information plays in such processes, and be able to access and use appropriate information. Therefore, information must flow freely, to and from all parts of the...
organisation, in order to have an impact on strategy formulation. Blockages in information flow may be eased by the development of corporate intranets which should include, ideally, the type of performance related information contained within a balanced scorecard”.

Right Source (Recipient): As mentioned previously, most scholars use the term the “right person”. In this research, it is clear to say that “right person” is not sufficient to indicate to all information sources and destinations. According to Nath [n.d.], sources of information could be people, institutions, publications, public databases and domains. Also Yang (2001) stated that the notion of the information cycle is divided into three phases: information creation, information flow and information storage. Concerning the information flow, there are two attributes: inter-organisational flow and intra-organisational flow. These reflect the sources and destinations of information. They could be internal or external to the organisation and they could be a person or a database etc. Hence, it can be concluded that information flows from the source to the recipient. A ‘person’ could be one or both of them.

Each person in the organisation has a job description with tasks that can be done by getting the right information. Therefore, completing these tasks requires different kinds of information being received and sent from/to the right source (recipient). Information is important for all, particularly the decision makers. Prac (2002) added that decision makers should be supported by sufficient information to help them make the best decision for the case (right information/time) according to their demand. Employees in the three common known levels (strategic, tactical and operational) are invited to satisfy their need for information through appropriate sources to optimally achieve their goals.

What is the relationship between information flow and the creation of knowledge? Widén-Wulff (2000) stated that information is a flow of messages, whereas knowledge is created and organized from this flow. The most important part in the organisational knowledge process is the individual and so this flow is considered as an interaction between information and experience and rationality. Furthermore, Prac (2002) added that: “KM could assist executives in learning who these people are, and what information and knowledge could be considered "right" for each organisation, which could be implemented via multiple role data”.

Right Channel: The contact method between the send point and the receive point is called the communication channel; it starts from the source of information (sender) to the destination point (recipient).
"Information must be communicated by an appropriate communication channel, with as little ambiguity or misunderstanding as possible, with clarity, to the right people, at the right time, with sufficient confidence in its accuracy. It should be comprehensive, and should be directed to towards the goals of the company as a whole, it must be provided at a cost which is less than the value of the benefits it provides." (Chartered Institute of Bankers, 1988, p 126).

Channels of information flow could be discussions, meetings, personal networks, training, group work, e-mail, intranet, reports and internal papers (Widén-Wulff (2000). Moreover, the Chartered Institute of Bankers (1988, p 127) added the following examples of communication channels of information: written reports, graphs or visual displays, sheets of figures, telephone conversations, management meetings, informal discussions, transfer of data by computer, information obtained simply by looking around to see what is happening, TV, films, broadcasting or announcing systems, company notice boards, company journals or magazines, procedure manuals or instruction manuals, personal letters or communication, circulars or memos, and employee reports.

Right Time: A fact of life is that time is limited. Wonderware (2003) stated a few issues concerning information timing. They are:

1. Companies need to get as much time as possible out of their business processes in order to increase their productivity and cut costs.
2. Real-time access to information is already a reality within the different departments within any company.
3. In today's competitive times, efficiency and productivity, achieved through a more effective use of information, may well determine which companies succeed.

Integration between the 4Ms (Man, Material, Management and Money) leads to more integration between the right information, the right time, the right source (recipient) and the right channel. Consequently, organisations are nowadays invited to study and understand the opportunities of improving the integration of information flow.
3.3.3 Information Flow Through the Organisational Levels

In the common known levels of each organisation (strategic, tactical and operational levels), information should flow according to the organisation's objectives. There is an interaction between these levels of organisation. Different information aspects are required to be ready for different people, particularly at a strategic level. As mentioned above, there is an interaction between the different departments in any organisation; the basic milestone of this integration is the information used. Widén-Wulff (2000) confirmed the importance of teamwork and the middle management in this interaction.

Concerning information levels, O'Brien (2005, p 294) and the Chartered Institute of Bankers (1988, pp 125-126) analysed information levels into three parts. They are:

1. Strategic information, which is used by senior managers and top executives in the objective planning of their organisations. They use this level of information in assessing whether the objectives are being met in practice and to monitor the strategic performance of the organisation (e.g. information includes the overall profitability, future market prospects, total cash needs, and capital equipment needs). Strategic information is communicated irregularly.

2. Tactical information: is used by the middle managers to develop short-and medium-range plans, schedules, and budgets for their subunits (e.g. information includes productivity measurements (output per man, or per machine hour), variance analysis reports, cash flow forecasts, and labour turnover statistics). Tactical information is usually prepared regularly (weekly or monthly).

3. Operational information: front-line managers, self-directed teams or operating managers use this level of information. It is used to ensure that specific tasks are planned and carried out properly within a factory or office etc. It is communicated hourly, daily or maybe weekly.

Concerning the direction of information flow, information should be sent and received along a specific direction. Before Chester Bernard's speech, it was believed that information flows from top to bottom but he changed this concept to mean that information can also flow from the bottom to the top level of an organisation. Both of them are used in real life. According to Gwynne (2005) the Scientific Management School wanted to improve organisations from bottom up but one of the few problems that Frederick Taylor saw was the loss of decision-making based on too little
information. On the other hand, Bureaucratic Theorists wanted to improve organisations from the top down and Henri Fayol wanted to increase efficiency through structure and control by using flow charts and Fayol's Bridge. In fact, the direction of information flows can be one-way or two-way, upward, or downward.

Due to blockages in information flow, Broady-Preston and Hayward (2001) stated that:

"Whilst writers such as Mintzberg (1998) have identified a key role for strategists in monitoring information flows, clearly this is a difficult area to manage. The majority of banks surveyed were aware of blockages in information flow within their organisations. Conversely, in the smaller banks especially, information was believed to flow easily within the organisation. Nonetheless, even in the smaller banks, blockages in the flow of customer information were acknowledged".

Regarding internal and external information, each organisation has relationships with its customers, suppliers, competitors, and recently with their employees (teleworkers). All these relationships can be managed by different sorts of information. On this subject, Optura (2004) added that employees, suppliers, customers and partners need to collaborate across functional and organisational boundaries and information and communication must flow across organisational and structural barriers in order to support the dynamic nature of business. Carai (1997) added that: "If you have analysed your information inflows and outflows you will have set filters in place to reduce the flows to what is useful and necessary".

From an organisational point of view, information can also flow in a vertical or horizontal direction. The Chartered Institute of Bankers (1988, p 131) presented the difference between both directions. Vertical flow could be downward or upward, and between superiors and subordinates whereas the horizontal flow is between people at the same hierarchical level in the organisation. Horizontal flow is necessary in formal and informal situations and it should be an organized procedure, or it should be made only as a request for assistance or as a response to such a request.

From the above section, it can be concluded that information flow can be integrated with the objectives of the organisation then costs and time can be saved. Information flow through the organisational levels has dimensions such as internal and external, high level (or mid and low levels) of management, horizontal and vertical flow. Four elements of integration of information flow were presented above to reflect the meaning of information use; they are related to getting the right information at the right time from/to
the right source (recipient) through the right channels. The next section is concerned with
the auditing of information flow.

3.4 Auditing the Information Flow

This section on information audit (IA) covers four subjects: concepts of IA, reasons for
conducting IA, the scope of IA, and applying IA.

3.4.1 Concepts of IA: In an applied sense, the auditing of information leads to the
right decision being made by the right person at the right time in an appropriate location.
Clearly, information that is often distributed needs to come together in an efficient way
to allow the best use of resources. However, the term Information Audit (IA) is not a
new term; it has been discussed in the literature for at least thirty years and suggests an
analogy with the activities performed by financial auditors in an agency, though in
practice most of the activities performed have little similarity (U.S. Department of
Commerce, 2002). There is no universally accepted definition of an information audit
(Orna, 1999, p 69). But attempts can be made to define it.

IA can be defined as: "A systematic evaluation of information use, resources, and flows, with a
verification by reference to both people and existing documents, in order to establish the extent to which
they are contributing to an organisation's objectives".

The above definition was adopted by ASLIB (Orna, 1999, p 69). The new informatics
directions are reflected in depth in this usage of the auditing approach. Also, Henczel
(2001a, p xxii) describes this definition as a reflection of the process of information audit
that enables the mapping of information flows within an organisation and between an
organisation and its external environment. Additionally, there is a definition of IA which
was presented by Ellis et al. (1993). They defined IA as: "Information audits extend the concept
of auditing from the traditional concern with evaluation an organisation's accounting and financial
procedures to that of the organisation's overall information systems". This definition reflects the
extending of the IA concept from its traditional concept to the new system definition.

McCracken (2001) in his revision of the related literature of IA found that Orna said:
"The word 'audit' is rather a misleading one because some people think you just identify where your

(0) The Association for Information Management in the UK.
resources of information are" whereas the identification of resources is just one step in the process of audit; the inventory produced is useless on its own. Also, he reviewed Henczel's model and found that she described it as:

"The information audit examines the activities and tasks that occur in an organisation and identifies the information resources that support them; it examines not only the resources used, but how they are used and how critical they are to the successful completion of each task".

3.4.2 Reasons for Conducting an Information Audit: Information should be audited to cut costs, save time, avoid delay and avoid duplication of tasks. According to Tapaswi (2001), information in the early stage of the organisation is unplanned and unmanageable, which causes increasing costs, wasting of time and wasting of effort.

In this study, IA is mainly used to audit the aspect of “information flow”, which is not possible without studying the processes, sources and needs of information. Managing these aspects of information is important for any style of management business because it is logically considered an important asset in each organisation. Hence, auditing them surely helps in the progress of productivity and achieving goals. All of them help to provide the right information at the right time. McCracken (2001) confirmed that by conducting IA, the organisation should find out why things are not flowing as smoothly or as efficiently as they should be in the organisation. However, an IA should aim to investigate at least one of the information lifecycle activities, which consists of collection, storage, access, use and disposal (U.S. Department of Commerce, 2002). A simple concept model is provided below. This model is just a guide for moving from the appearances of problem to the target outputs and outcomes (Figure 3.3).

According to Tapaswi (2001), McCracken (2001), the U.S. Department of Commerce (2002), Henczel (2003)(1), Henczel (2001a, p 28, and pp 132-136), Pantry and Griffiths (2002, pp 22-23) and Swash (1997), IA is used if there is at least one of the following indicators that are related to needs (appearances) of the unorganized information. These are: cost and time issues, information issues, knowledge management issues, staff issues, and decisions issues, as shown below:

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(1) Henczel S., 2003, Conducting IA in the teleworking studies, face-to-face interview, London.
Cost and time issues: the first issue is concerned with wasting time and money in the same information being acquired by many workers (due to lack of centralisation), duplication of efforts (due to a lack of certain information), or it could be a multiple number of personnel spending their time searching for the same information. In the second issue, the costs of acquiring, storing and processing information are high, and the cost of purchasing new technology is high.

Information issues: There are five issues concerning information:

(1) Right information: IA is used in locating the available/scattered information when a little appreciation, knowledge or control of the degree of relevance or utility of the information being collected is required; shows how to produce the information in the format needed; identifies what information exists within the organisation; and prioritises information requirements and outputs in line with organisational objectives. Swash (1997) clarified that: “Information can have both a purchase cost and a value to the organisation, where value is measured in terms of the benefits that can be derived from its use”.

(2) Source of information: IA helps in determining where information needs exist which are not being adequately catered for; where information resources are being maintained but can be shown to have become redundant to either current or future requirement and to be generating unnecessary overheads for the business; in measuring the effectiveness of existing information sources; and where information resides and is located.

(3) ICT: IA determines if the information systems are as efficient and secure as they should be and determines if the enabling technologies are as efficient and secure as they should be.

(4) Information needs: IA helps in answering the following questions: what information the organisation needs and when it is needed; who uses the information; what is the architecture, policy and strategy of information; what is the current information needs of the organisation and assigning a level of strategic importance to those needs; and IA identifies the resources and services currently provided to meet those needs.

(5) The information map: produces a map of information flow within an organisation and between an organisation and its external environment; IA helps in evaluating the soundness of the information distribution; identifies efficient
flows; and analyses gaps, duplications, inefficiencies, inconsistencies, bottlenecks and other inefficiencies in existing flows.

**Knowledge Management (KM) issues:** Henczel (2000) stated that IA is a first step towards effective knowledge management. It is not a counting exercise but a platform from which to develop a total KM strategy. So, it identifies existing channels which can be utilized for knowledge-transfer and areas of the organisation where there is a need for high quality knowledge that are not being met. Also, it is used to increase the understanding of how an organisation works with regards to information and knowledge to be a knowledge organisation and knowledge society.

**Staff issues:** Each organisation ought to balance between poor information use and information overload. Hence, IA is used to answer the following questions: where potential customers for information are in the organisation; why people use a particular service or source of information in preference to others; why some people use the service frequently or occasionally; why some people never use the service; and what are the consequences of information for individuals, their departments and for the business as a whole.

**Decision issues:** if the following appearances are found in the organisations, IA should be used. They are: the same information is repeatedly requested by various departments within an organisation for different purposes; they are unable to make quick decisions due to non-availability of readymade information within the organisation; to avoid lack of communication between departments; and living in a competitive environment.

It is clear from the above appearances or needs that IA can be used to investigate the use (or flow, need, processes, sources and resources) of information in an organisation. Carefully determining them helps in finding out clear and targeted outcomes and outputs. A relevant example is the study by Tali & Mnjama (2004), which used IA to identify the information needs, information flows and processes and information resources within SADC Secretariat in order to improve the management of information in the organisation. The study identified the information sources, the lack of an information policy, inadequate training, low usage of the library and registry. Also, the study found that it was necessary for the organisation itself to recognize the value of information and its vital role in effective management and operations. The main recommendation of this study was to create an information centre which would truly serve its needs.
Subsequently, after using IA, some problems are actually revealed, which are mainly concerned with lack, duplication, gaps, staffing and knowledge. From these revealed problems, some recommended strategies could be taken in order to implement a priority plan. Pantry and Griffiths (2002, p 26), and Henczel (2001a, pp 132-136) stated the following problems: Inequitable distribution of resources, the use of sub-standard resources (outdated, out-of-context, lacking authority); gaps, inconsistencies and duplication of information; information hoarding/overload; information being fragmented as a result; limited sharing; lack of transparency and accountability, lack of information traceability; sections and individuals may have developed databases but not have taken a co-ordinated approach; out-of-date information may be being used; information that has not been checked for validity and authority; members of the community may be suffering from telecommunication problems such as a lack of email facilities; staff lacking training in information skills; a community acquiring the same or closely similar information several times through a lack of co-ordination between various groups of actors. Based on the above simple concept model of problems’ appearances (IA need), a comprehensive model of IA is presented below in Figure (3.3):

![Diagram of IA concept model](image)

Figure (3.3) IA concept model

Figure 3.3 shows four steps for carrying out change and satisfying needs in the intended organisation. They are:
1. Need for change, which has its explanation in the problem appearances. It is the most critical step in conducting IA.

2. Applying the IA model by using a practical guide, such as Henczel's model.

3. Solutions that are concerned with presenting hard and soft solutions. Hard solutions aim to implement such tools as ICTs and soft solutions are concerned with staff training issues, for example.

4. Change and maintenance, which has recommendations with outcomes and outputs. Henczel (2001a) discussed the main outcomes and outputs of using IA. The main expected outputs are: database reports, tables/charts and visualisation (flow diagrams, concepts maps, etc.) whereas the main outcomes are: (1) intranet content management, (2) information product and service development and delivery, (3) knowledge management programs, and (4) information policy development.

Concerning the stage of applying IA, Swash (1997) and the U.S. Department of Commerce (2002) confirmed that auditing can be internal or external. Swash (1997) explained some characteristics of both of them:

1. Internal auditors:
   - This group should be an internal project group.
   - They require shorter lead times to identify which are the key departments and who are the individuals of greatest significance to the audit, as they come to the task with an understanding of how the organisation functions.
   - They may, however, be at a disadvantage as interviewers if they are seen to be too closely aligned to departmental or sectoral interests, in which case the use of a multi-disciplinary team would increase their chances of success.

2. External auditors:
   - External auditors should be external consultants.
   - Their task requires agreement or a contract.
   - They may be preferred for the very fact that they do not know the people involved or the politics and history which lie behind existing systems and processes.
   - They will be seen to provide a fresh and objective view of what may be sensitive issues.
   - They, however, would require the active support and guidance of internal advisers to help them assimilate the manner in which the organisation is
structured and to identify individual targets for the survey in terms of their strategic significance and information role.

Whichever method is used, literacy of the information life cycle confirms that one of the auditor’s role is to improve the efficiency and effectiveness of information and enhance the productivity of the organisation (U.S. National Commission on Libraries and Information Science, 2002). From a practical point of view, the term information auditor refers to a team of auditors. Information itself should be audited by the information/compliance auditor. After determining the audit team, the scope of the IA should be identified.

"At the moment, there are no tools available that are specifically aimed at conducting an information audit. Most consultants advocate the use of spreadsheets, databases and drawing tools and, if you intend sending out an e-mail survey, specialist survey software to help with the analysis" (McCracken, 2001).

So, IA is used to map an organisation’s information and knowledge needs and assets, and to identify the gaps, the map itself may indicate the kind of communication, which reflects that a one way relationship does not do enough to have a knowledge culture, the relationships must be two way (TFPL Ltd., 2003).

3.4.3 Information Audit Scope: IA scope has three elements: information items checklist, auditing level and auditing analysis unit. All of them are clarified below. In order to compare the conceptual and physical inventory the following points should be noted: (1) Document data: auditing documents can be done by comparing the physical with conceptual inventories. (2) Survey data: are used if there are no documents.

"Where the information has not been documented by the Information Inventory, the information auditor may need to make some judgment as to whether a particular individual system contains valuable information which should be recognized and adopted at the corporate level" (U.S. Department of Commerce, 2002).

To collect the required data for auditing, a questionnaire survey and interviews were used although questionnaires are more often used. Before starting the auditing, it is important to determine the kind of data, normal distribution data and non-normal distribution data, that are required. If the data are distributed normally, a lower and upper level of each
period is required to determine the acceptance level of auditing and then it is necessary to find the gap in information flow, as well as the needs, resources and processes. On the other hand, if the collected data are not distributed normally, the conceptual inventory should be derived from the respondents themselves, and the auditor needs to make some judgment. For instance, assume you have used a questionnaire with a Likert scale 1 to 4, option 1 being unintegrated and option 4 integrated information flow. Because there is no clear document in the teleworking studies, reports and policies concerning the information inventory, the option “Strongly Agree” is selected to be a target (Conceptual Inventory). So, clearly, the target level of integration of information flow should be equivalent to the option of “Strongly Agree” on the 1-4 scale. To determine the upper and lower level of this period, the 1-4 scale was divided into four equal parts:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td></td>
<td>&lt;1.75</td>
<td>1.75 ≤ x &lt; 2.5</td>
<td>2.5 ≤ x &lt; 3.25</td>
<td>x ≥ 3.25</td>
</tr>
<tr>
<td></td>
<td>Unintegrated flow</td>
<td>Poor integrated flow</td>
<td>Semi-integrated flow</td>
<td>Integrated flow</td>
</tr>
</tbody>
</table>

Table (3.1) Coding and Decoding of the 1-4 scale (Conceptual Inventory Scale)

It is clear from the above table that the 1-4 period is divided into equal divisions. Hence, the target level is the Mean of 3.25 or more, and if any item is worth less than 3.25 this indicates there is a lack of integration of information flow. Means of less than 2.5 indicate poor integrated information flow and unintegrated information flow. Both of them are not acceptable.

Although the treatment of the ordinal scale is a controversial issue, some researchers treat the ordinal scale as an interval scale. For example, the Network and Centre for Agriculture Marketing Training in Eastern and Southern Africa (1995) stated that: “Likert scales are treated as yielding internal data by the majority of marketing researchers”. The judgment of this scale is derived from the questionnaire design itself. The option “Strongly Agree” is

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(1) This scale was confirmed by the Professor Richard Lowery, the professor of psychology in the Vassar College (USA). Some contact took place during May, 2005, through email to confirm the definition of the Conceptual Inventory of integration of information flow to apply the IA Model in next stages.
selected to be equivalent to an integrated information flow. The three remaining options reflect a lack of integration of information flow. In fact, Henczel (2001a) recommended judging if there are no clear standards for measuring information flow. Because IA is used to review and assess information flow, this is called an information inventory.

How many auditing items are audited in depth? In general, there are two levels of auditing: broad level auditing (holistic level) and in-depth level auditing (embedded level). The U.S. Department of Commerce (2002) asserted that:

"the level of audit may be defined in items of the levels of the conceptual Information Inventory, and IA may examine some or all of information form, content, processes, classifications, costs and values at any stage of the information lifecycle and assess them against criteria under the identified purpose of the Audit, they also presented some kinds of auditing levels, which an information audit may be applied: The information content (item level); The information form (document or database level); The business system or tactical level; and the corporate or strategic level".

Concerning the analysis unit, the unit depends on the definition of each appearance of the problem, the level of audit, and the target need of IA. It can be the organisation as a whole, the sector, department, unit, employee or the process itself.

The above figure shows the umbrella of IA scope, which contains an analysis unit, auditing level, and items checklist. "Once the size and scope of the audit has been decided, the auditor should consider carefully the resources and time required to complete the audit, and document this in the audit plan" (U.S. Department of Commerce, 2002). Acquiring the related data is very
important in auditing information. The U.S. Department of Commerce (2002) also stated that: "the prime source for this should be the Conceptual Information Inventory, which should have pointers to more detailed information".

3.4.4 Applying of IA (guidelines, benefits and applied models): Because applying IA is a rotational process, there are some guidelines and standards for applying IA. The U.S. Department of Commerce (2002) provided some guidelines for conducting IA. Appendix (1) contains them. In fact, each applied model has some standards and guidelines for conducting IA.

On the subject of IA benefits, some scholars have divided these into tangible and intangible benefits. Others named them on the time line as benefits in the short term and benefits in the long term. McGracken (2001) stated the following benefits of using IA: (1) a regular IA is the only way to ensure that business is really efficient, (2) it typically brings both tangible and intangible benefits, (3) on the less tangible side, there is a snapshot of information and communication within the organisation, and (4) the analysis will show, not only where tasks are being supported, but where they are not supported and where they are duplicated.

According to Oma's view (2004, p 47), IA gives a map of what the organisation is actually doing with information and allows us to measure how well the reality matches what the organisation ought to be doing with information. IA in the short term provides: (1) attention to immediate threats and risk avoidance, (2) cost saving from more rational management, and (3) quick gains from making information more accessible or usable for those who need it. In the longer term IA provides: (1) enriched understanding of what information and knowledge mean for the organisation at the top and throughout the organisation, (2) interaction and negotiation among the "guardians" of information resources and the stakeholders, (3) developing a strategy for managing knowledge and information, (4) better use of information in supporting key business processes and in initiating and responding to change, (5) integrated management of the organisation's complete range of information, supported by appropriate management and technology, and (6) reliable assessment of the cost-effectiveness of information and its use, and of the proportion of the organisation's total valuable assets which is contributed by the use of knowledge and information.
Regarding IA procedures, Orna in 2004 (p 47) stated that: "there is as yet no standard for how to do information audits". Also, Boon (2003) confirmed by reviewing the various approaches for applying the IA, that every model of IA has some limitations and there is no universal model for applying IA. The U.S. Department of Commerce (2002), however, described IA as a process consisting of an examination or survey, and an assessment followed by a report and recommendations. In addition, Swash (1997) stated that "the information acquired by means of an information audit should focus primarily on business activity in the first instance, looking for breadth rather than depth".

To carry out an IA, there are few conductable models. The most common known models are concerned with Henczel's model in 2001 and Orna's model in 2004. The procedures in both of them are clarified below.

<table>
<thead>
<tr>
<th>Orna's Model</th>
<th>Henczel's Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Orna, 2004, p 47-49)</td>
<td>(Henczel, 2001a, p 17-19)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>1.</th>
<th>1. Planning</th>
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<tbody>
<tr>
<td>2.</td>
<td>2. Data collection</td>
</tr>
<tr>
<td>3.</td>
<td>3. Data analysis</td>
</tr>
<tr>
<td>4.</td>
<td>4. Data evaluation</td>
</tr>
<tr>
<td>5.</td>
<td>5. Communication recommendations</td>
</tr>
<tr>
<td>6.</td>
<td>6. Implementing recommendations</td>
</tr>
<tr>
<td>7.</td>
<td>7. Information audit as a continuum</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8. Analyse information implications of objectives (what should we be doing with information)</th>
<th>8. Plan the audit</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Ensure support and resources from management</td>
<td>9. Do the audit</td>
</tr>
<tr>
<td>10. Get support from people in the organisation</td>
<td>10. Interpret the findings (match what is against with what should be)</td>
</tr>
<tr>
<td>11. Plan the audit</td>
<td>12. Present the results of the comparison (Recommend action)</td>
</tr>
<tr>
<td>12. Do the audit</td>
<td>13. Implement change</td>
</tr>
<tr>
<td>14. Repeat the auditing cycle</td>
<td></td>
</tr>
</tbody>
</table>

Table (3.2) The Procedures of Orna's Model and Henczel's Model

In spite of both being similar in general as a process, the main difference between them is concerned with the specificity of both of them. A few comments can be added: (1) Orna's model is derived from information strategy need and Henczel's model is derived from the information audit itself, (2) Henczel's model is more concerned with information auditing than Orna's model, (3) the author of the Henczel model has many
publications and is running many workshops in IA in worldwide, (4) according to Henczel's view, information map is one of IA model outputs, (5) according to Henczel (2001a, p xiii), her model is not a highly structured and controlled process that operates in a tightly defined manner. This means the components can be 'tailored' to suit the objectives of the organisation and the resources available, and (6) the practical application of Henczel's model is more obvious.

Hence, Henczel's model is more convenient for achieving the research aims than Orna's model. The aims are concerned with investigating and mapping information flow. In Chapter Eight, more details are provided for the results of auditing and mapping information flow in the virtual organisations.

This section, which is concerned with the IA model, started with providing the definition of IA and related concepts and has presented the reasons for applying IA, a proposed model for using IA, and procedures necessary before and after applying the IA itself. These procedures are mainly concerned with starting with the problem's appearances and ending up with the targeted outcomes and outputs. This flow should be controlled with the IA Umbrella, which has an analysis unit, auditing level and an items checklist. Benefits of using IA are also presented, and Henczel's and Orna's models are clarified. The decision was made to select Henczel's model because it is convenient for auditing the information flow in the virtual organisation. The next section is concerned with the mapping of information flow, which is one of the most common of the IA outputs. It is actually prepared by one of the visualisation techniques.

3.5 Mapping of Information Flow

Mapping of information is one of the IA outputs. It can be defined as a mapping of information movement through the organisational layers, internally and externally, with customers, suppliers, competitors and, more recently, with employees while they are working outside their physical locations (teleworking). Mapping flow can be done for the flow of information, data, knowledge, tasks and the process. In this research, mapping takes place in information flow. Elizabeth Orna states that: "Experience shows that people concerned with information management have no difficulty with the concept of information mapping, or with deriving knowledge and information needs from the objectives of their own organisations" (Hibbered and Evatt, 2004). The needs, reasons and benefits of using information
mapping are clarified below. In fact, the benefits of mapping information flows are threefold (Hibbered and Evatt, 2004). Henczel (2001a, p 123), Pojasek (2004), and Hibbered and Evatt. (2004) stated the following needs of using information mapping:

- **Improving processes through auditing the information flow:** This means that the mapping of information flow is one of many methods for finding out the opportunities for improving the processes, because examining the information flow determines the root cause of the problem. In fact, the systems approach is used to improve the process and to allow workers to become involved directly in such a program as it affects their work steps. Hierarchical process maps can be used to show the improvements that are being made in the process. It can be said that process maps can be used to determine the potential sources of the excursion.

- **Shifting from a bottom-up point of view to a top-down:** Information mapping based on an organisation’s goals and objectives can help shift the information professional’s natural bottom-up point of view to a top-down, strategic perspective and increase his or her perceived value. The collected data from the Information Audit survey provides the data needed to map how information flows within an organisation and between the organisation and the external environment.

- **Finding out inefficiencies:** the mapping of information flows identifies the lacks, gaps, duplications and inefficiencies that hinder effective information provision.

- **Understanding the real needs:** Information mapping is important as a framework for analysing how information moves within an organisation and for understanding the services necessary to match the true needs of clients because it enables an understanding of how information is used and by whom. The outcome of this process produces a deeper understanding of the organisation, stakeholders, various types of information services to the stakeholders, where information touches as it passes through the organisation. It offers support for a ranking system to identify the most valuable potential clients for information resource centre (IRC) services and creates a picture of the competitive landscape.

Concerning the scope of information mapping, as was mentioned before, mapping of information is used to help in processes improvement. Pojasek (2004) stated that:
“Whenever there are work steps with many information requirements, there will be opportunities to improve the information flow; this opportunity can be fed from computerizing some of the information collection and storage, and operational controls and feedback can also be used to prevent excursions from the approved range”.

Activities are actually divided into two types: main activities and supported activities. By using the Pareto Principle (80/20), we are able to give a priority to the most important activities, which are concerned with focusing on the 20% of activities that typically account for 80% of their information needs. As Pojasek (2004) also stated, this helps to focus the effort and facilities and to build a workable information system in a “modular” fashion by applying the 80/20 rule and obtaining some outside assistance. Henczel (2001a, p 123) said that mapping information flow can be achieved through two levels of analysis:

1. **Level One**: shows the general internal and external flows for the organisation. It can be based on the organisational chart and show (1) inflows and outflows of the organisation, (2) inflows and outflows for each business unit, (3) relationships between the organisation and external entities, (4) relationships between the business units within the organisation, and (5) identification of the internal communication channels (formal and informal).

2. **Level Two**: shows details of information inflows and outflows in each business unit that enables identification of efficiencies such as bottlenecks, gaps and duplications.

So, it can be concluded that the scope of information mapping is concerned with the level of mapping and the determining of the system and the organisation. Once both the system and the organisation are determined, it is important to determine the level of auditing, which is actually based on the need for mapping, and the budget, mission and vision of the organisation itself. To produce the information mapping, there are a few steps that can be taken. Pojasek (2004) stated that “many organisations that use lean production techniques have already begun to address information flow by using a tool known as a value stream map (VSM)”\(^{(1)}\). As Hibbered and Evatt (2004) said, mapping information flows is a five-step process involving certain tasks: describing the current situation, describing potential

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\(^{(1)}\) A VSM depicts the entire “value stream” — that is, the manufacturing process from raw material to shipping dock (Pojasek, 2004).
clients, mapping potential clients, ranking solutions for prioritization, and creating an information map.

An information map, however, enables the identification of the information that is acquired and generated by the organisation, who acquires or generates it, and who uses it and how they use it. This, in turn, enables bottlenecks and duplications to be identified, allowing the analysis of the flows to optimise the use of resources, identifying information on specific topics, and identifying the formal and informal communication channels existing within the organisation (Henczel, 2001a, p 123).

What are the required techniques for drawing an information map? Henczel (2001a, p 123) also stated that information flow diagrams can be developed using commercially available software such as Micrograffx Flowcharter, ABC Flowcharter, Microsoft Draw or other drawing and charting products, and qualitative analysis software such as ATLAS.ti and QSR NUD*IST. Nowadays, there are many software tools that can be used to draw the map of information flow. The simple and cheapest one is MicroSoft Power Point, which enables the drawing of the information map in a simple way.

In order to visualise an information map, it is recognized that appropriate tools are needed and there are many tools actually used in visualisation: Data Flow Diagram, Flow Chart, Entity-Relationship Diagram, Signed Diagraph, UML, and Use Cases are the most commonly known. Concerning the visualisation of information flow, Elizabeth Orna stated that information mapping is a method to “visualise the immediate and wider organisational context and the ‘outside world’ (Hibbered and Evatt, 2004).

"The interpretation of information flows is the best done using a visual representation of the inputs and outputs of each business unit (level2 IF diagram). Examine the inflows and outflows for each business unit, then put the results together to form the bigger picture. The information flows can be then used to identify efficient flows" (Henczel, 2001a, pp 137-138).

The next section is related to the modelling of information flow by using different types of visualisation tools. They are Information Flow Diagrams (Inflows and Outflows), Flow Chart Diagrams, and Use Cases Modelling. All of them are clarified in depth and a proposed road map for using them is presented at the end.
3.6 Modelling of Information Flow (Visualisation Tools)

Mapping information flow can be modelled through many tools. This section of Chapter Three is concerned with providing brief details about the main modelling tools of information flow. Concerning the aims of this research study, Information Flow Diagrams, Flow Chart diagrams, and Use Case Modelling are used intensively in modelling the information flow in virtual organisations.

3.6.1 Information Flow Diagram: This is one of the simplest tools to document findings from the requirements determination process. It is a simple diagram showing how information is routed between different parts of an organisation and has an information focus rather than a process focus (Bocij et al., 2003, p. 391). In the same direction, they added a few reasons for using IFD (Bocij et al., 2003, p. 391):

- IFD is used to document the main flow of information around the organisation;
- IFD helps the analyst to check that they have understood those flows and that none has been omitted;
- IFD could be used during the fact-finding process itself as an accurate and efficient way to document findings as they are identified;
- IFD is a high-level (not detailed) tool to document information flows within the organisation as a whole or a lower-level tool to document an individual functional area of the business.

![Example of Information Flow Diagram](Image)

Figure (3.5) Example of Information Flow Diagram (Source: Hampstead School (n.d.))
The above figure shows inflows and outflows of information in the organisation and also shows the types of information (such as invoices, order, payments, etc.). Bocij et al. (2003, pp 391-392) stated that some IFD features are concerned with (1) Its components are basically a source or destination, an information flow, and the information system boundary, (2) The ellipse in the diagram represents a source of information which then flows to a destination location, (3) In a high-level diagram, the source or destination would be a department or specific function of the business such as sales, accounting or manufacturing, (4) In a lower-level (more detailed) diagram, one might refer to subfunctions such as accounts receivable, credit control or payroll, (5) The name of a source or destination should appear inside the ellipse, (6) The source or destination is sometimes referred to as an "internal" or "external entity" according to whether it lies inside or outside the system boundary, (7) The term "entity" is used frequently when constructing entity relationship diagrams, (8) The information flow, as represented by the arrowhead line, shows a flow of information from a source location to a destination, (9) In an IFD the line should always be annotated with a brief description of the information flow. Below is a description of each of the Flow Chart Diagrams and Use Cases.

3.6.2 Flow Chart Diagram: Flowcharts can be defined as "a schematic representation of a process. They are commonly used in business/economic presentations to help the audience visualize the content better, or to find flaws in the process" GuruNet Corporation, [n.d]. In this research, they will be used to visualise the flow of information through completing the process. Saudi National Quality Committee (2001) presented some features of the Flowchart. They are:

- Steps in a process are shown with symbolic shapes and the flow of the process is indicated with arrows connecting the symbols.
- The steps of a process are logical: uncovering problems or miscommunications, defining the boundaries of a process and developing a common base of knowledge about a process.
- Flowcharting a process often brings to light redundancies, delays, dead ends and indirect paths that would otherwise remain unnoticed or ignored.
- Flowcharts do not work if they are not accurate, if team members are afraid to describe what actually happens, or if the team is too far removed from the actual workings of the process.
Furthermore, they presented the three main types of flowchart. They are as follows:

1. High-level flowcharts, which map only the major steps in a process for a good overview.
2. Detailed flowcharts, which show a step-by-step mapping of all events and decisions in a process.
3. Deployment flowcharts, which organise the flowchart by columns, with each column representing a person or department involved in a process.

![Flowchart Diagram](image)

**Figure (3.6) Example of a Flow Chart Diagram**

To construct an effective flowchart, a few steps should be taken. The Saudi National Quality Committee (2001) also presented the following steps: (1) define the process boundaries with start and end points, (2) complete the big picture before filling in the details, (3) clearly define each step in the process, (4) identify time lags and non-value-adding steps, and (5) circulate the flowchart to other people involved in the process to get their comments. A brief background of flowcharts has been presented above. The last visualisation technique to be used was Use Case modelling. An in-depth analysis of its concepts, types, development and scenarios are contained in the next sub-section.

### 3.6.3 Use Case Modelling

According to Geoconnection (2002), Use Case can be defined as:
"a kind classifier representing a coherent unit of functionality provided by a system, a subsystem, or a
class as manifested by sequences of messages exchanged among the system (subsystem, class) and one or
more outside interactors (called actors) together with actions performed by the system (subsystem, class)".

Furthermore, Booch, Rumbaugh and Jacobson (1999, p 220) noted that there are a
number of important parts of the Use Case definition. Each sequence represents the
interaction of the things outside the system (its actor) with the system itself (and its key
abstractions). They presented the following definition of use cases: "A use case is a
description of a set of sequences of actions, including variants that a system performs to yield an observable
result of value to an actor".

Use cases aim to capture the functional requirements of a system and may have
associated performance requirements (Geoconnection, 2002). Moreover, John and
Muthing (2002) stated that use cases are a widely accepted means to support domain
understanding, to find and document user requirements by understanding what the user
wants from the system, and give a good means of communication about the system.
They are used for single system requirements engineering to capture requirements from
an external point of view.

Use Cases are also used to describe system behaviour. Booch, Rumbaugh and Jacobson
(1999, p 219) and John and Muthing (2002) confirmed the role of use case. It describes
the system's behaviour\(^{(1)}\) under various conditions, so it captures the intended behaviour
of a developed system without having to specify how that behaviour is implemented.
Because use cases define the functionality or behaviour of the developed system, they are
used to model work units that the enclosing system provides as services to outside

Modelling means providing a new concept of behaviour to be, instead of what is. In use
cases, logical process models describe processes without suggesting how they are
conducted but physical models include information about how the processes are
implemented (Braunstein, 2000). To sum up, use case is one form of prototype
methods (Whitmore, 2001). But, according to Caro, Guevara and Aguayo (2003), use
cases have advantages and disadvantages: they provide a great increase in performance in
information system development but they cannot support group work or make it
possible to skip steps in the methodology.

\(^{(1)}\) System behavior is what a system does when responding to external events (Maciaszek, 2001, p 48).
The above figure shows the main components of use cases. Part one shows the use cases within the system, the actors outside the system, and that there are relationships between actors and use cases. Part two demonstrates the relationship between actor and the use cases, and the relationship between use cases themselves. Actor, use case and the relationships are clarified in depth below:

The **Actor** is described by Albir (1998, p 160), Booch, Rumbaugh and Jacobson (1999, pp 221-223), Maciaszek, (2001, pp 48-49), and Penn State University (2004) as:

1. An actor represents whoever or whatever (person, machine, etc.) that interacts with a use case. The actor interacts with the use case in expectation of receiving a useful result.
2. Actors are denoted as a stereotyped class rectangles or as stick person icons.
3. Actor refers to an external entity to the system.
4. Actors and use cases are determined from the analysis of function requirements.
5. A use case represents a complete unit of functionality of value to an actor.
6. An actor who does not communicate with a use case is meaningless. There may be some use cases that generalize or specialize main use cases and do not directly interact with actors. They are used internally in the use cases model and assist the main use cases in providing results to actors.
7. An actor represents a coherent set of roles that users of use cases play when interacting with these use cases.
8. Actors are not actually part of the system: they live outside the system.
9. Actors may be connected to use cases only by association.
10. The general kinds of actors (such as customers) can be specialized (such as commercial customer) using generalization relationships.

11. Actors are used to model users outside of a system that interact directly with the system as part of coherent work units.

Use case: According to Maciaszek (2001, p 49), Booch, Rumbaugh and Jacobson (1999, p 222), and Albir (1998, p 161), a use case can be derived from the identification of the tasks of the actor. It is denoted as ellipse or oval, and it must have a name (a textual string). It has two kinds of name. The name alone is known as a simple name; a path name is the use case name prefixed by the name of the package in which that use case lives. Moreover, Penn State University (2004) added that "a use case describes what an actor does, when using the system, to finish a process".

Relationship: As mentioned above, relationship is located between an actor and use cases, or between the use cases themselves. Booch, Rumbaugh and Jacobson (1999, p 221) said that, in all interesting systems, some use cases were included as parts of other use cases, and use cases that extend the behaviour of other core use cases. So, these kinds of relationship are divided into four types: (1) Association relationship, which establishes the communication path between an actor and a use case. This is described by John and Muthing (2002) as denoting the participation of an actor in a use case. (2) Extended relationship, which is stereotyped by the words <<extend>> (Maciaszek, 2001, p 135) and denoted by a generalization arrow (Albir, 1998, p 164). In this kind of relationship, John and Muthing (2002) stated that: "an extend relationship indicates that an instance of a use case may be augmented by the behavior specified by another use case", (3) Included relationship, which is stereotyped by the word <<include>> (Maciaszek, 2001, p 135) and described by John and Muthing (2002) as indicating that an instance of a use case will contain the behaviour of another use case, and (4) Generalisation relationship: according to John and Muthing (2002), this is a specialization of one use case to another. It allows a specified use case to change any aspect of the base use case (Maciaszek, 2001, p 135).

Use Cases Types: Booch, Rumbaugh and Jacobson (1999, p 223) and Albir (1998, p 162) stated that use cases mapping has three levels: system levels (topmost), subsystem levels and class levels (lowest). So, the main two levels are presented below:

1. High level Use Case: is concerned with drawing the behaviour of the system level. Penn State University (2004) and Scacchi (2001) provided the following features of a high
level use case: (1) It has use case, actors, type and description, (2) It describes the process in abbreviated terms, and (3) essential use cases express a process in an abstract, non-technical manner. An example of a high-level use case is presented below (Figure 3.8). It reflects the use case for the Distributed & Enhanced Call Centre (D&ECC) service.

![High-level Use Case for D&ECC service](EURESCO, 1999)

2. **Detailed Use Case**: this has more detail than the high-level use case. Penn State University (2004) and Braunstein (2000) stated the following features of the detailed use case: (i) it is called expanded uses, which has use case, actors, purpose, overview and type, (ii) it describes a process using more detail than the high-level use case. The figure below shows a more detailed use case, which provides more detail than the previous figure (Figure 3.8).

![Detailed UC for D & ECC](EURESCO, 1999)
Scenarios and stories: Producing the use case diagram requires starting with the scenarios. They are useful in this manner. Scholars like Braunstein (2000), Scacchi (2001), and Alexander (2004) have already presented some issues regarding producing the scenarios and stories. They are:

1. In order to design and test the system, it is necessary to use the scenarios directly.
2. A use case actually tells a story of reaching a goal, or a set of stories about reaching or failing.
3. The UC story captures: (1) a relation (activity designated by a verb/verb phrase), (2) the role/community/actor who performs the activity, and (3) the normal, exceptional and error scenarios.
4. Scenarios are the starting point for all modelling and design.
5. Scenarios are a powerful antidote to the complexity of system development.
6. Scenarios are applicable to all types of systems, and all stages of the life development. This means it varies from brief stories to richly-structured analyses. At any level of story, it is important to leave the sequence of actions.
7. Stories help engineers to ask key questions like: Are these steps in the right order? Has a step been omitted? What could go wrong here? Is this story complete?
8. Sequence: 'A straight-line sequence of steps taken by independent agents playing system roles' is roughly what most engineers mean by scenario. Synonyms include Operational Scenario – itself part of a Concept of Operations, (Test) Case or Script, Path, and Course (of actions or events). The terminology is clearly rather slippery.

Developing Use Cases: Each use case needs some preparation. According to Maciaszek (2001, p 49), one must start with listing the actor (or actors) and use case (or cases) for each requirement. Furthermore, John and Muthing (2002) added that:

"There is no standardized form for the content of a use case itself, the standard describes the graphical representation and the semantics of use case diagrams only. Use cases serve as a means of communication from one person to another, often among persons with no training in UML or software development. So writing use cases in simple text is usually a good choice. There is no general agreement on the attributes use cases should have and on the level of description of the use cases. The use case is described with its actors, the triggers, which means the actors that can activate the use cases. The input and output of the use case are described and the post conditions and a success guarantee (what the user wants from the use case) and a minimal guarantee (what should in any case not go wrong) are given. The main part of the use case is the main success scenario which describes what the use case actually does."
This means starting with the scenario itself then presenting a textual and diagram for the use cases.

**Use Case Diagram:** is the output of conducting use cases. It summarises text (words) in a figure. In textual use cases, tags can be used but in diagram use cases, stereotypes should be used (John and Muthing, 2002). Maciaszek (2001, p 51) defined use case diagrams as "the principle visualization technique for a behavioural model of the system". Also, he enumerated a few features of use case diagrams: it is not just a diagram but also a full documented model of the system’s intended behaviour, it assigns use cases to actors, and it allows the user to establish relationships between use cases, if any. The use case diagram is the principle visualisation technique for a behavioural model of the system and the two main elements of use case diagrams are use case and actor. Penn State University (2004) added that in use case diagrams, an event that causes an actor to interact with the system is a process and its name should be a verb-phrase.

**Applying a Use Case:** This can be discussed through the following issues. They are presented by Booch, Rumbaugh and Jacobson (1999, p 221), Maciaszek (2001, p 82), and John and Muthing (2002):

- Use cases can be applied to the whole system (excellent sources of integration and systems tests), or to part of the system, including subsystems (excellent sources of regression tests) and even individual classes and interfaces.
- Traditional methods of requirements elicitation include interviews, questionnaires, observations and study of business documents. Interviews are a primary technique of fact finding and information gathering.
- Use cases can be derived from paper documents, experts or legacy systems so they can be used with all information sources.
- A complete set of use cases and use case diagrams makes sense in larger projects with a staff size bigger than 10. In smaller projects it might be more useful to make only an overview use case diagram but not all the use cases.
- The use case approach is independent of the organisational environment.
- Use cases are a good means to elicit, structure and represent user-level information during the requirements phase. Extended with variation points, they also enable people easily to switch from single-system requirements-engineering practices to domain analysis.
3.6.4 Relationships between Modelling Tools: A model is defined by Booch, Rumbaugh and Jacobson (1999, p 6) as "a simplification of reality". It could be structural, emphasizing the organisation of the system, or it may be behavioural, emphasizing the dynamics of the system. There is a fundamental reason behind doing the model: we build models so that we can better understand the system we are developing. Also the principles of modelling can be added, which are (1) the choice of what models to create has a profound influence on how a problem is attacked and how a solution is shaped, (2) every model may be expressed at different levels of precision, (3) the best models are connected to reality, (4) no single model is sufficient. Every nontrivial system is best approached through a small set of nearly independent models (Booch, Rumbaugh and Jacobson, 1999, p 6-10).

A process model is a formal way of representing how a business operates (Braunstein, 2000). This modelling needs some tools or techniques. As presented above, IFD, Flow Chart, and Use Cases are used for visualisation. Shirky (2002) indicated that the tools of visualisation are used to develop software or services. This means they are used as aids to cognition and to see what the writer (or speaker) is saying. So, the presented tools in this research study were used to visualise the services that teleworkers are actually doing in their virtual organisations.

"Whereas most of the visual tools we use are designed for presentation of known objects or quantities, information visualisation is more open-ended. It is a way of using graphical tools to see things previously unseen: structures, relationships or data obscured by other data. The techniques used make it easier to handle multi-variate and dense sets of data in a comprehensible way, and offer presentation methods customized for particular domains and densities of information" (Shirky, 2002).

To apply all of IFD, Flow chart and Use Cases together, the proposed plan below (Figure 3.10) is used. The first point starts with IFD (Inflows and Outflows). The second line uses the Use Case Modelling and the third line the Flow Chart. At the end, information mapping should be completed.
This section has three techniques of visualisation. The first tool is the diagram of inflows and outflows, the second tool is the flow chart diagram, which actually has three levels of representation: the high-level flowchart, detailed flowchart and deployment flowchart. The last technique is the use case modelling, which has two levels of visualising: high-level use case and detailed use case. All of these techniques are used to visualise the information mapping in the virtual organisation. The relationship between all of these techniques is discussed. Also, a road map for using them is clarified above, which has a recommendation of starting with IFDs. The second line uses the Use Case while the third line has the Flow Chart. At the end, information mapping should be completed.
This chapter has five sections. They are concerned with providing a background of information concepts, information flow, information auditing, information mapping, and the visualisation of information flow. Different definitions of information, knowledge and data are presented and the results seek to say that information is different from data and knowledge; they cannot be considered as interchangeable words. Information should flow efficiently from its source to the recipient, and through its life cycle of creation, searching and utilization. The main model of investigating the integration of information flow is presented above. It aims to investigate the flow of the right information from/to the right source (recipient) through the right channel at the right time. Also, the flow of information through the organisational levels is discussed.

Information Audit is discussed with respect to its use in investigating the integration of information flow, the relationships between ICTs and the integration of information flow, and enabling information flow mapping in a visualisation figure. Its definition, reasons for its application, a proposed model for use, and its procedures are discussed. A decision was made to select Henczel's model because it is convenient for auditing information flow in the virtual organisations. One of the IA outputs is the information map which helps in identifying the inefficiencies. To visualise an information map, it is accepted that certain tools may be needed and there are many tools used in visualisation: Information Flow Diagram, Flow Chart and Use Cases. The last section contains more details concerning these techniques. Their definitions, kinds, level of visualisation and developing procedures are clarified in depth.

Lastly, a conceptual road map is presented to show the relationship between these techniques of visualisation. It recommends starting with Inflow and Outflow diagrams. The second stage uses Use Case modelling, and the third stage uses a Flow Chart. In the end, information mapping should be completed.

The next chapter deals with teleworking as a new style of working. It is concerned with completing tasks outside the physical location. This chapter has two parts: Part One aims to provide a clear picture of a virtual organisation (definitions, teleworking and telecommuting, types of teleworking and the implementation of teleworking) while Part Two is concerned with the ICTs that are actually used in the virtual organisation and the flow of information that can be seen through using these ICTs.
Chapter Four

The Virtual Organisation and ICT Applications

Introduction

The main aim of this chapter is to provide a detailed background regarding a new approach and style of working, considered to be a new way of completing tasks; this is teleworking or a virtual organisation. To fulfil this aim, the chapter is divided into two parts, one concerned with the concepts, types and implementation of teleworking; and the second related to the tools of Information and Communication Technologies (ICTs) which are required in the adoption of the Virtual Organisation (VO).

The origins of manpower planning can be traced back to 1676 when Samuel Pepys became interested in providing a career structure for naval officers in the Royal Navy (Chartered Institute of Bankers, 1988, p 170). Since then, manpower planning has been viewed as an important issue in the development of any organisation as, in today's world, employees of one organisation may not all work in the same place (Management Centre Europe, 2002). Since technology allows some types of work to be done anywhere and at any time, workers are no longer constrained in geographical terms (Cooke, 2002).

Work can now be carried out globally, 24 hours a day, seven days a week, in a world of perpetual travel, virtual teams, virtual management and sometimes multiple bosses. Also, although completing tasks has become more flexible as companies have restructured themselves, middle management has begun to disappear even though the work they did has not (Management Centre Europe, 2003). Executives of today, however, are largely self-sufficient. They have a mobile phone, a laptop, and may do most of their own typing, filing, scheduling and telephoning. Management assistants, on the other hand, are able to assume more responsibility and may be replacing middle managers (Management Centre Europe, 2003). It is clear that the systems recreate themselves according to the needs of customers.

Technology has changed the lives of both employees and employers, bringing both advantages and disadvantages. Cisper (2000) said that "Just a few years after the Arab oil embargo in 1974, confrontations in the Middle East once again drove fuel prices to new heights". Hence, planners, owners and policy makers took the responsibility for finding a
convenient way of completing tasks in order to cut costs and work with greater flexibility. Some of these suggest that teleworking might help to find more flexible working methods.

No one can deny that this kind of work reveals an argument in research. Most scholars argue for supporting and increasing teleworking practices. Others, for example, Furnham (2000) found that (1) many people find teleworking alienating, as an electronic communication is cold and impersonal; (2) teleworking is a source of isolation with teleworkers becoming forgotten telecolonial people; (3) people are social animals who need interaction and who are happiest in contact groups and an organised job offers a sense of identity and loyalty; and (4) one study found that teleworkers lost their sense of identification with and interest in their organisation, feeling that they were forgotten people. However, this chapter seeks to provide details of concepts of teleworking, types of teleworking, implementation of teleworking and the ICTs that are used in teleworking practices. These details will surely help in understanding the environment of teleworking. Then the flow of information can be investigated.

Part One: The Virtual Organisation

This part of the chapter illustrates the new style of working that allows workers to work across time and locations: this is teleworking or working in virtual organisations. However, this part covers three sections: concepts of virtual organisations, types of teleworking, and implementing virtual organisations.

4.1.1 Concepts of a Virtual Organisation (VO)

The Virtual Organisation has been given many different definitions; this reflects its novelty. These definitions are derived from the competitive digital environment that all organisations nowadays live in. These definitions also encompass the creation and re-creation of markets throughout history, since markets have always re-created themselves, shifting the economic fortunes of those present at the creation (Fingar, Kumar and Sharma, 2002). So, there are many basic elements regarding the definition of the Virtual Organisation. To be clearer, autonomous working comprises the independent
workers (teleworkers or telecommuters) whereas non-autonomous working comprises dependent workers. According to Travica (2002), a standard dictionary defines "virtual" as "being in essence or effect, not in fact; not actual but equivalent". Then, the related literature revealed different dimensions of VO definitions. They can be divided into four categories.

Electronic networks: This approach of definition deals with the effective connections between many electronic tools and devices and also uses communications extensively (Travica, 2002). In 1997, Armitage defined the VO as: "The use, in connection with an individual's employment, of electronic communications technology from any location, including that party's traditional place of employment, in such a manner that business benefits accrue over and above those achieved by traditional means of communication". This suggests that a VO is a network of organisations and/or individuals who share a common purpose or interest; these collectively make up a single entity. Thus, the opposite of "virtual" is "actual", and the term "virtual" means "practical", "effective" or "essential". Thus, a virtual organisation has less formal structure (Stratege, 2002). Wijk, Geurts and Bultje (1998) defined a VO as being identifiable as one organisation while consisting of many different organisations. Moreover, Travica (2002) stated that Oravec (1996) noted that the VO is "imaginary" since it is only created through the linkages of the organisation. Furthermore, Travica (2002) added that the VO is real because it can act and deliver products. The idea of the VO may be confusing because it juxtaposes the real and the imaginary.

Various Constituencies (Individuals, Groups, Firms): Travica (2002) noted that Davidow & Malone (1992) defined a "virtual corporation" as a temporary association of between individuals, groups, firms, etc. This association reflects the response for the market changes. A virtual organisation is therefore one whose members are physically distant and communicate by computer, while appearing to be a unified organisation in an actual physical location (Whatis, 2000a). The first definition sees a VO as a dispersed organisation while the second suggests that the VO cannot exist without the support of IT to link its disparate parts. Both of Lucas & Baroudi (1994) and Travica (2002) supported the concept of VO as an amalgamation of people and/or organisations committed to achieving common goals by the joining of their expertise and resources, the production process can not be completed without using and supporting the technologies to link the VO's parts. Partners have equal importance and depend on an ICT infrastructure to do their activities. This type of VO is based on ICT and the VO can be described as immaterial, supported by ICT (Wijk, Geurts and Bultje, 1998).
Flexible Working: Unlike a traditional organisation, the VO does not have a physical reality or boundaries. In terms of time, it can also remain in existence for anything from several hours to years (Travica, 2002). Flexibility in this sort of working is derived from its freelance at working across time and across location. Wijk, Geurts and Bulje (1998) noted that a VO is a network of independent organisations “with a partial mission overlap”. Each independent entity provides its own particular expertise and co-operation based on semi-stable relations, trust and IT, with loyalty being shared among partners. The products and services of a Virtual Organisation often depend on innovation and are strongly customer based. There is also a clear distinction between the strategic and operational levels.

Temporary Organisation: The VO is a new form of organisation which has inherited certain characteristics (Travica, 1995). Travica also defined the VO after seven years as: “a dynamic, electronic, more or less temporary, inter- or intra-organizational network that is capable of delivering special products”.

Byrne (1993) defined a VO as: “a temporary network of suppliers, customers, and rivals”, while Davidow & Malone (1992) defined “virtual corporation” as a “temporary association of various constituencies (individuals, groups, firms, etc.) that come together in order to harness swiftly a sudden market opportunity”. Furthermore, Robey, Boudreau and Storey (1998) defined the virtual organisation as: “a temporary, flexible arrangement of dispersed components, contributed by multiple organizations and linked together with information technologies”.

According to the literature review, which was done by Travica (1997), there is disagreement regarding the newness of VOs. Some researchers consider the VO as a new organisational form, with a flexible structure and collaborative culture. Others said that all organisations share some “virtual” characteristics, the sharing and collaboration are the most important criteria for that consideration. This reflects the overlapping between different definitions of VO, like virtual corporations, virtual companies, virtual organisations, e-work, teleworking, telecommuting, flexible working, homeworking and mobile working.
Byrne (1993) stated that: "The virtual organization is a temporary network of independent companies linked by information technology to share skills, costs and access one another's markets. The companies quickly unite to exploit a specific opportunity and will disperse afterwards." Wijk, Geurts and Bultje (1998) described this definition as it encompasses three core views on the nature of the VO: it is immaterial, supported by ICT, and potentially present but constantly changing. The co-operation is temporary but the organisation can be initiated again when a new opportunity occurs.

As mentioned earlier from the evidence above, four basic elements of the VO emerge: electronic linkages, working across time (that is, they are temporary), working across location (they are geographically separate), and they consist of various constituencies working with flexibility. Travica (1997) has his own view of a VO as: "VO refers to a temporary or permanent collection of geographically dispersed individuals, groups and/or organizational units, which do or do not belong to the same organization; or entire organizations that depend on electronic linking in order to complete the production process".

The study has its own view for providing a definition of the virtual organisation (office). It can be defined as a connection of teleworkers of Information and Communication Technologies (ICTs) across locations and time.

Palmer and Speier (1997) presented four types of virtual organisation. The main criteria for this category were: the projected length of time spent in the virtual work, types of projects, the range of involvement, and the number of personnel involved. These criteria suggested four distinct types of virtual organisation:

- **Permanent Virtual Organisations**: This form brings together players in order to respond to market opportunities either to improve profits or to make cost savings. This model involves the virtual concept in all operations: tasks, teams and management.

- **Virtual Teams**: Generally, virtual teams come from a specific business unit within a larger organisation (Greiner and Metes, 1996).

- **Virtual Projects**: In this design, organisations form alliances or bring together other organisations or units, calling on manufacturers, developers and markets from a variety of organisations to address a market opportunity. Often these are organisations based around similar industries or companies. Examples include new business alliances, industry trade associations and buying consortia.
Temporary Virtual Organisations: These may take on multiple projects and develop responses to a specific market opportunity. Once the opportunity ends, so does the organisation.

In order to illustrate the different views on virtuality and virtual organisations, Campbell (1999) presented four definitions from the literature:

- **Internal Virtual Organisation**: this applies to one organisation which operates with internal teams and consists of several business units, all of which consist of autonomous groups and teams. Management tasks are often decentralised and employees are available in many different places. Thus, the structure of such an organisation is flexible.
- **Stable Virtual Organisation**: based on cooperation between different organisations, this VO aims to contract out non-core-competencies to several committed suppliers closely related to the main organisation.
- **Dynamic Virtual Organisation**: a dynamic VO is involved in large-scale, but temporary and opportunistic, cooperation with other organisations. This cooperation, which is extremely flexible in nature, takes place when there are market incentives.
- **Web-company (or an 'agile organisation')**: this is a temporary network of organisations based on the use of the Internet where knowledge management and knowledge sharing is essential.

### 4.1.2 Teleworking and Telecommuting: Concepts

In fact, European Telework Online (ETO, 2000c) provided some points concerning both terms: (1) These terms mean to work outside of the physical office, (2) the word "telecommuting" being coined by Jack Nilles who promoted these concepts in the USA, (3) This term is most widely used in the USA, while telework is more commonly used in Europe, (4) the term "Telework" is used by the European Commission which sponsored research in this field, particularly as means of developing and creating work opportunities in rural areas or places with economic problems.

Moreover, "telework" is the European term, which is considered broader than the American term "telecommuting". Telecommuting is a subject of telework because telecommuting involves only the substitution for the daily commute to/from work.
Whichever term is used, this is the practice of working full or part-time by computer in one place that is linked to the company's central office or traditional place of work, with messages and data being transferred electronically between the locations (Y-Telework, 2000).

The common element across all aspects of telework is: "The use of computers and telecommunications to change the accepted geography of work". This term is often represented by the media and people generally to indicate "home-based working" (European Telework Online, 2000c). Moreover, British Telecom (BT) stated that: "teleworking 'means different things to different people', but its definition is 'working away from the traditional workplace on a full or part-time basis, using telecommunications to stay in touch and do business'" (BT, 1997). Furthermore, teleworking is the organisation of work by using information and communication technologies in order to enable managers and employees to get access to their labour activities from remote locations (Pe'rez et al., 2005).

However, both teleworking and telecommuting are used interchangeably in this research. Also, the virtual organisation (or office) is used as synonymous for teleworking. Wherever one of them is mentioned, they have the same meaning.

4.1.3 Types of Teleworking

Since there are a number of types of teleworking, it is useful to offer some definitions at this point:

1. **Teleworker, telecommuter**: This indicates someone who works at home all or part of the time. It may also mean someone who commutes a short distance (to a telecentre, for example) instead of travelling to a more distant office (European Telework Online, 2000c).

2. **Flexible Working**: This can include flexible working hours as well as flexible location, contracts of employment etc. The concept of flexibility involves rethinking employment policy and its consequences. One example of flexible working is the idea of "hot desks". Employees do not "own" a particular desk but use any desk that is available on that day. An office in New York State supports 800 people with just 200 desks, for example. IBM, for example, uses these ideas extensively, being driven by
aggressive competition in the computer industry (European Telework Online, 2000c).

3. Telecentres: Traditionally, businesses gather staff at a single location but computers and telecommunications allow team members to work together whether or not they are in the same office, town or country. With telecentres, employees travel to the office that is most convenient and the team then communicate and work together electronically (European Telework Online, 2000c). At a telecommuting centre, employees work outside of a central office. Furthermore, such centres can be used by employees from one company or shared (Bredin, 1996, p 7). Evidently, if such centres were developed, this would accelerate take-up of telework methods and would provide facilities for people who wish to avoid the cost, time and inconvenience of commuting but are not happy to work from home (European Telework Online, 2000c; European Telework Online, 2000b).

4. Telecottages: These are telecentres which are situated in rural villages. This movement started in Scandinavia and has now spread to many other parts of Europe such as Ireland, France, England, Wales and Scotland. Telecottages may be converted redundant buildings or conventional office buildings. The idea of telecottages was to bring opportunities to people in remote areas to gain skills by working for "hi-tech" employers who were traditionally situated in urban centres. Telecottages also help with economic regeneration by helping local people to find work and have often introduced new technology to local companies. Furthermore, they provide local, home-based people with a network of contacts as people do in a conventional office (European Telework Online, 2000c).

5. Concentrative teleworking: One example of concentrative telework was provided by Dell, who brought together customer support operations from several European countries (UC) and concentrated them in centres in Ireland and the UK. Such work aims to provide quick and effective services for customers who are generally concerned with service rather than the physical location of the service provider. With network-delivered services, and with economies of scale and variations in local cost, it is reasonable to question the conventional idea of placing service personnel close to the market they serve since modern telecommunication eradicates ideas of distance (European Telework Online, 2000c).

6. Offshore telework: Offshore telework, a term coined by MTA during the Study of Telework (1992-1993), is about moving jobs away from their traditional region, town or country. It is important to remember, however, that telework neither creates job
opportunities nor destroys them; instead it offers opportunities. For example, India has become involved in software production, the Philippines in systems maintenance and data management, and the West Indies in customer services work. This gives rise to fears that offshore telework may indicate moving work to lower cost economies. The MTA's published report that was designed to assist local, regional and national governments and economic development agencies, responds to both the opportunities and the threats posed by offshore telework (European Telework Online, 2000c).

7. Televillage: The televillage is an extension of the telecottage, the idea being to develop a community geared to the environment of the networked economy, where each home is fully equipped with an internal network which is connected to the village network and, through broadband, ultimately to the "global village", thus combining a rural lifestyle with access to the "information highways". A televillage is already being developed in Wales and the idea is being discussed in areas such as the Highlands and Islands region (European Telework Online, 2000c).

8. Nomadic teleworking: Service engineers, sales personnel and many executives are examples of nomadic workers as their work demands considerable travel. For such, their place of work is wherever they happen to be at the time and they may make use of technology such as notebook PCs, mobile telephones, voice and fax mailboxes, messaging services and remote access. Nomadic teleworkers usually have some office facilities at home but mainly need to have access to good facilities when travelling. These needs are being recognized by some airports, trains, hotels chains and airlines which provide rooms with easily accessible jack points for modems (European Telework Online, 2000c).

9. Part-time and full-time teleworkers: Teleworking may be part-time or full-time, the option being controlled by mixing organisational and personal needs. Y-telework (2000) defined them as: (1) Part-time home office: such employees still work primarily at the traditional office but spend a certain amount of hours at home (the average being 1.5 days per week), carrying out similar tasks to those they would complete at their office. (2) Full-time home office: here the primary work place for employees is their home. For this type of working, all the necessary equipment needs to be at hand.

10. Mobile teleworkers: Mobile telework involves workers, such as executives, professionals, representatives or service staff, using ICTs to deliver a range of services "on the road", from a car or even a briefcase. Previously, such activities
would have involved office-based staff or visiting company offices. Sales representatives use this form of teleworking as they have no base office as they are constantly on the move (European Telework Online, 2000b; Bredin, 1996, p 8; Y-telework, 2000).

11. Functional relocation: Functional relocation is where tasks and functions that were carried out close to the customer are now delivered at a distance. For example, selling that once took place in the High Street, is now delivered by phone or computer (the "front office"); and service and maintenance work once carried out "on site" may now be done anywhere in the world using remote access (the "back office") (European Telework Online, 2000b).

12. Employed teleworkers (self-employed): For such workers, their contract of employment includes the home as a place of work as well as, or instead of, their employer's premises. Self employed or freelance teleworkers tend to follow the market and will work on site if needed (European Telework Online, 2000c).

13. Informal or illicit teleworkers: Some teleworkers may work informally or even illicitly as they and/or their management see the benefits of teleworking and adopt the practice, but without the approval of the company, sometimes even when the company is actively opposed to such work. Research carried out by European Telework Online (ETO) showed that informal teleworking in the UK is more common than formally supported programmes (European Telework Online, 2000c).

14. Entrepreneurial teleworkers: Some people who start up a business for the first time, work from home until they can afford a traditional office. Now, however, many entrepreneurs reject the idea of a formal office and expand their businesses on a networked basis, with staff working on an individual basis (European Telework Online, 2000c).

15. Hotel teleworker: This is a description for work arrangements where employees use desks on an "as-needed" basis (Bredin, 1996, pp 8-10). This type of teleworking is called hotelling or "hot deskng"). Most hotels supply a contact with a network in, for example, a sleeping room and/or a lobby.

16. Client site teleworkers: This type of teleworker satisfies the needs of their customers at the customer's own site.

17. Satellite office teleworkers: Where there is a significant concentration of employees, these may be based in a remote office location, allowing employees to share files and thus reduce expenditure and travelling time (Y-telework, 2000).
18. **Home-based teleworkers**: Home-based telework is when an employee works at home instead of at the employer's premises (European Telework Online, 2000c). Baruch (2000) stated that this style of working is not a new phenomenon: large numbers of people worked at home in the pre-industrial era.

This section of Chapter Four explains the different types of teleworking i.e. flexibility of teleworking is reflected in these various types. The following section covers the implementation of a virtual organisation.

### 4.1.4 Implementation of the Virtual Organisation

"The word "virtual" might be said to be today's organisational buzzword" (Johnson, Heimann and O'Neill, 2001). However, this virtuality cannot happen without the art of ICTs, particularly the Internet, which is the main platform for virtuality. As Fingar, Kumar and Sharma (2002) stated, the Internet market is considered the virtual place where the buyers and sellers exchange products and services. This virtuality allows a company more effectively to meet the needs of its customers. Thus, the approach of virtuality helps providers to be near to their customers, which is the aim of all businesses.

The implementation and implementing of VOs involves the adding of new technology, which raises issues, including:

- In implementing a new technology, active interaction actually happens between four elements: organisational structure, people, technology and processes. The people are customers, employees (internal employees and teleworkers), suppliers and shareholders.

- Adopting a new technology has a positive and negative impact on managerial, organisational and human issues. Ellis and Reavill (1999) confirmed the significant impact of technological change on both humans and organisations (public and private), and also, the importance of using a systematic approach in the investigation that impact.

- Management Centre Europe (2003) offered three suggestions for implementing virtual and remote team technologies: map the virtual infrastructure and its technologies; select the right tools for collaborative work; and build a community and team spirit through technology.
• Adopting a new technology into a virtual organisation should be controlled by using such standards. They are mainly balanced between flexibility in working and the cutting of costs.

• The strategic purposes of new technology are to reduce operating costs, to increase flexibility, to improve the quality of a product or service, and to provide better control and integration by means of better information and better error detection processes (Chartered Institute of Bankers, 1988, p 135).

Also, there are some issues concerning training. They are:

• Teleworkers need to train in order to do their work remotely, and managers need to train in how to facilitate them and monitor their progress.

• Regarding the needs for training, Resnick (2004) stated that technology alone is not sufficient to achieve the objectives of knowledge management. This reflects the real need for adding the training strategy to technological solutions. However, the TCA (2000, p 317) mentioned that teleworkers naturally need training in (1) the teleworker's specialism (accountancy, design, etc.), (2) entrepreneurship, business and management skills, (3) IT skills, and (4) management of VOs (including self-management, managing teleworkers, project teams, etc.).

• This new economy offers both opportunities and risks. Highly skilled workers in IT are in demand and attract above average compensation packages. Less skilled and some non-IT workers are more likely to be displaced by rapidly changing technologies (Cooke, 2002).

• Using new technologies and new ways to manage, a virtual organisation cannot only be successful, but can also achieve an extraordinary level of excellence (Underwood, 2002, p 209).

• Concerning knowledge management, Damodaran and Olphert (2000), confirmed that the system of knowledge management must be a socio-technical system that has, as its objective, the management and sharing of knowledge to support the achievement of organisational goals. In fact, it is a vital point in the implementation stage.

There are some barriers against adopting a teleworking system. Managerial resistance to teleworking is often cited as the most common reason why teleworking schemes do not succeed (Fuller and Harriman, 2000). In fact, managing teleworkers is considered to be an important issue nowadays.
"The information revolution has forced organisations into radical new ways of working - a world of global operations working 24 hours a day, seven days a week. As companies have restructured and flattened, middle management has begun to disappear. Their work, however, has not disappeared with them!" (Management Centre Europe, 2001).

Whether to move towards centralisation(1) or decentralisation is an important question now days. Schermerhorn (1999, p 215) noted that decentralisation has increased with the revolution of Information Technology because, with advanced information systems, managers can more easily stay informed about a wide range of day-to-day performance matters, as they have information on results readily available. It means that they can allow more decentralisation in decision-making and centralised control.

On the subject of information flow in the virtual environment, teleworkers actually work outside their physical location of employment. The milestone of this flexibility is the advanced use of ICT. Flexibility does not mean losing information flow, but it should mean flow in an efficient way otherwise teleworkers are working in isolation. There are already some frustrations, such as Sawin, Calcaterra and Olka (2003) in their research. They found that battery use and communications set-up were two of the most frequently cited frustrations. Furthermore, Bakkeren, Köthe and Schulz (1997) found that one of the key problems of the virtual enterprise was the sharing of information between different companies. They tried to indicate the reasons behind this problem by stating that this problem includes the need for neutral specification of information, the distribution of information, the control of information flow, and the security of information. Moreover, Harris Miller, president of the ITAA stated that: "Studies show the frustration of slow speed network connections is one of the biggest show stoppers to widespread adoption of e-work. The good news is that high speed Internet access is now widely available" (Greenspan, 2002).

It is important to establish flexibility in working outside the office without sacrificing the objectives of the job.

In the virtual organisation, face-to-face contact is substituted by electronic, paper-based, audio, or voice communication. These should be enough to complete tasks without sacrificing the humanity of teleworkers. Information flow in the virtual organisation is considered a milestone in studying the progress of virtuality applications. According to Greenspan (2002), 20% of respondents feared that they would not have enough contact.

(1) "Centralisation is the concentration of authority for most decisions at the top level of an organisation. Decentralisation is the dispersion of authority to make decisions throughout all levels of the organisation" (Schermerhorn, 1999, p 215).
with their fellow workers and 60% of those with this concern said they would be more likely to telecommute if, through technology, they could have immediate face-to-face contact. This is a challenge to business today. Dr. Mark Hale stated that: “the fundamental challenge today is when you move assets from one place to another, you lose all the information and business processes that go with them” (Serva, 2004). According to Strader, Lin and Shaw (1998) an information infrastructure, utilizing Internet and Intranet technology, can support the communication required for effective virtual organisation management. So, the theoretical readings (reports, magazines, contracts and other forms of teleworking) confirm the concept of integration of information flow. However, the following question is raised: Is this the case in real life? Hence, this research study tries to investigate and map the information flow in the VOs.

Researchers have invested considerable effort in isolating the conditions under which electronic communication is most effective. A number of years ago Daft and Lengel (1986) proposed that, as channel capacity decreases from face-to-face to telephone to computer-based systems and memos, the medium becomes less rich. They proposed that for equivocal tasks, face-to-face meetings should be used, and for unequivocal messages lean media, such as written memos should be used. Their theory has not been supported by the research data, however. For example, a number of studies report no superiority of video communication (greater channel capacity), over audio or text-based media (less channel capacity). The belief that face-to-face interaction is more powerful than mediated interaction continues to exist in popular writing on virtual organizations” (DeSanctis and Monge, 1998).

There are two points here. The first one is the standards of information use in the VOs. Information should flow according the needs of users. What is more important? The distribution of work is divided into two styles: working across locations (physically) or working across time (temporally). So, the work should be designed and applied with such standards of distribution tasks, information and knowledge. Also, any system of information needs to be developed and improved regularly according to these standards. One of these standards is the “integrated information flow” which will be investigated later in this research. The Chartered Institute of Bankers (1988, p 135) added that improved information systems should help managers to plan and control work more effectively (e.g. using databases) and the better information systems open opportunities for more centralisation of decision-making by top management and a reduced need for middle managers, who might be reduced.
The second point is the understanding of profiles which lead to an understanding of the real needs of information. For example, Pezeshki-Rad and Zamani (2005) investigated the information-seeking behaviour of extension managers and specialists in Iran. They identified the factors that correlate with this behaviour. The results of 213 questionnaires revealed a negative correlation between managers' years of extension work and their information-seeking behaviour while a significant positive correlation was found between years of education, level of job satisfaction and information-seeking behaviour for specialists. Also, they suggested that providing valuable information sources and removing information seeking barriers, can improve information-seeking behaviour of extension specialists and managers.

Conclusions to Part One: It can be deduced that organisations are moving towards more flexible working. Through history, it appears that working across locations and time is more beneficial for employees, employers, customers and society. Different concepts of the VO are provided in this part. In this work, all virtual organisation terms (teleworking and telecommuting) are used interchangeably. Different types of teleworking are also provided in this chapter. The last section covers some issues regarding the implementation of the VO, particularly the information flow in the VOs, and both the adopting of a new technology and training as two opportunities for improving the information flow in the VOs, are discussed. As was mentioned before, a VO relies heavily on using ICTs. Consequently, the second part deals with covering various tools of ICTs that are actually used in the VO.
Part Two: The use of ICTs in Virtual Organisations

The aim of this part is to present a clear view regarding ICTs that are used in the virtual organisation. These ICT tools are considered the infrastructure of a VO. However, the advancement of ICT and IT leads to more practice of teleworking. A number of comments have been made regarding IT/ICT and VOs, including:

- The IT revolution and the development of the Internet constitute the next major change in society as it moves from the industrial to the information age (Terashima, 2002, ix; Kevan and McGrath, 2001, p 3).
- IT or ICT? According to Smith (1999, p 7), "IT can be defined as what 'comprises the knowledge, skills and understanding' to make appropriate, productive use of ICT", whereas ICT involves the tools that should be used, which also can be broadly defined as a set of activities that facilitate, by electronic means, the capturing, storage, processing, transmission, and display of information.
- DeSanctis and Jackson (1994) stated that IT is a basic mechanism for providing support and control to virtual forms.
- The development of technology should increase the workers ability to work in flexible arrangements.
- The review of the literature indicates an implication of the definition of a VO is that a VO can be thought of as an electronic network organisation (Travica, 2002).
- Gupta, Karimi and Somers (1995) noted the telecommuting problems associated with communication technologies and their capabilities.
- "Widespread use of IT has reduced the importance of geographical boundaries and allowed some types of labour services to be provided from practically any location. For example, the Internet and other networking technologies now allow some workers to work from home when competing for talent. They can also lower their costs by redistributing work to regions or even countries where labour costs are relatively lower. IT also gives employers access to a more diverse pool of workers including the disabled, older workers, parents with small children, and others who prefer to work from home" (Cooke, 2002).
- The vital relationships between system usage and user satisfaction are widely accepted and used as surrogate measures of information system success (Bokhari, 2005).
• Bokhari (2005) used a meta-analysis approach to validate the relationship between system usage and user satisfaction. The findings confirmed that there exists a significant positive relationship between "system usage" and "user satisfaction".

Each tool of ICT should have its facility of hardware or software, or both. Regarding the definition of hardware, this refers to devices that you can actually touch, like disks, disk drives, display screens, keyboards, printers, boards and chips (Webopedia, 2003). Wischhusen, Snell and Scales (2000, pp 103-117) provided a list of the main categories of hardware: input devices (e.g. keyboard, mouse), main processing unit (e.g. CPU, memory), storage devices (e.g. hardware drive, floppy drive), output devices (e.g. printers, speakers), and cables connectors. In contrast, software is untouchable. Software exists as ideas, concepts and symbols but it has no substance. Software systems are computer instructions or data. Anything that can be stored electronically is software (Webopedia, 2003). Regarding kinds of software programs, Wischhusen, Snell and Scales (2000, pp 118-124) presented the categories of software as follows: The ROM BIOS chip (read-only memory), operating systems (e.g. MS-DOS), applications software (e.g. spreadsheets), and programming languages (e.g. C++ and Java).

ICT itself is divided into three categories: electronic office systems, electronic communication systems, and office management systems. Certain conclusions will be presented at the end of this chapter.

4.2.1 Electronic Office Systems (EOSs): these include photocopiers, scanners, word processors, spreadsheets, statistics packages, project management tools, audio conferencing, videoconferencing, multimedia systems, and presentation software.

Word Processing: This involves the use of a computer to create, edit and print documents. It is considered the most common computer application. It enables the user to create a document, store it electronically on a disk, display it on a screen, modify it by entering commands and characters from the keyboard, and print it on a printer (Webopedia, 2003). Word processors are used to produce letters, reports, project and books (Williams, 1999, p 32). Regarding publishing by using word processing: "More advanced uses may be made of word processing software to create desktop publishing (DTP) products. In these cases the presentation of the text is more complex, and pictures can be included" (Poole, 1998, p 66).
The great advantages of word processing over using a typewriter are that it is possible to make changes without retyping the entire document. Mistakes can be corrected easily by backing up the cursor and correcting the mistake so it is easy to delete a paragraph, equally easy to insert a word, sentence or paragraph in the middle of a document, and it is easy to send the file to a printer to get a hard copy (Webopedia, 2003). This use of word processing reflects the importance of the electronic format of information because it is easy to manage and control.

According to Webopedia (2003), the advanced kind of word processors are called full-featured word processors which usually support the following features: file management, font specifications, footnotes and cross-references, graphics, headers, footers and page numbering, layout, macros, merges, spell checkers, tables of contents and indexes, thesaurus, and Windows.

Figure (4.1) Example of Microsoft Office Word

The above figure reflects an electronic information format (electronic document). It is created by hand printing and is easy to change, modify and save work electronically.

Photocopier: The photocopier started its development in the early 1800s. Then, electrostatic photocopying was invented in 1938 by Chester F. Carlson, an American physicist. It is a machine which reproduces copies of documents or illustrations (Flenly, n.d.; PrinterCartridgesInk, 2003; GizmoHighway, 2003). Moreover, Flenly [n.d.] stated that: “Unlike the earlier methods which require liquid chemicals, photocopiers were completely dry. This type of photocopying is known as 'Xerography,' "Xeros" in Greek means 'dry' and 'graphy' means writing". In general, photocopiers present the same shape of the used paper as well as
controlling size and colour, so it is easy to minimize or maximize the size of the paper. Concerning the lifecycle of information, the photocopier is actually used in the storage stage.

**Scanner:** This can read text or illustrations printed on paper and translate the information into a form the computer can use. This translation relies on digitizing an image, dividing it into a grid of boxes, representing each box with either a zero or a one. The resulting matrix of bits, called a bit map, can then be stored in a file (Webopedia, 2003). Wischhusen, Snell and Scales (2000, p 108) stated that the principle working of scanner relies on “reading words, symbols or other graphics from a printed page and ‘translate’ the pattern of light and dark (or colour) into a digital signal the computer can store and manipulate”.

Also, Webopedia (2003) stated that scanners differ from one another in the following respects: scanning technology, resolution, bit depth, size and shape. There are two types of scanner: the flat-bed scanner and the hand-held scanner. The most common type of scanner is the flat-bed scanner, the hand-held scanner is smaller and cheaper. Scanned pictures, which can be changed using sophisticated image editing software, are often used in publishing work (Williams, 1999, pp 6-7). The most popular type of scanner is a flatbed scanner which works in a similar way to a photocopier (Wischhusen, Snell and Scales, 2000, p 108). In fact, the scanner aims to transfer the hardcopy of paper to an electronic version which is then easy to save, send, modify and retrieve by using the computer.

**Spreadsheets:** A spreadsheet is a grid of cells in which values can be laid out and calculations performed. The traditional basis of the use of spreadsheets is the concept of modelling. They are used for calculations, forecasting and modelling (Poole, 1998, pp 68-69; Williams, 1999, p 32). Regarding the basic working of the spreadsheet:

“A spreadsheet is a computer program which is designed to display and process numbers. It is made up of a grid into which numbers are entered. The program contains many mathematical, statistical and financial calculations which can be applied to the numbers. Many spreadsheets can also show the numbers in the form of graphs” (Williams, 1999, p 54).

Most spreadsheet applications are multidimensional(1) (Webopedia, 2003).

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(1) meaning that you can link one spreadsheet to another.
Figure 4.2 Example of Microsoft Office Excel

It is clear from the previous description of spreadsheet and the above figure that the main aim of a spreadsheet is to process data in order to aid decision-making.

Audio Conferencing Systems: This kind of system aims to send and receive audio messages through the telephone networks. More than two users can be in this kind of meeting. Terashima (2002, p 40) stated that it is less expensive than other distance education systems. So, this kind of connection aims to send and receive audio information over the telephone networks.

Videoconferencing Systems: This can be defined as linking individuals or groups communicating across networks using audio voice and video images (Williams, 1999, pp 89; Armitage, 1997). This kind of meeting is cheap when compared with traditional types of meeting.

For installations of videoconferencing, it is basically important to determine the number of people involved at each end of the videoconferencing link, the arrangement of cameras and the size of the display screen will vary. Desktop systems, mobile units, and room installation are the three common known groups of conferencing systems. A camera, often placed on the top of the monitor, records the digital images of the user while a microphone captures the speech. This signal is then transmitted across the network to the receiving station where the image is displayed in a window on the monitor (Williams, 1999, p 89).

In addition to the required bandwidth to transmit a video signal, VC requires two channels to transmit both audio and video signals in conferencing (Terashima, 2002, p
41). The main benefits of a VC are: (1) It connects offices in different countries around the world, (2) It saves time, (3) It saves the cost of traveling and accommodation (Williams, 1999, p. 89). This sort of meeting and information (audio, video) flows from sender to receiver via convenient electronic channels. These could be online meetings as well as face-to-face. In fact, both audio and video conferencing seek to contact at least two persons in different locations at the same time.

**Multimedia Systems:** Multimedia communication provides an existing new way of presenting information in an interactive and non-linear format that is referring to the representation, storage, retrieval and dissemination of machine-processable information expressed in multimedia, such as voice, image, text, graphics and video (Poole, 1998, pp. 74-75; Hac', 2000, p. 33). In fact, web page design now incorporates multimedia features.

"Multimedia is the mixing of different forms of media within one program. Such media include text, graphics - in the form of drawings, clip art, scanned photographs or images from digital cameras - video clips, sound clips or animations" (Poole, 1998, p. 74).

Since the mid 1990s, the development of multimedia is increasing, with increases in performance and decreases in price. This increased usage is due to the use of computers to present text, graphics, video, animation and sound in an integrated way (Webopedia, 2003). However, the main multimedia components and their characteristics are video, audio, computer graphics, text, photographs and translations.

Regarding the advanced technology of multimedia: first, Heath (2001, pp 2-4) noted that the digital multimedia revolution needed to have several things in place. He noted that the first if these was demand from the customer, compression techniques to make transmission viable or reduce the amount of bandwidth needed, processing power to handle the compression/decompression, standards, back channels to provide an interactive loop, bandwidth, and internal distribution. Secondly, Poole (1998, p. 75) stated that, through the use of hypertext and hotspot link pages, text, images, sound music and video can be transmitted. Authoring languages such as HTML are relatively simple to understand and use. Languages such as Java give wider scope but are more difficult.

On the subject of comparison between audio conferencing, video conferencing and multimedia systems conferencing, it can be summarised that audio conferencing is concerned with sending (receiving) audio information, video conferencing is related to sending (receiving) audio and video information and multimedia conferencing covers the
other format of information (such as text, graphics, animation), in addition to audio and video information. Regarding the role of multimedia in information flow, Lim and Benbasat (2002) also confirmed the influence of multimedia on improving the comprehension of organisational information.

**Presentation Software:** There are many kinds of software that are used to show intended information that is designed for participating in promotion, marketing, launching, project management, etc. These programs create various sorts of charts, figures, tables, diagrams and text. Webopedia (2003) presented a type of business software that enables users to create highly stylized images for slide shows and reports. Most systems enable the user to import data from a spreadsheet application to create the charts and graphs. Presentation graphics are often called business graphics. Therefore, visualisation of data by such presentation software helps in processing data to be understood as information to get the required decision.

**Statistical Packages:** Statistical packages are usually used in decision-making procedures. They are also used to clarify data after processing to be convenient information for decision making and taking. There are two shapes of these statistical diagrams: charts and graphs. A 2D diagram can often represent objects more clearly than words so statistical diagrams can represent numbers more clearly (Wischhusen and Scales, 1996, p 201). There are two kinds of statistical programs: general purpose statistics package like Stata, Minitab, and BMDP), and special purpose like TSP, SPSS, SAS, S-Plus, Speakeasy, SCA, SAS/JMP(SAS)/ INSIGHT*, RATS, LISREL and LIMDEP, IMSL, EQS and GAUSS). For more information regarding these programs, see Appendix 2. Regarding the effect of statistical packages on information flow, it is important to know that converting data from numbers to graphs and charts is increasing the understanding of each case. One can deduce that the usage of a few statistical packages may increase the efficiency of decision-making.

**Project Management Tools:** the deadline is the major critical success factor (CSF) for each project. To meet this deadline efficiently, each project requires such tools, which should cover at least one of the following tasks: principles of project planning, project initiation, project lifecycles & planning, identifying tasks & estimating, quality issues, anticipating problems & motivation, financial issues, and applying principles (Farthing, 2002). These tools of management are important because any project is actually divided
into a few parts. So, there is a real need for managing the time to complete each part within the target time.

To sum up this section, it is clear that the above ten tools of electronic office systems are mainly concerned with processing data in order to be ready information to be used for decision-making and managing the format of information to be useful in decision-making. Three of them (audio conferencing, videoconferencing and multimedia systems) are concerned with sending/receiving the different forms of information to different locations at the same time. No one can deny the importance of all these systems in the teleworking environment. The second section covers the methods of electronic communication.

4.2.2 Electronic Communication Systems (ECSs): These systems are usually constructed from telephone-land lines (PSTN), facsimiles, multiple phone lines, mobile telephones, computer modems, ISDNs, ADSLs, electronic mail, voice mail, answer machines, call waiting and chat software. Basically, there are three kinds of communication networks: telephone networks, computer networks and the Internet network.

1. **The telephone network** is mainly used for transmission of voice signals. Besides that, it is used for the transmission of image and data, especially in Internet dial-up connections, or for using ADSL connections.

2. **Internet network**: there are three concepts related to the Internet network: The Internet, the Intranet and the Extranet. The **Internet** is sometimes called simply "the Net". It is also called the network of networks which means that local area networks are interconnected by telephone lines and/or dedicated lines. The Internet includes websites, email, newsgroups and other forums (Terashima, 2002, p 56; Goleman, 2002, p 1266; Mariosalexandrou, 2003). Also, the Internet can be defined historically as:

"The Internet grew out of a U.S. Department of Defense project. Originally called the "ARPANET," the Internet was developed starting in 1969 by the Advanced Research Project Agency. It was designed to ease the sharing of information between researchers at various universities and in the military" (Coon, 2001).
According to (Macdonald, 2001, pp 8-9), an **Intranet**: is an internal system of computer communication that is available only for employees to access through workplace computers and possibly laptops provided to employees who work remotely. The main purposes of the Intranet are to provide up-to-date information about the company's products, services, customers, new contracts won, sales successes, policies, procedures, holiday entitlement, pension scheme membership, private medical insurance scheme, job vacancies, health and safety information, company's vision, future plans, and general company 'news'. An **Extranet** is considered to be a private network which uses the Internet protocol and the public telecommunication system to share securely part of a business's information or operations with suppliers, vendors, partners, customers or other businesses. It can be viewed as part of a company's intranet that is extended to users outside the company. These require firewall server management and means of user authentication, encryption of messages, and the use of virtual private networks (VPNs) that tunnel through the public network. According to Mariosalexandrou (2003) and Whatis (2000b), the main benefits of an Extranet are to:

i) Exchange large volumes of data using Electronic Data Interchange (EDI) or XML.

ii) Share product catalogues exclusively with wholesalers or those in the trade.

iii) Use training programs with other companies.

iv) Access services provided by one company to a group of other companies.

v) Share news with partner companies.

3. **A Computer network** "is composed of networks and components and is used to interconnect computers that are widely distributed" (Terashima, 2002, p 21). There are two sorts of connection computers. The first is the **Local Area Network (LAN)** which can be used through wire cables, fibre optic cables, microwave links or satellite. Computers can be connected in a bus, star or ring network structure (Williams, 1999, pp 80-82). LANs are interconnected via dedicated lines or telephone networks, terminals such as workstations, personal computers, and/or computers such as file servers, database servers or mail servers (Terashima, 2002, p 21).

The second kind is the **Wide Area Network (WAN)** that is used when computers are linked over larger geographical areas to/form a wide area network. The main requirements of a WAN are a modem, ISDN, Internet, Email, Spam and unsolicited
mail, Email security, electronic bulletin boards, and the World Wide Web (www) (Williams, 1999, pp 80-87). More recently, broadband connection has become the main carry channel for WANs.

**Telephone-land Lines:** In the 1870s, two inventors, Elisha Gray and Alexander Graham Bell, both independently designed devices that could transmit speech electronically. This was called the telephone (Farley, 2002b). Originally, telephone communication was designed for speech but it is now also possible to send and receive digital data. This capability to receive and transmit words, files and pictures along telephone lines has led to an increase in electronic communication networks such as view data (Wischhusen and Scales, 1996, p 131). This sort of communication aims to send/receive voice and data. The information flows through two telephones for voice and through computers for data.

**Answer Machine:** This is considered one of the most important support services on the telephone line. It is used, in both the cases, where the telephone line is used for saving the calls while the line is busy when calling the telephone and saving while the line is busy in dialling-up services for connecting with the Internet. “This facility lets a user find out who’s calling while the user is online, it means he/she will never miss an important call again” (Everydaybusinessonline, 2003). It is mainly related to saving audio messages while the user is busy.

**Voice Mail:** This type of communication enables users to leave spoken messages for one another and listen to the messages by executing the appropriate command in the e-mail system (Webopedia, 2003). “Voice mail was the brainchild of Gordon Mathews. He applied for a patent in 1979 to cover his voicemail invention and sold the first system to 3M. A few years later, in 1982 the patent for his invention was awarded” (Voicenation, 2003). Recently, most companies have implemented this sort of communication, especially for effective contact with customers and remote workers.

**Call Waiting:** This type of service deals with managing calling through more than two persons and is related to being in contact with customers. “Terminal A calls terminal B, which is busy, so is connected to terminal C. So, a signal is sent to terminal B information it of the arrival of a second call. If the called party would like to talk the call from terminal A, he or she clicks the phone, picks up the second call and talks with caller A while caller C is put on hold” (Terashima, 2002, p 53). Regarding information flow in this service, it is clear that the flow of
information relies on the owner of this service; he/she can change from the first call to another call as much as is necessary.

**Multiple Phone Lines:** seek to provide more than one phone call over the one telephone line. It refers to the ability to contact more than one person at the same time and is convenient for collaboration among groups or family members. This service is important to those who actually run a business (from home or from another business). There is a need to make many calls at the same time. When using just one line, losing calls is easy because the line can be busy. The point is to choose one line, or multiple lines, and a suitable system and to know how to use it efficiently. This choice and knowledge will surely lead to (by sending and receiving) an integrated information flow. So, this system satisfies the high demand of calls.

**Facsimile:** This emerged in 1842, when Alexander Bain invented a machine capable of receiving signals from a telegraph wire and translating them into images on paper (Theteacher, 2003). It is used to send and receive the contents of a document (text and/or pictures) via a telephone line (Wischhusen and Scales, 1996, p 131; Terashima, 2003, p 38). Each document is converted into electronic shape which is translated automatically into a series of zeros and ones (called a bit map) that can be transmitted like normal computer data. On the receiving side, a fax machine reads the incoming data, translates the zeros and ones back into dots, and reprints the picture. The main differences between faxes and other forms include speed, printer type, paper size, paper cutter, paper feed, and autodialing (Theteacher, 2003).

**Mobile Telephone:** On June 17, 1946 in Saint Louis, Missouri, AT&T and South Western Bell introduced the first American commercial mobile radio-telephone service (Farley, 2002a). This kind of electronic contact came after the development of wireless communication. There are three terms related to the mobile: cellular phones, pagers and cordless phones. Phonewarehouse (2002) presented the differences between them.

**Cellular phones** began in 1947 when researchers looked at crude mobile (car) phones and realized that by using small cells with frequency re-use could increase the traffic capacity of mobile phones substantially. **Pagers** were used in 1959 and referred to a Motorola radio communications product, a small radio receiver that delivered a radio message individually to those carrying the pager device. **Cordless phones** were primitive by today’s standards. They were given a frequency of 27 MHz.
In Japan, typical users of the i-mode service accessed the Internet with their mobile phones more often than with PCs (Burkhardt et al., 2002, p 17). Connecting the Net through a mobile is considered vital nowadays. Teleworkers who work via mobile are called mobile workers. In the UK, the Office of National Statistics (2002a) stated that there are more mobile workers than other types of workers.

**Computer Modem**: Modern computers are electronic and digital. Each computer actually consists of hardware and software (Webopedia, 2003). According to Williams (1999, pp 1-2), computers can be divided into five types:

- Supercomputers: These have huge processing power and are used mainly for scientific and engineering applications such as weather forecasting and complex graphical techniques.
- Mainframe computers: They are used in large companies for data processing and by scientists for complex mathematical calculations.
- Minicomputers: They are used by smaller business to manage their processing needs. Complex programs and older database programs can be linked to newer programs running on the Internet.
- Embedded computers: Telephones, missiles, cameras, and washing machines, many modem devices contain built-in computers or embedded systems. There is no need for these systems to use keyboards and computer monitors, since the inputs required come from the device's sensors, and outputs control the operation of the device.

**ISDN**: This refers to Integrated Services Digital Network, an international communications standard for sending audio, video and data over digital telephone lines or normal telephone wires, it supports the transferring of data under rate of 64 Kbps (Webopedia, 2003). Because ISDN is convenient for WANs, it is usually used for multimedia services, because multimedia has become necessary to transmit not only voice signals, but also video and text information (Terashima, 2002, p 24). Regarding the case of the UK, British Telecom introduced the first services of ISDN in the UK in 1985 (Griffiths, 1998, p 10).

**ADSL**: This means Asymmetric Digital Subscriber Line. The term asymmetric refers to the fact that ADSL provides more capacity downstream than upstream, and provides a perfect fit for the Internet requirement (Stallings, 1999, p 51). ADSL is a new modem
technology transferring data at high speed over existing telephone copper wire into access paths for high-speed communications of various sorts (International Engineering Consortium, 2003). It is difficult to deliver multimedia data by the traditional telephone network or down cable, hence ADSL allows multimedia to deliver via this network of ADSL (Heath, 1999, p 168). However, ADSL is a communication channel for high speed of Internet access.

Electronic Mail: The most important application for Internet connectivity is e-mail, which is probably the most widely used and most important in communications. Its messages travel via an "electronic post office" (Kessler and Southwick, 1997, p 514; Poole, 1998, pp 78-79; Wischhusen, Snell and Scales, 2000, p 22). This electronic communication developed alongside the Internet. A better definition of electronic mail is that it is "individually received in an electronic mailbox". This means the transmission of messages over communications networks. These messages can be entered from the keyboard or by using electronic files stored on disk (Vicom, 1998; Hoffman, [n.d.]).

"The two most common protocols used on the Internet are e-mail and the Web. The basic difference between e-mail and the Web is that e-mail is delivered to the electronic mailboxes of users, while Web content is actively fetched by users. In other words, email comes to a user, but the user goes out on the Web to browse for content" (Hoffman, [n.d.]).

E-mail provides a cost saving to a business in that the cost of e-mail is not dependent on how far the message travels (Elliot and Starkings, 1998, p 273). Regarding the future directions of the Internet, there is no doubt that the Internet will shape future communications far beyond its current uses (Vicomsoft, 2003). According to the previous perception of email, it is important to say that email has significant features in making information flow (text, image) via electronic communication with efficient up-streaming and down-streaming speed.

Chat Software (eg. MSN Messenger): Luckevich (1998) said that chat software provides the ability to "talk" using the keyboard in real-time with other people (who have special interests) on a network of computers like the Internet or a company Intranet. There is much software supporting this service. It aims to contact two persons (or more) in different locations to send and receive text messages over the Internet network at the same time. This method of connection enhances knowledge sharing.
At the end of this section, the twelve systems of electronic communication are concerned with transferring the different formats of information (text, audio, video, images) among different locations throughout the world. They are also used through three types of networks: computer networks, Internet networks and the telephone network. The next systems to be examined are the office management systems.

4.2.3 Office Management Systems (OMSs): These consist of interactive diaries/scheduler, file systems, expensive management tools, electronic mailing list, databases, credit card verification, and workflow software.

Databases: Databases can be considered as an electronic filing system that is used to store, sort, search, hold and retrieve information (Williams, 1999, p 42; Escuela Campo Alegre, 2001). Traditional databases are organised by a field as a single piece of information; a record, which is one complete set of fields; and a file that is a collection of records (Escuela Campo Alegre, 2001). The sort of data management reflects the need of more structured data by using databases.

"An alternative concept in database design is known as Hypertext. In a Hypertext database, any object, whether it be a piece of text, a picture, or a film, can be linked to any other object. Hypertext databases are particularly useful for organizing large amounts of disparate information, but they are not designed for numerical analysis" (Escuela Campo Alegre, 2001).

The point here is managing the database for improving decision-making. So, designing any database is an important issue that reflects the need to design it according to the job goals. Then, the right processing of data means obtaining the right information which is ready to be used.

Credit Card Verification: This kind of credit accessibility has long been used by customers. For teleworkers, it is useful for satisfying their financial needs with local access. The main purpose of this card is used to withdraw cash from ATMs. There are magnetic strips on each card. “They are thin strips of magnetic tape, often found on the back of plastic credit and debit cards. When the card is used, the strip passes record and playback heads, similar to a tape recorder, which reads data from, and writes data to, the stripe” (Williams, 1999, p 10). The aim of this system is to save the time of teleworkers.
File Systems: The main aim of these systems is to manage the flow of information. It is important to know where information will be sent, so it useful to use file transfer by means of sending a file to the printer or using a network to transfer data electronically between computers remote from each other (Wischhusen and Scales, 1996, p 151). The core of file systems is file, which can be defined as a collection of data or information that has a name, called the filename. There are many different types of files: data files, text files, program files and directory files (Webopedia, 2003). The information required should be in a system so that the file system arranges and files according to the users’ needs.

Expense Management Tools: These tools are called in to manage the expenses because expense is considered the main factor in production itself and all companies try to decrease the cost of production so it is important to manage such expenses. They participate in saving time and providing accurate information to others.

Electronic Mailing Lists: This list of emails contains full details regarding more than two persons or sometimes a group or all the contacts. This list also gives priority based on alphabetical arrangement. It aims to save time in contact and the sharing of knowledge is obviously reflected in it.

Interactive Diaries/Scheduler: This is software that is usually used to help a group of colleagues schedule meetings and other appointments.

"It allows members to view each others’ calendars so that they can choose a convenient time. Once a time has been selected, the scheduler can automatically send out reminders through e-mail and can even reserve resources such as conference rooms and overhead projectors. Operating systems, a scheduler is a program that coordinates the use of shared resources, such as a printer" (Webopedia, 2003).

This kind of management office increases the coordination and collaboration among the group members, especially in meetings, deadlines and project management so it is concerned with managing time. Throughout the above discussion of OMSs, it can be concluded that they are related to managing the timeliness of information and the accuracy of information. Conclusions concerning the second part of this chapter are below.

Summary of Chapter Four: The aim of this chapter is to provide a clear picture regarding the paradigm of virtual organisations and their use of ICTs. The first part of
this chapter covers a detailed review of the paradigm of virtual organisations. It can be deduced that organisations are moving towards more flexible working. A chronology of the virtual organisation was presented in this part and was chosen to use all virtual organisations, teleworking and telecommuting as interchangeable words. Different types of teleworking are also provided in this chapter. The last section covers some issues regarding the implementation of a VO, particularly information flow in the VOs, and both adopting a new technology and training as two opportunities for improving the information flow in the virtual organisations.

The second part provided a picture of the ICTs which are used in VOs. In fact, teleworkers cannot work remotely without using ICTs. Hence, significant relationships should be confirmed between ICTs and the integration of information flow. However, EOSs are mainly concerned with processing data as information and to transfer information in different formats (audio, video, text, image). ECSs cover the methods of caring for this formatted information while OMSs deal with managing the timeliness of information (the right information) and also the accuracy of information (the right information). No one can say which tool is the most important. In fact, all of them are important to the use of information in the teleworking environment. They are important to achieve an integrated information flow. The next chapter will demonstrate the related brief of teleworking throughout world, including USA, Canada, Latin America, Europe, Asia, Australia and the United Kingdom.
Chapter Five

Teleworking throughout the World

5.0 Introduction

In the previous chapter, a review of teleworking concepts, implementation of teleworking and also the use of ICTs was provided. The picture of teleworking is still not clear, so there is a need to highlight the world view of teleworking. Teleworking may seem easy for back-office employees to adopt but difficult for the front-office employees. The basic review of the related literature revealed many common known cases of teleworking. Hence, in this chapter, some highlights will be discussed and summarized from 23 cases of teleworking throughout the world. A brief description of each case (country) will be provided including the name of the country, its population, area, weather, air pollution, labour force, teleworking, and ICT infrastructure. In fact, this review helps the general understanding of the situation of teleworking throughout the world. The selected cases are categorised into the USA, Canada, Latin America, Europe, Asia and Australia. This will also be covered in Part One of Chapter Five. Part Two is related to an in-depth discussion of teleworking in the United Kingdom.

Part One: Teleworking Worldwide

This part deals with providing a clear picture of teleworking worldwide. This discussion will be based on presenting a brief of each country, its economic state, population, labour force, teleworkers, ICT infrastructure, and a discussion of its needs in order to be a teleworkable country. According to the Gartner Group, there was an estimated 137 million teleworkers in 2003 worldwide (Canadian Telework Association, 2005). These were scattered throughout the world. In this part of Chapter Five, some countries will be highlighted. The most important cases are: Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Greece, Hungary, India, Italy, Japan, Malaysia, The Netherlands, Portugal, Romania, Russia, Spain, Sweden, Switzerland and the U.S.A. The case of the UK will be discussed in more depth in the next part of this chapter.
5.1.1 United States of America (USA): Britain's American colonies broke with the mother country in 1776 and were recognized as the new nation of the United States of America following the Treaty of Paris in 1783. The US remains the world's most powerful nation-state. The economy is marked by steady growth, low unemployment and inflation, and rapid advances in technology. Its location is in the north of America, bordering both the North Atlantic Ocean and the North Pacific Ocean, between Canada and Mexico with an area of 9.629.091 sq km. Its capital is Washington, DC. The main language of the USA population is English but Spanish is spoken by a sizable minority. The US is the largest and most technologically powerful economy in the world. US business firms enjoy considerably greater flexibility than their counterparts in Western Europe and Japan. The population of the USA is estimated to be 291.639.900 (2003 est.). Half of these constitute the labour force (141.8 million). This includes unemployed (2001). The rate of unemployment is 5% (2001). This force is divided into managerial and professional 31%, technical, sales and administrative support 28.9%, services 13.6%, manufacturing, mining, transportation, and crafts 24.1%, farming, forestry, and fishing 2.4% (2001) (Countryreports, 2003; Internet-World-Stats, 2003; U. S. Department of State, 2003; Census, 2003).

Regarding the infrastructure of communication, the USA has 194 million (1997) telephone-main lines in use, 69.209 million (1998) mobile cellular telephones in use, 7.800 (2000 est.) ISPs and 177.547.277 (2003) Internet users (Countryreports, 2003; Internet-World-Stats, 2003). In 2003, the USA ranked in the top 25 countries with the highest number of Internet users (Internet-World-Stats, 2003). The total number of American teleworkers was estimated by the International Telework Association and Council (ITAC) to be 28 million. They are divided into four categories: 24% work on the road; 21.7% work from home; 7.5% work at telework centres; and 4.2% work at satellite offices; nearly half (42.4%) work in more than one of these locations (YouCanWorkFromAnyWhere, 2001; JALA International, Inc., 2003).

“On 12 September 2001 the US had many more “instant” eworkers. Although there is little reliable information as to the exact numbers, it seems clear that the aftermath was similar to that observed after two major earthquakes in California (in 1987 and 1994)” (Johnston & Nolan, 2002).

US legislation is concerned with the air quality act, small business telecommuting act, the telework tax incentive act, and the broadband deployment & telework incentive act of 2001 (Denbigh, 2001).
According to the International Telework Association & Council (2004), the American Interactive Consumer Survey, which was conducted by The Dieringer Research Group, found that the number of employed Americans who work from home, with a frequency range from as little as 1 day a year to full-time, increased from 41.3 million in 2003 to 44.4 million in 2004, a 7.5% growth rate.

5.1.2 Canada: A land of vast distances and rich natural resources, Canada became a self-governing dominion in 1867 while retaining ties to the British crown. Economically and technologically the nation has developed in parallel with the US, its neighbour to the south across an unfortified border. It is located on the northern part of North America, bordering the North Atlantic Ocean on the east, the North Pacific Ocean on the west, and the Arctic Ocean on the north, north of the conterminous US. This area of Canada covers 9.976.140 sq km. Its climate varies from temperate in the south to subarctic and arctic in the north. As an affluent, high-tech industrial society, Canada today closely resembles the US in its market-oriented economic system, pattern of production and high living standards. Nevertheless, with its great natural resources, skilled labour force, and modern capital plant, Canada enjoys solid economic prospects. The main characteristic of its environment is vehicle emissions impacting on agricultural and forest productivity. Ottawa is the capital of Canada. The population of Canada is 31.720.400 (2003 est.) with 59.3% using English (official), French 23.2% (official), and “other” 17.5%. 16.4 million (2001 est.) of Canada's population represent the labour force that are divided according to services 74%, manufacturing 15%, construction 5%, agriculture 3%, and other 3% (2000). The rate of unemployment is 7.2% (2001 est.) (Countryreports, 2003; Internet-World-Stats, 2003).


(1) Telephone system: general assessment: excellent service provided by modern technology domestic satellite system with about 300 earth stations international: 5 coaxial submarine cables; satellite earth stations - 5 Intelsat (4 Atlantic Ocean and 1 Pacific Ocean) and 2 Intersputnik (Atlantic Ocean region).
5.1.3 Latin America (Brazil): Following three centuries under the rule of Portugal, Brazil became an independent nation in 1822. Highly unequal income distribution remains a pressing problem. It is located on Eastern South America, bordering the Atlantic Ocean, with an area of 8,511,965 sq km. Its capital is Brasilia. The Brazilian climate is mostly tropical but is temperate in the south. The population of Brazil is 179,712,500. Their official language is Portuguese. Furthermore, Spanish, English, French are also used. Regarding the workforce, it is estimated at 79 million (1999 est.) with a 6.4% (2001 est.) unemployment rate. This labour force is divided into three categories: services 53%, agriculture 23% and industry 24% (Countryreports, 2003; Internet-World-Stats, 2003).


5.1.4 Asia

In this section, three Asian countries will be discussed: Japan, Malaysia and India.

5.1.4.1 Japan: While retaining its time-honoured culture, Japan rapidly absorbed Western technology during the late 19th and early 20th centuries. After its devastating defeat in World War II, Japan recovered to become the second most powerful economy in the world (after the USA). It is located on the Eastern Asia island chain between the North Pacific Ocean and the Sea of Japan, east of the Korean Peninsula with total area of 377,835 sq km. Its climate varies from tropical in the south to cool temperate in the north. Its capital is Tokyo. The vast majority of Japan uses the Japanese language. Japan is ranked the second most technologically powerful economy in the world after the US and the third largest economy in the world after the USA and China. One notable characteristic of the economy is the working together of manufacturers, suppliers and distributors in closely-knit groups called keiretsu. A second basic feature has been the guarantee of lifetime employment for a substantial portion of the urban labour force. The population of Japan is estimated at 127,708,000 (2003 est.), 67.7 million (December 2000) of these are considered part of a labour force that is divided into three categories:
services 65%, industry 30% and agriculture 5%. Besides that, the rate of unemployment reached 4.9% in 2001 (Countryreports, 2003; Internet-World-Stats, 2003).


5.1.4.2 Malaysia: Malaysia was formed in 1963. It is located in south eastern Asia and is a peninsula with the northern third of the island of Borneo, bordering Indonesia and the South China Sea, south of Vietnam with area of 329,750 sq km. It has a tropical climate with annual southwest (April to October) and northeast (October to February) monsoons. Its capital is Kuala Lumpur and the official language(0) is Bahasa Melayu. There is air pollution caused by industrial and vehicular emissions. Malaysia’s population is estimated at 24,014,200 (2003 est.) but less than half form the labour force (9.9 million) (2001 est.). This force is divided into local trade and tourism 28%, manufacturing 27%, agriculture, forestry, and fisheries 16%, services 10%, government 10%, and construction 9% (2000 est.). The unemployment rate of Malaysia is considered low at 3.7% (2001 est.) (Countryreports, 2003; Internet-World-Stats, 2003).


Concerning the implementation of teleworking in Malaysia, 98 organisations were investigated on the adoption of teleworking in multinational firms. The results show that in both multinational and Malaysian firms, the nature of work, organisational design, transportation problems and relative advantage are important telework drivers. Also, the availability of teleworking infrastructures is an important determinant of adoption in Malaysian firms but not in multinational firms, while workforce limitations have a strong

(0) Beside the official language, there are English, Chinese dialects (Cantonese, Mandarin, Hokkien, Hakka, Hainan, Foochow), Tamil, Telugu, Malayalam, Panjabi, Thai; note - in addition, in East Malaysia several indigenous languages are spoken, the largest of which are Iban and Kadazan.
influence on teleworking adoption in multinational firms but none in Malaysian firms (Ndubisi and Kahraman, 2005).

5.1.4.3 **India:** The Indus Valley civilization, one of the oldest in the world, goes back at least 5,000 years. It is located in southern Asia, bordering the Arabian Sea and the Bay of Bengal, between Burma and Pakistan, with 3.287.590 sq km and has a climate which varies from tropical monsoon in the south to temperate in the north. New Delhi is the capital of India. Regarding the environment, there is air pollution from industrial effluents and vehicle emissions; the huge and growing population is overstraining natural resources. India’s population is estimated at 1.067.421.100 (2003 est.). 406 million (1999) are part of the labour force which is divided into three categories: agriculture 60%, services 23% and industry 17% (1999). The rate of unemployment was 4.4% (1999). English(0) enjoys associate status but is the most important language for national, political and commercial communication; Hindi is the national language and primary tongue of 30% of the people. India is a major exporter of software services and software workers (Countryreports, 2003; Internet-World-Stats, 2003).


5.1.5 **Europe:** In this section, European cases will be highlighted. These countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Portugal, Romania, Russia, Spain, Sweden and Switzerland.

5.1.5.1 **Austria:** Once the centre of power for the large Austro-Hungarian Empire, Austria was reduced to a small republic after its defeat in World War I. It is located in the central area of Europe, north of Italy and Slovenia, with an area of 83.858 sq km and a

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(0) There are 14 other official languages: Bengali, Telugu, Marathi, Tamil, Urdu, Gujarati, Malayalam, Kannada, Oriya, Punjabi, Assamese, Kashmiri, Sindhi, and Sanskrit; Hindustani is a popular variant of Hindi/Urdu spoken widely throughout northern India but is not an official language.
climate which is temperate. Continental and cloudy, winters are cold with frequent rain in the lowlands and snow in mountains; summers are cool with occasional showers. Its capital is Vienna. There is air pollution as a result of trucks transiting Austria between northern and southern Europe. Austria, with its well-developed market economy and high standard of living, is closely tied to other European Union (EU) economies, especially Germany's. Austria's population is estimated at 8,169,929 (July 2002 est.). The official language is German. The Austrian population has 4.3 million (2001) as a labour force, which is divided into services 67%, industry and crafts 29%, agriculture and forestry 4% (2001 est.). The rate of unemployment is estimated in 2001 at 4.8% (Countryreports, 2003).

Regarding the telephone and Internet infrastructure, it has 4 million main lines telephones.

Furthermore, it has four mobile telephone providers who serve more than 6.4 million (2002) users and 3 million (2000) Internet users are provided with the service by 37(2000) ISPs (Countryreports, 2003). It seems relevant that private access from home has increased sharply during the last two years from 16% (1999) to 33% (2000) and 42% in 2001 (Johnston & Nolan, 2002). Teleworkers in Austria number 50,000; their percentage of the labour force is 1.5% (Biaize, 2001; Johnston & Nolan, 2002).

Concerning legislation regarding teleworking, there is still no particular legislation established in Austria concerning ework but employers and employees have to make a written contract. Examples of regulations are: eworking must be voluntary and the working material must be provided by the employer, as well as the expenses for the home office (Johnston & Nolan, 2002).

5.1.5.2 Belgium: Belgium became independent from the Netherlands in 1830 and was occupied by Germany during World Wars I and II. It is located in western Europe, bordering the North Sea, between France and the Netherlands, with an area of 30,510 sq km and a climate that is temperate: mild winters and cool summers that are rainy, humid and cloudy. Its capital is Brussels. The environment is exposed to intense pressures from human activities such as urbanization, a dense transportation network, industry, intense animal breeding and crop cultivation. Belgium's population is estimated at 10,340,000 (March 2002). The languages of Belgium are: Dutch 60%, French 40%, German less than

(0) Consisting of 3,600,000 analog main lines plus 400,000 Integrated Services Digital Network connections; in addition, there are 100,000 Asymmetric Digital Services lines (2001).
1% and legally bilingual (Dutch and French). This population is 4.44 million (2001) in the labour force with 6.8% (2001 est.) unemployed (Countryreports, 2003; Johnston & Nolan, 2002).

Concerning the infrastructure of the Internet and communication, the main telephone lines total 4.769 million (1997) and there are 974.494 (1997) of mobile cellular phones. ISPs in Belgium are estimated at 61 (2000), all of them combined to present a convenient service for 2.807 million (2001) Internet users (Countryreports, 2003). Teleworkers in Belgium number 200.000 and their percentage of the labour force is 5.3% (Biaizpe, 2001). A law on home working has been in force since March 1997 (Johnston & Nolan, 2002).

5.1.5.3 Denmark: Once the seat of Viking raiders and later a major north European power, Denmark has evolved into a modern, prosperous nation that is participating in the general political and economic integration of Europe. It is located in the north of Europe, bordering the Baltic Sea and the North Sea, on a peninsula north of Germany (Jutland) with area of 43.094 sq km. It has a climate which is temperate: humid and overcast with mild, windy winters and cool summers. Its capital is Copenhagen and the main language is Danish, in addition to Faroese, Greenlandic (an Inuit dialect) and German (a small minority). Air pollution in Denmark is principally caused by vehicles. This thoroughly modern market economy features high-tech agriculture, up-to-date small-scale and corporate industry, extensive government welfare measures, comfortable living standards, a stable currency, and high dependence on foreign trade. Denmark is a net exporter of food and energy and has a comfortable balance of payments surplus. In 2002 Denmark’s population was estimated at 5.368.854 (July 2002 est.). 2.856 million (2000 est.) of them are in the labour force that is categorised into services 79%, industry 17% and agriculture 4% (2000 est.). The rate of unemployment was estimated in 2000 at 5.3% (Countryreports, 2003).


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(0) note: English is the predominant second language.
This increase in both home working and home-based e-work in Denmark goes hand in hand with an increase in the number of employees who work flexible hours (Johnston & Nolan, 2002). Denmark was one of the first countries to introduce the very popular employee home-PC scheme (Johnston & Nolan, 2002).

5.1.5.4 **Finland:** Finland won its independence in 1917. It is located on the north of Europe, bordering the Baltic Sea, the Gulf of Bothnia and the Gulf of Finland, between Sweden and Russia, with an area of 337.030 sq km. It has a climate that is cold temperate, potentially subarctic, but comparatively mild because of the moderating influence of the North Atlantic Current, Baltic Sea, and more than 60,000 lakes. The main official language is Finnish 93.4%, in addition to Swedish 5.9% (official), and small Lapp- and Russian-speaking minorities. The capital of Finland is Helsinki. Air pollution is caused from manufacturing and power plants. Finland has a highly industrialized, largely free-market economy, with a per capita output roughly that of the UK, France, Germany and Italy. Its key economic sector is manufacturing, principally wood, metals, engineering, telecommunications and electronics industries. Finland’s population is estimated at 5,183,545 (July 2002 est.) with 2.6 million (2000 est.) in the labour force and with a 9.4% (2001 est.) unemployment rate. This labour force is divided into public services 32%, industry 22%, commerce 14%, finance, insurance, and business services 10%, agriculture and forestry 8%, transport and communications 8%, and construction 6% (Countryreports, 2003).

The main phenomenon in contemporary business and work is structural change towards work in networks and virtual environments (Johnston & Nolan, 2002). Concerning this environment infrastructure, the telephone and mobile lines in use are estimated at 2.861 million (1997) and 2.162,574 (1997) respectively. Moreover, 2.27 million (2000) Internet users are serviced by 23 (2000) ISPs (Countryreports, 2003). Teleworkers in Finland number 150,000; their percentage of the labour force is 6.3% (Biaizpe, 2001).

5.1.5.5 **France:** France today is one of the most modern countries in the world and is a leader among European nations. It is located in western Europe, bordering the Bay of Biscay and the English Channel, between Belgium and Spain, southeast of the UK and bordering the Mediterranean Sea between Italy and Spain with an area of 547.030 sq km. It has a climate that has generally cool winters and mild summers, but mild winters and
hot summers along the Mediterranean, with an occasional strong, cold, dry, north-to-northwesterly wind known as the Mistral. The capital of France is Paris and the population of France which uses French is 100% (1). There is air pollution from industrial and vehicle emissions. France is in the midst of transition, from a well-to-do modern economy that features extensive government ownership and intervention, to one that relies more on market mechanisms. France's population is estimated to be 59,303,800 (2003 est.). The labour force totals 26.6 million (2001 est.) which is divided into three categories: services 71%, industry 25% and agriculture 4% (1997). The rate of unemployment is 8.9% (2001 est.) (Countryreports, 2003; Internet-World-Stats, 2003).


There are no particular laws established in France concerning ework. However, new legislative measures have been initiated or are under discussion about the information society (Johnston & Nolan, 2002). Appendix (3) illustrates some changes in France's legislation regarding ework.

5.1.5.6 Germany: As Europe's largest economy and most populous nation, Germany remains a key member of the continent's economic, political and defence organisations. It is located in central Europe, bordering the Baltic Sea and the North Sea, between the Netherlands and Poland, south of Denmark with an area of 357,021 sq km, and a climate which is temperate and marine with cool, cloudy, wet winters and summers and an occasional warm wind. Its capital is Berlin and the sole language is German. Germany's population was estimated in 2003 at 81,904,100. The labour force totals 41.9 million (2001) and has an unemployment rate of 9.4% (2001). They are three kinds of industry

(1) Rapidly declining regional dialects and languages (Provencal, Breton, Alsatian, Corsican, Catalan, Basque, Flemish).
33.4%, agriculture 2.8% and services 63.8% (1999) (Countryreports, 2003; Internet-World-Stats, 2003).

It is important to clarify the network of communication in Germany. Concerning the Internet, there are 200 (2001) ISPs and 43.664.571 (2003) Internet users. Regarding telephones and mobiles, there are 50.9 million (March 2001) main line telephone in use, and 55.3 million (June 2001) mobiles (Countryreports, 2003; Internet-World-Stats, 2003). Telework in Germany started to diffuse and penetrate to a larger extent in the 90s and is slowly being expanded and replaced by a variety of different forms of flexible working, commonly summarised under the name of eWork (Johnston & Nolan, 2002). Teleworkers in Germany total 600.000; their percentage in the labor force is 1.9% (Biaizpe, 2001). An example of German teleworking is now in place at the German headquarters of Sun Microsystems in Heimstatten where 680 of the total staff of 980 take part in desk-sharing (Johnston & Nolan, 2002). For more information concerning German cases, see Appendix (3).

5.1.5.7 Greece: Greece achieved its independence from the Ottoman Empire in 1829. Its location is in southern Europe, bordering the Aegean Sea, the Ionian Sea and the Mediterranean Sea, between Albania and Turkey with an area of 131.940 sq km. Its climate is temperate with mild, wet winters and hot, dry summers. Greece's capital is Athens. The official language of Greece is the Greek language (99%). English and French are also used. The population of Greece is estimated at 10.645.343 (July 2002 est.). 4.32 million (1999 est.) of these are part of the Greek labour force that is divided into industry 21%, agriculture 20% and services 59% (2000 est.). In Greece, the rate of unemployment is considered to be high at 11% (2001 est.) (Countryreports, 2003).

Regarding the infrastructure of the Internet and telephones, Greece has 5.431 million (1997) main lines telephones in use, 937.700 (1997) mobile cellular telephones, 27 (2000) ISPs and 1.33 million (1999) users of the Internet (Countryreports, 2003). Teleworkers in Greece number 20.000; their percentage of the labour force is 0.5% (Biaizpe, 2001). A good example in Greece of teleworking is the Pilot tele-medicine programs which were developed during the last years by the connection of remote islands with central hospitals in Athens (Johnston & Nolan, 2002).
IT technologies and e-work are expected to achieve a higher rate of growth in Greece for it to be an “information society”. There is no doubt that IT and e-work in Greece may be developed to a satisfactory level (Johnston & Nolan, 2002).

5.1.5.8 Hungary: Hungary was part of the polyglot Austro-Hungarian Empire, which collapsed during World War I. Its location is in central Europe, northwest of Romania with 93,030 sq km of area. It has a temperate climate with cold, cloudy and humid winters and warm summers. Budapest is the capital of Hungary. The main language is Hungarian 98.2% with others 1.8%. Hungary continues to demonstrate strong economic growth and to work toward accession to the European Union. The population of Hungary is estimated to be 10,075,034 (July 2002 est.) with a -0.3% (2002 est.) of growth rate. 3.5 million (2001) are part of the labour force that is categorised into three kinds: services 65%, industry 27% and agriculture 8% (1996). The rate of unemployment is 6.5% (2001 est.) (Countryreports, 2003; Wesselenyi, 2001).


"According to ECOSTAT Research, about 25,000 people in Hungary do some work on a home computer. Most of this work is done in occupations such as accounting, translation, typing/editing, research, planning and design" (Wesselenyi, 2001).

5.1.5.9 Italy: Italy became a nation-state in 1861. It is located in Southern Europe and is a peninsula extending into the central Mediterranean Sea, northeast of Tunisia, with an area of 301,230 sq km. Its climate is predominantly Mediterranean but is Alpine in the far north and hot and dry in the south. Its capital is Rome. Italian is the official language. Air pollution is caused by industrial emissions such as sulphur dioxide and coastal and

(1) German (parts of Trentino-Alto Adige region are predominantly German speaking), French (small French-speaking minority in Valle d'Aosta region), Slovene (Slovene-speaking minority in the Trieste-Gorizia area).
inland rivers are polluted by industrial and agricultural effluents. Italy has a diversified industrial economy with roughly the same total and per capita output as France and the UK. The Italian population is estimated at 56,209,900 (2003 est.) with 23.6 million (2001 est.) in the labour force that falls into three categories: services 63%, industry 32% and agriculture 5% (2001). It is considered to have one of the highest unemployment rates 10% (2001 est.) (Countryreports, 2003; Internet-World-Stats, 2003).

“One of the results has been the creation of a fertile terrain for the expansion of ework among Italian companies and institutions” (Johnston & Nolan, 2002). Regarding its communication infrastructure, Italy has 25 million (1999) main line telephones in use, 20.5 million (1999) mobile cellular telephones, 93 ISPs (2000) and 18,697,197 (2003) Internet users (Countryreports, 2003; Internet-World-Stats, 2003). Teleworkers in Italy amount to 250,000; their percentage of the labour force is 1.2% (Biaizpe, 2001).

5.1.5.10 The Netherlands: The Kingdom of the Netherlands was formed in 1815. In 1830, Belgium seceded and formed a separate kingdom. It takes its own place in Western Europe, bordering the North Sea and between Belgium and Germany with an area of 41,526 sq km. Its climate is temperate and marine, with cool summers and mild winters. The capital of the Netherlands is Amsterdam but The Hague is the seat of government. The official language is Dutch. Air pollution is caused by vehicles and refining activities. An estimation of the Netherlands’ population is 16,258,300 (2003 est.) and its labour force is 7.2 million (2000) who fall into three categories: services 73%, industry 23% and agriculture 4% (1998 est.). It has a low rate of unemployment at 2.4% (2001) (Countryreports, 2003; Internet-World-Stats, 2003).

Concerning the Netherlands as an electronic country, it is not surprising that the Netherlands is one of the European countries where ework is most widespread and has an overall high take up of ICTs. It has 9,132,400 (1999) main line telephones, 4,081,891 (April 1999) mobile cellular telephones, 52 (2000) ISPs and 10,351,064 (2003) Internet users (Countryreports, 2003; Internet-World-Stats, 2003; Johnston & Nolan, 2002). IDC estimates that formal eworkers number 300,000(1) (Johnston & Nolan, 2002). Legislation and regulations are dated and are largely based on traditional home working and are, in

(1) Taking the broad definition of ework, including informal ework and the use of ICTs for mobile working, call centre work, etc
some aspects, inappropriate for modern eworkers (Johnston & Nolan, 2002). Appendix (3) shows two cases from the Netherlands.

5.1.5.11 Portugal: Following its heyday as a world power during the 15th and 16th centuries, Portugal lost much of its wealth and status with the destruction of Lisbon in a 1755 earthquake, occupation during the Napoleonic Wars, and the independence in 1822 of Brazil as a colony. Its location is in South western Europe, bordering the North Atlantic Ocean, west of Spain with 92.391 sq km of area. Its climate is maritime temperate: cool and rainy in the north, warmer and drier in the south. The capital of Portugal is Lisbon and the official language is Portuguese. Air pollution is caused by industrial and vehicle emissions. The population of Portugal is estimated at around 10.084.245 (July 2002 est.). The labour force is estimated at 5.1 million (2000) is divided into three categories: services 60%, industry 30% and agriculture 10% (1999 est.). 4.4% (2001 est.) is the unemployment rate (Countryreports, 2003).

Main-line telephones in use total 5.3 million (year end 1998), and mobile-cellular telephones number 3.074.194 (1999). Moreover, Portugal has 16 (2000) ISPs and 3.459.000 (at the end of 2001) users of the Internet (Countryreports, 2003). Teleworkers in Portugal total 60.000 and their percentage of the labour force is 1.3% (Biaizpe, 2001; Johnston & Nolan, 2002).

5.1.5.12 Romania: Its location is in South eastern Europe, bordering the Black Sea, between Bulgaria and Ukraine, with an area of 237.500 sq km and a climate that is temperate with cold, cloudy winters with frequent snow and fog and sunny summers with frequent showers and thunderstorms. Its capital is Bucharest. There are three languages used in Romania: Romanian, Hungarian and German. Romania, one of the poorest countries of Central and Eastern Europe, began the transition from Communism in 1989 with a largely obsolete industrial base and a pattern of output unsuited to the country's needs. The population of Romania is close to 22.317.730 (July 2002 est.) with a negative growth rate (-0.21% (2002 est.)). 9.9 million (1999 est.) comprise the labour force which is divided into three kinds: agriculture 40%, industry 25% and services 35% (1998). The rate of unemployment is 9.1% (2001) (Countryreports, 2003).

5.1.5.13 **Russia**: Russia's location is in northern Asia, bordering the Arctic Ocean, between Europe and the North Pacific Ocean with an area of 17.075.200 sq km. The climate of Russia ranges from the Steppes in the south through to a humid continental climate in much of European Russia. Subarctic is subarctic and the climate is tundra in the polar north. Winters vary from cool along Black Sea coast to frigid in Siberia; summers vary from warm in the Steppes to cool along the Arctic coast. Its capital is Moscow. The Russian language is mainly spoken. Air pollution is caused by heavy industry, emissions of coal-fired electric plants, and transportation in major cities both industrial and municipal. The population of Russia is estimated at around 141.364.200 (2003 est.) with a negative growth rate -0.33% (2002 est.). The labour force in Russia is estimated at 71.3 million (2001 est.) who are categorised into three kinds: agriculture 10.8%, industry 27.8% and services 61.4% (2001 est.). The rate of unemployment is 8.7% (2001 est.). There is also considerable underemployment (Countryreports, 2003; Internet-World-Stats, 2003).


5.1.5.14 **Spain**: Spain's powerful world empire of the 16th and 17th centuries ultimately yielded command of the seas to England. It is placed in South western Europe, bordering the Bay of Biscay, the Mediterranean Sea, the North Atlantic Ocean, and the Pyrenees and southwest France with an area of 504.782 sq km. Its climate is temperate with clear, hot summers in the interior, more moderate and cloudy along the coast, cloudy, cold winters in the interior, and partly cloudy and cool along the coast. Its capital is Madrid. The languages used are Castilian Spanish (official) 74%, Catalan 17%, Galician 7% and Basque 2%. The population of Spain is estimated at around 41.547.400 (2003 est.) with a high rate of unemployment 13% (2001 est.). It has 17.1 million (2001) in its labour force that fall into three categories: services 64%, manufacturing, mining and
construction 29% and agriculture 7% (2001 est.). Reducing unemployment will pose a challenge to Spain over the next few years (Countryreports, 2003; Internet-World-Stats, 2003).

Regarding its communication network, Spain has 17.336 million (1999) main line telephones, 8.394 million (1999) mobile cellular phones, 56 (2000) ISPs and 13.076.212 (2003) users of the Internet (Countryreports, 2003; Internet-World-Stats, 2003). Teleworkers in Spain total 80.000 and their percentage of the labour force is 0.6% (Biaizpe, 2001). Spain is now one of the countries in the European Union where the number of eworkers is increasing sharply; it is estimated that, in the year 2005, eWork in Spain will consist of 1.4% of the working population (Johnston & Nolan, 2002).

5.1.5.15 Sweden: A military power during the 17th century, Sweden has not participated in any war in almost two centuries. It has its own location in Northern Europe, bordering the Baltic Sea, the Gulf of Bothnia, Kattegat and Skagerrak, and between Finland and Norway with an area of 449,964 sq km. It has a climate that is temperate in the south with cold, cloudy winters and cool, partly cloudy summers; it is subarctic in the north. The capital of Sweden is Stockholm, and the official and sole language is Swedish. Aided by peace and neutrality for the whole 20th century, Sweden has achieved an enviable standard of living under a mixed system of high-tech capitalism and extensive welfare benefits. It has a modern distribution system, excellent internal and external communications, and a skilled labour force. The population of Sweden is estimated at 8.872.600 (2003 est.). The labour force totals 4.3 million (March 2002) which falls into three categories: agriculture 2%, industry 24% and services 74% (2000 est.). The rate of unemployment was estimated in 2000 at 3.9% (Countryreports, 2003; Internet-World-Stats, 2003; Johnston & Nolan, 2002).


(1) Sweden has the highest percentage of mobile phone use in Europe, the cheapest.
The Swedish government decided in 2000 to make the information society available to every household and enterprise by broadband access. IDC ranks Sweden as the number one IT nation in the World for the third year in a row. For example, there are 360 companies defined as call centres with approximately 10,000 employees (Johnston & Nolan, 2002).

5.1.5.16 Switzerland: Switzerland's independence and neutrality have long been honoured by the major European powers and Switzerland was not involved in either of the two World Wars. Its location is in central Europe, east of France and north of Italy, with an area of 41,290 sq km and a climate that is temperate but varies with altitude. It has cold, cloudy, rainy/snowy winters and cool to warm, cloudy, humid summers with occasional showers. The capital of Switzerland is Bern. It has three official languages: German 63.7%, French 19.2% and Italian 7.6%, while Romansch is spoken by few 0.6%, and others 8.9%. Air pollution is caused by vehicle emissions. The population of Switzerland was estimated in 2003 at 7,376,000 (2003 est.). Its labour force totals 4 million (2001), divided by occupation into services 69.1%, industry 26.3% and agriculture 4.6%. The rate of unemployment is (1998) 1.8% (2001) (Country reports, 2003; Internet-World-Stats, 2003).


It is important to say regarding teleworking in Europe that most European cases show an increasing belief in teleworking, especially in western countries. At the same time, the European Union does not have the capacity to generate as much employment as the United States. In Sweden's case, there seems to be a 'silent movement' to mobile working supported by wireless technologies (Johnston & Nolan, 2002). For example, the THINK project integrated 300 disabled people as teleworkers in seven European countries (60 in Portugal, 60 in Spain, 60 in Italy, 40 in Greece, 20 in Scotland, 20 in Latvia, 20 in Lithuania and 20 in Estonia). All services were performed for disabled

Sweden has the highest broadband penetration and the lowest telecom rates in Europe. According to IDC, Sweden has the world's largest cluster of telematics companies and is leading research country on wireless communication technologies.

THINK: Towards Handicap Integration Negotiating Knowledge
people through teleworking from home in these areas: helpdesk; remote assistance, 
programming, translations, desktop publishing, data processing, transcriptions, direct 
marketing and consulting (THINK, 2002). Concerning the future of teleworking in the 
European countries, “DC has forecast that the numbers of teleworkers in Europe will increase to 
over 28.8 million by 2005, up from 10 million last year” (Online Recruitment (onrec), 2001). 
The next section covers the case of teleworking in Australia.

5.1.6 Australia: Australia became a commonwealth of the British Empire in 1901. 
Long-term concerns include pollution, particularly depletion of the ozone layer, and the 
management and conservation of coastal areas, especially the Great Barrier Reef. A 
referendum to change Australia's status, from a commonwealth headed by the British 
monarch to an independent republic, was defeated in 1999. It is located in Oceania, a 
continent between the Indian Ocean and the South Pacific Ocean with area of 7.686.850 
sq km and a population of 19.918.161 (25 August 2003). Its workforce totals 9.2 million 
(December 2001) with a 6.7% (2001) unemployment rate. Its first language is English 
and the capital is Canberra. It is considered to be a wide area of country (Countryreports, 

Regarding the infrastructure of telephones and the Internet: 10.05 million (2000) main 
line telephones are in use, 8.6 million (2000) mobile cellular telephones, 603 (2001) ISPs 
and there are 12.651.597 (2003) users of the Internet (Countryreports, 2003; 
Internet-World-Stats, 2003).

To sum up the first part of Chapter Five, it can be concluded that the previous cases of 
teleworking need to be discussed according their profile of population, labour force, ICT 
infrastructure, legislation, air pollution, weather, etc. All of these criteria and others will 
be discussed at Chapter Nine (the discussion chapter). An in-depth understanding of 
teleworking in the UK is also needed so the teleworking practice in the UK is covered in 
the second part.
Part Two: Teleworking in the United Kingdom (UK)

The main aim of this part is to provide information that is related to teleworking in the United Kingdom. This style of working has taken place in the last decade of the 20th century and appears to decision-makers as a new way of decreasing unemployment and solving many family problems. According to this aim, this part of Chapter Five will be directed to clarifying the following points: a background of the UK and its application of teleworking, the labour force of the UK, the teleworkers' association, teleworkers' legislation, international comparisons, the future directions of UK teleworking, and some cases in the UK.

5.2.1 Background and History of Teleworking

Great Britain, the dominant industrial and maritime power of the 19th century, played a leading role in developing parliamentary democracy and in advancing literature and science. Its location is in Western Europe and it is a group of islands including the northern one-sixth of the island of Ireland between the North Atlantic Ocean and the North Sea, northwest of France with area of 244,820 sq km. Its own climate is temperate, moderated by the prevailing southwest winds over the North Atlantic Current; more than one-half of the days are overcast. The population of the UK mainly uses English, Welsh (about 26% of the population of Wales), and a Scottish form of Gaelic (about 60,000 in Scotland). The UK, a leading trading power and financial centre, is one of the quartet of trillion dollar economies of Western Europe and so is still one of the strongest economies in Europe. Inflation, interest rates and unemployment remain low, and the government expected growth of 2% to 2.5% in 2002. The UK's population was estimated in 2003 at 59,040,300. Roughly half of these are considered as part of the labour force (28,207,135 (2001)) who fall into three categories: agriculture 1%, industry 25% and services 74% (1999). The rate of unemployment is 5.1% (2001 est.) (Countryreports, 2003; Internet-World-Stats, 2003).
Regarding the infrastructure of the Internet and telephones\(^{(1)}\), the UK has 34.878 million (1997) main line telephones, 13 million (year end 1998) mobile cellular telephones, 245 (2000) ISPs and 34.387.216 (2003) users of the Internet (Countryreports, 2003; Internet-World-Stats, 2003). “Over the second quarter of 2002, an estimated 11.1 million households in the UK could access the Internet from home representing 45% of all households” (Office of National Statistics, 2002b). The latest official government statistics illustrated that the number of teleworkers had grown to 2.2 million people in 2002, amounting to 7.4% of the total labour force (Hotopp, 2002).

“The UK public sector has traditionally been at the forefront of applying conventional flexible working practices such as flexitime, job-sharing, term-time working, part-time jobs and so on. This is often because it has to attract and retain staff in competition with the private sector, which tends to pay more” (Johnston & Nolan, 2002).

Many employers are forced to consider alternative locations. For example, two of the UK’s largest banks are relocating out of the City of London to the new Docklands business district and are actively considering new ways of working in the process. This forced relocation is caused by three main reasons: (1) The pressure on public transport, (2) disruption to services, and (3) a £5 charge for driving into central London (Johnston & Nolan, 2002).

5.2.2 Teleworkers in the UK

There are considerable differences in the number of teleworkers between different industries and hence, it is difficult to find a full-description of teleworker statistics for recent years. About 25% of teleworkers worked in real estate, renting and business activities, with very few in energy and water (Hotopp, 2002). As mentioned before, the labour force is estimated at 28 million and the UK has 1.78 million teleworkers. It can be seen in the table below that the total number of male teleworkers is greater than the total for females. This table also shows three categories of teleworkers: telehomeworkers,

\(^{(1)}\) general assessment: technologically advanced domestic and international system

domestic: equal mix of buried cables, microwave radio relay, and fiber-optic systems
international: 40 coaxial submarine cables; satellite earth stations - 10 Intelsat (7 Atlantic Ocean and 3 Indian Ocean), 1 Inmarsat (Atlantic Ocean region), and 1 Eutelsat; at least 8 large international switching centres.
mobile teleworkers and occasional teleworkers. The most numerous are mobile teleworkers, then occasional teleworkers and finally telehome-workers.

<table>
<thead>
<tr>
<th></th>
<th>Telehome-workers</th>
<th>Mobile-teleworkers</th>
<th>Occasional-teleworkers</th>
<th>All teleworkers</th>
<th>eEnabled remote workers</th>
<th>Other workers</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>186.700</td>
<td>650.196</td>
<td>366.948</td>
<td>1.203.844</td>
<td>216.803</td>
<td>14.088.724</td>
<td>15.509.371</td>
</tr>
<tr>
<td>Total</td>
<td>394.665</td>
<td>823.772</td>
<td>561.585</td>
<td>1.780.022</td>
<td>355.383</td>
<td>26.071.730</td>
<td>28.207.135</td>
</tr>
<tr>
<td>% of workforce</td>
<td>1.4%</td>
<td>2.92%</td>
<td>1.99%</td>
<td>6.31%</td>
<td>1.26%</td>
<td>92.43%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table (5.1) Telework in the UK in 2002 by gender (Office of National Statistics, 2002a)

Equally, the total number of teleworkers could be divided according to their mode of work. As seen below, the total of full-time teleworkers is greater than part-time teleworkers, numbering 1.413.750 and 365.018 respectively.

<table>
<thead>
<tr>
<th></th>
<th>Telehome-workers</th>
<th>Mobile-teleworkers</th>
<th>Occasional-teleworkers</th>
<th>All teleworkers</th>
<th>eEnabled remote workers</th>
<th>Other workers</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time</td>
<td>219.250</td>
<td>688.724</td>
<td>505.776</td>
<td>1.413.750</td>
<td>279.400</td>
<td>19.496.723</td>
<td>21.189.873</td>
</tr>
<tr>
<td>Part-time</td>
<td>174.595</td>
<td>134.614</td>
<td>55.809</td>
<td>365.018</td>
<td>75.983</td>
<td>6.568.563</td>
<td>7.009.564</td>
</tr>
<tr>
<td>p/t as % of total</td>
<td>44.33%</td>
<td>16.35%</td>
<td>9.94%</td>
<td>20.52%</td>
<td>21.38%</td>
<td>25.20%</td>
<td>24.86%</td>
</tr>
</tbody>
</table>

Table (5.2) Telework in the UK in 2002, by working hours (Office of National Statistics, 2002a)
It can be deduced from the above table that half of UK teleworkers are mobile teleworkers, others are home-workers and occasional teleworkers (client site teleworkers, telecentre teleworkers). It is also important to clarify some characteristics of UK teleworkers. Their occupations are listed below:

<table>
<thead>
<tr>
<th></th>
<th>Employed teleworkers</th>
<th>Self-employed teleworkers</th>
<th>Total(^0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers and senior officials</td>
<td>328.988</td>
<td>90.989</td>
<td>419.977</td>
</tr>
<tr>
<td>Professional occupations</td>
<td>242.011</td>
<td>135.841</td>
<td>377.852</td>
</tr>
<tr>
<td>Associated professional &amp; technical</td>
<td>169.451</td>
<td>193.531</td>
<td>362.982</td>
</tr>
<tr>
<td>Administrative and secretarial</td>
<td>79.512</td>
<td>36.314</td>
<td>115.826</td>
</tr>
<tr>
<td>Skilled trades</td>
<td>48.102</td>
<td>181.526</td>
<td>229.628</td>
</tr>
<tr>
<td>Personal services</td>
<td>17.382</td>
<td>13.921</td>
<td>31.303</td>
</tr>
<tr>
<td>Sales and customer services</td>
<td>24.591</td>
<td>14.139</td>
<td>38.73</td>
</tr>
<tr>
<td>Process, plant and mechanical ops</td>
<td>2.033</td>
<td>25.545</td>
<td>27.578</td>
</tr>
<tr>
<td>Elementary occupations</td>
<td>5.367</td>
<td>16.106</td>
<td>21.473</td>
</tr>
<tr>
<td>All</td>
<td>917.437</td>
<td>707.912</td>
<td>1,625.349</td>
</tr>
</tbody>
</table>

Table 5.3 Occupations of the UK teleworkers in 2001 (Johnston & Nolan, 2002)

The table above demonstrates the two main kinds of UK teleworkers: employee teleworkers (who represent around 56% of the total teleworkers) are more numerous than the self-employed teleworkers. Managers and senior officials scored the highest percentage of UK teleworkers. The table below shows the qualifications of UK teleworkers.

\(^0\) The original data in the total column did not reflect the total of employed and self-employed teleworkers. So, the researcher recalculated them again and restated the right total.
## Table 5.4 Qualifications of UK eworkers in 2001 (Johnston & Nolan, 2002)

<table>
<thead>
<tr>
<th>Qualifications</th>
<th>Workforce</th>
<th>eworkers</th>
</tr>
</thead>
<tbody>
<tr>
<td>University degree or equivalent</td>
<td>15.13%</td>
<td>36.50%</td>
</tr>
<tr>
<td>Higher education</td>
<td>8.26%</td>
<td>12.71%</td>
</tr>
<tr>
<td>GCE A Level or equivalent</td>
<td>23.87%</td>
<td>24.07%</td>
</tr>
<tr>
<td>GCSE grades A-C or equivalent</td>
<td>22.16%</td>
<td>14.56%</td>
</tr>
<tr>
<td>Other qualifications</td>
<td>13.64%</td>
<td>7.03%</td>
</tr>
<tr>
<td>No qualification</td>
<td>16.26%</td>
<td>4.82%</td>
</tr>
</tbody>
</table>

|   |   |   |

Regarding the qualifications of teleworkers, it seems that roughly half of them have a university degree or have experienced higher education to a greater extent than the total UK workforce. It could be said that teleworking requires a higher level of education than the normal workforce.

### 5.2.3 Legislation of Teleworking

The law in the UK is aware of employment rights and conditions. These rights need to be focused on social as well as organisational aspects. The teleworker has his/her own rights in terms of equal pay, lifestyle testing, references, taxation, working time, employment contracts, family policies, pensions, sick pay and unfair dismissal. In effect, employers have the same legal obligations towards employees working remotely, including those working at home, as they do towards employees in a traditional office. Recent UK tax law changes have affected the home use of employers’ PCs (Denbigh, 2001).

There are many considerations that must be adopted in contracts of employment. The Department of Trade and Industry (2003) has presented some of these considerations:

- **Place of work**
- **Hours of work.** Greater flexibility within the limits of the Working Time Regulations may be possible, perhaps with a set ‘core’ time when remote workers undertake to be working or to be contactable. There may be a need to have an agreement regarding attendance at on-site team meetings. Equally the employee
needs to know on what basis the reporting manager and the other company personnel are contactable.

- Extra responsibilities or duties. This may include procedures for reporting to the office.
- Expenses policies may have to be altered, for example, to allow claims for expenses to attend team meetings or travel to the office for other reasons.
- For home-based workers: allowances for business rates, heating, lighting, wear and tear may be considered. For home-based workers, access arrangements to the working area may need to be clarified. Health and safety requirements mean that an employer has a responsibility to assess the home workplace (e.g. for the electrical power supply, safety of equipment, ergonomic use of equipment).
- For home-based workers, provision of equipment by the employer. Provision of telephone line/ISDN line for work purposes. Equipment and data security procedures, including back up. Maintenance arrangements.
- Employer's insurance may need to be extended to cover work equipment not kept in the office, including equipment used on the move. Workers using their own equipment for work purposes should check whether such use is covered by their home insurance policy.
- The statutory minimum set by the Working Time Regulations and sick leave arrangements must be kept in line.
- Procedures if the teleworker wishes to return to working in the office.

5.2.4 Telework Association (TCA) in the UK

A brief outline of The Telework Association (TCA) is required because the members of TCA were invited to participate in investigating the information flow in the VOs. However, Johnston and Nolan (2002) defined TCA (the TeleCottage Association) as “the biggest telework association in the UK. Although its roots are in the telecottage movement its full title is The Telework, Telecottage and Telecentre Association”. More than 800 people and organisations have joined since 1993. The TCA aims to improve the quality of life for workers by improving access to work and focuses on individuals, corporate schemes and telecottage managers (TCA, 2003; Denbigh, 2003(\textsuperscript{5})). This is a UK

(\textsuperscript{5} Denbigh A., 2003, TCA profile, Telephone Interview by Saleh Al halalat, 9 September, 2003.)
association with 150 centres whose members include the self-employed, company employees working from home, and companies introducing teleworking. It produces a teleworker magazine, handbook, an advice line, seminars and training (Internet Homeworking Directory, 2003). Furthermore, an electronic weekly newsletter is sent to the TCA members to provide them with news of teleworking, new opportunities, etc.

5.2.5 Case Studies in the UK

Stephen Meyler presented his own view of work: “Work is not a place, it is something we do” (Meyler, 2001). This concept is accepted by many in the UK as well as in other parts of the world. The change of place is considered with regard to carrying out the work effectively. There are many such cases in the UK. The most important of them are: BT, Microsoft, British Gas, RNIP, and John Laing Property (JLP). A description of each case is highlighted below:

The case of BT: The official name of BT is British Telecommunications plc and its main function is as a communication provider and operator in this type of market. It is under private ownership and has been operating as such since 1984 (BT, 2003b). In 1993, BT launched the workstyle option 2000. This flexible working programme is considered to be the largest in Europe and saved £180m (see Appendix 4) a year in property costs (BT, 2003c). Recently, BT has the largest intranets in Europe (RNIB, 2005). Hopkinson and James (2001), in their study, found that most BT teleworkers expect home-based flexi-working to be beneficial in terms of reduced travel time, cost, stress and associated family benefits. However, a minority feel that they are being pressured into it and that it will therefore increase stress. Moreover, in March 2002, 5128 BT teleworkers were asked to give their perception about the social side of teleworking. The majority of them felt that they had a better life through teleworking than if they commuted to an office. Additionally, it appears that BT teleworking not only creates personal benefits, but also public ones in the form of greater involvement in community and volunteering activities, and perhaps also greater use of local services (Hopkinson, James and Maruyama, 2002a).
The case of Microsoft: Microsoft\(^{(0)}\) has recently arranged with BT to offer home ADSL access to 1500 UK employees. This is the first corporate customer of a service that uses DSL technology to connect home workers to their employees (Fielding, 2002).

The case of British Gas: According to Wustemann (2001), workers from a call centre in British Gas have joined the Automobile Association’s telework programme. Roughly 25 employees of British Gas Services now complete their tasks on a full-time basis answering customer enquiries. In the Leeds area, there are now 50 teleworkers and another 100 based near the AA’s remaining call centres at Newcastle and Cheadle near Manchester. Staff are no longer recruited directly into homeworking. Staff at the centres normally work a single 8.75-hour shift. Teleworkers now work various hours according to business needs.

The case of the RNIB: The RNIB is a UK charity which provides services for the blind and partially sighted. It has recently begun to recruit home-based telesalespersons for fundraising campaigns and already has around 700 people working for between 15 and 20 hours per week; they are paid up to £5.50 per hour. A telephone access code is used so that phone costs are billed direct to the RNIB and work is received and sent off when complete by post. Training is provided at the charity’s expense (BT, 2002).

The case of John Laing Property (JLP): In fact, this case is different from the others as it uses a relocating approach for satisfying its needs. It has relocated its office to the centre of London. JLP stated that flexible 'futurespace' will allow the use of offices and reports that the company has moved into an office half the size of the original one but in a central London location and with limited additional cost. Susie Gray emphasised that productivity increases (see Appendix 4). Six staff members are based full-time in the office where they provide the necessary management, administrative and support functions. JLP approached the move as an opportunity to enter new markets by providing a showcase office to investors and end-users (BT, 2003a).

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\(^{(0)}\) In 2002, Microsoft came second in the Sunday Times 100 Best Companies to Work For ranking, and picked up a special award for its commitment to a work/life balance.
Reducing the costs of accommodation and overcrowding in offices are the main two aims for organisations nowadays. There is a growing realisation that better mobility can lead to better performance (Millar, 2003). One of the many solutions is increasing numbers of staff working from home. Then, IT managers find themselves facing a vital challenge. They are asked to protect the integrity of email and other data being transmitted to corporate networks over dial-up links (ITWEEK, 2002). It means that reducing costs will not be available without many precautions.

Maximizing worker's rights in this new style of working may cut costs. For example, a report by the Institute of Employment Studies (IES) shows that the UK only uses 30% of its teleworking potential (Huws, Jagger and Bates, 2001). Implementing a teleworking infrastructure will help the UK to maximise the benefits of teleworking potential. Many organisations are now looking at virtual private networks (VPNs(s)), a low cost alternative to expensive leased lines. In fact, the trend towards remote and mobile working is driving the virtual private network (VPN(2)) towards the status of a commodity technology (ITWEEK, 2002; Stevens, 2003).

Regarding the growth of teleworkers in the UK, the Department of Trade and Industry in the UK notes that throughout the period 1997 to 2001, the total number of teleworkers has increased by between 65 and 70 percent (Hotopp, 2002). An international comparison shows that teleworking in the UK is only equivalent to the average in the EU. Germany and France have the smallest proportion of employed people working as teleworkers, while Finland has the highest proportion (Hotopp, 2002; Virtualni Informacni Par, 2002). The UK teleworkers' population is estimated to grow to reach 8.3 million by 2005, according to BT commissioned research (Fielding, 2002). It is estimated that the number of teleworkers in 2010 will be around 10 million (Biaizpe, 2001). After 25 years this number will be between 80 to 90 million compared with the USA which will rank at the highest level with more than 140 million teleworkers (Nilles, 1998).

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(1) A VPN is a way to use the Internet to provide remote offices or individual users with secure access to their organisation's network (ITWEEK, 2002).

(2) While the cost of deploying a VPN based on the IP Secure (IPSec) protocol may be falling, this type of solution is still far from straightforward and does not provide the kind of extensive access controls needed to secure the extended enterprise.
Conclusions: This chapter, regarding teleworking throughout the world, has presented an overview of teleworking in 23 countries as well as teleworking in the UK. To achieve this aim, the chapter was divided into two parts.

Part one dealt with providing information of teleworking worldwide (USA, Canada, Brazil, Europe, Asia and Australia). The first finding is related to a lack of teleworking statistics, which are not up to date and sometimes estimated. This lack of statistics causes limitations in studying the practice and progress of teleworking. Understanding the real information needs of teleworkers is not easy before identifying the profile, definitions, and statistics of teleworkers. Hence, it is vital to start with defining teleworking, finding more reliable statistics of teleworking, and identifying the teleworkers profiles. This finding will help in understanding the information needs of teleworkers. The second finding is related to the importance of managing the differences of time zones, and languages across locations, otherwise, a lack of information flow can be found. The third finding is the application of teleworking style. The results indicated that the vast majority of cases may have some problems with air pollution, their weather is mostly cold, and they can be considered as information societies. Therefore, there may be a need for applying the teleworking style in the rural areas and the capitals. The derived lesson here is concerned with a slight indicator for applying the teleworking style in the other parts of the world such as the Middle East, particularly the Gulf Area, which has a lot of issues such as working in high temperatures, high air pollution and high funding of establishing the ICT infrastructure. The fourth finding that leaders of teleworking were identified such as Finland and its leading position in teleworking in Europe. The potential growth of teleworking in the USA was highlighted.

The second part, which was entitled “Teleworking in the United Kingdom”, provided the background on teleworking in the UK, including the labour force, legislation, case studies, the Telework Association (TCA), and some trends in the near and far future. In fact, the UK is considered to be a teleworkable country and may also be an information society. Also, the findings indicated a lack of teleworking statistics, which means there is need of understanding the teleworkers profile. A discussion of all of these results and others will take place in Chapter Nine (the discussion chapter). The next chapter deals with the management of the study survey. This provides a clear view of the designed questionnaire and interviews, as well as the management of the pre-test, the pilot-test and the main survey.
Chapter Six

Survey Management

6.1 Introduction

This chapter is devoted to the management of the survey, the purpose of which is to solve the problem posed by the study by modifying suitable methods. These methods basically rely on a questionnaire and interviews. A designed questionnaire, containing a list of closed and open-ended questions, was devised by the researcher, the aim of which was to collect data relevant to the information flow and the ICTs used in the virtual organisations. Besides, suitable semi-structured interviews were adopted to collect other pieces of data regarding the study problem and were used to support the questionnaire. Both of these involved problem-solving procedures. Before starting with the survey strategies (the questionnaire and interview), the population and sample of the research study needs to be clarified. This chapter is divided into three main sections: the research population (sample), the questionnaire and the interview.

6.2 Research Population (Sample)

According to the basic rules of research methods, choosing a sample from the specified population is an important issue so the definition of the population and sample should be presented clearly. "Population" refers to everyone in a well-defined group and the only way to get the population value is to measure everyone in the population (Hopkins, 2001). But, in real life, it is difficult to do that as there are some obstacles and limitations, time and cost being the main ones. Below, the population frame, population elements, the sample frame, sample elements, representativeness and generalisability are offered.

Population Frame (population elements): All the members of the Teleworker Association (TCA) in the UK were the population of this research. A weekly electronic newsletter\(^{1}\) was sent to them by the Executive Director (Mr. Alan Denbigh). This population consisted of roughly 800 members (according to the interview with Mr. Alan Denbigh, 2003). These members worked in various companies, government departments

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\(^{1}\) This e-newsletter is distributed from TC office to its members via their emails. It usually has: last news of teleworking, job offers, seminars, conferences, studies, article, technical support, articles, links, and new regulations.
and some were self-employed teleworkers. Respondents also had various profiles in terms of education, age, experience, living and working areas, as well as fields of work.

Sample Frame (Sample Elements): According to the size of the population and the capacity of the research, it seems not prohibitive in terms of time, cost, access and other human resources to consider the population as a target sample. Applying the IA Model in any case requires agreement or a contract, which was achieved through several contacts with the executive director of the TCA. So, the sample frame consists of all the TCA members, 800 in total and the designed questionnaire was distributed to all of these.

Representativeness and Generalisability: Basically, Silverman (2005, p126) stated that: “generalisability is a standard aim in quantitative research and is normally achieved by statistical sampling procedures”. In this research, the population was selected as the sample. Therefore, the representativeness was high and any result obtained from the data analysis could be generalised to the population as a whole. By this method, the sample statistic (e.g., $\bar{x}$, $s$) is fairly close to the population parameter (e.g., $\mu$, $\sigma$). Consequently, the sample data should represent the population’s characteristics. This method generates a heterogeneity of distribution of the collected data, making it easy to generalize the results of the analysis. The criteria for evaluation include the representativeness of the whole population, random selection from a specified population, purposive sampling from a specified population, volunteers, and unidentified groups (Black, 1993, pp 56-57). In this research, the population is considered as a sample and the questionnaire was distributed randomly; this means the representativeness is approximately high. Because the questionnaire was the main instrument that was used in this research, the generalisability issue can be mentioned.

“For the survey’s results to be valid, the sample must represent the population. As the response rate of a survey increases, the results will more closely represent the population - thus the higher the response rate, the more accurate the survey. The total design of any project should aim to get as high a rate of response as is economically prudent” (Readex Learning Centre, 2004).

TCA also has various kinds of teleworkers from BT, British Gas, Microsoft, etc., so it reflects the general view of teleworking in the UK. The survey was mainly used to collect the required data and was combined with the documents of teleworking worldwide,
particularly in the UK. The survey actually includes two tools: the questionnaire and interviews. As Foo and Hepworth (2000) confirmed, one of the most commonly used techniques for quantitative survey is the questionnaire.

After determining the population and sample, the next stage was to determine the types of survey methods. There are different methods of conducting a survey. According to Cannell, Miller and Oksenberg (2002, p 5), the main kinds of survey are telephone surveys, mail surveys, Internet surveys, e-mail surveys and interview surveys. More sample surveys are done by mail than by any other survey method. The main reasons for the wide use of mail survey method are, first, it presents a lower cost implication; second, procedures for mail surveys are often deemed simple enough for individuals and organisations to conduct on their own rather than relying upon survey research organisations (Dillman, 2002, p 90). In recent decades, the most widely used method for obtaining market research and other survey data has been by telephone. There were two major reasons for the switch to telephone surveys. First, telephone sampling has become much more attractive. The second major reason for the shift to telephone interviewing was the costs of door-to-door surveys (Sudman and Blair, 2002, p 275). Recently, Couper (2002, p, 149) stated that: “rapid development of surveys on the World Wide Web (WWW) is leading some to argue that soon Internet (and, in particular, Web) surveys will replace traditional methods of survey data collection”.

So, the questionnaire was used as the main technique for collecting the required data with the first and second phases of interviews to support it. Data that were collected from both of them were used to achieve the second, third and fourth aims of this research study. However, in-depth details of both are given below.

6.3 Questionnaire management

The main part of the survey was the questionnaire, which was structured according to the aims of the research. Below, different kinds of questionnaire designs, the pre-test, pilot-test, and main distribution are clarified.
6.3.1 Types of Questionnaire

A designed questionnaire was used to collect data on the integration of information flow and the used ICTs in the virtual organisation. Below is a list of questionnaire types, together with their structure. Frazer and Lawley (2000) presented the four main kinds of questionnaires: mail questionnaires, personally administered questionnaires, telephone questionnaires and Internet questionnaires. A comparison of these questionnaire communication methods is presented below:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Mail questionnaire</th>
<th>Personally administered questionnaires</th>
<th>Telephone questionnaires</th>
<th>Internet questionnaires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Low</td>
<td>High</td>
<td>Moderate</td>
<td>Very low</td>
</tr>
<tr>
<td>Speed of data collection</td>
<td>Slow</td>
<td>Immediate</td>
<td>Immediate</td>
<td>Fast</td>
</tr>
<tr>
<td>Ability to reach geographically dispersed segments</td>
<td>High</td>
<td>Very low</td>
<td>Medium</td>
<td>Very high</td>
</tr>
<tr>
<td>Length of questionnaire</td>
<td>Long (4-12 pages)</td>
<td>Long (30-60 minutes)</td>
<td>Medium (10-30 minutes)</td>
<td>Long (4-12 pages)</td>
</tr>
<tr>
<td>Questionnaire complexity</td>
<td>Simple only</td>
<td>Simple to complex</td>
<td>Simple only</td>
<td>Simple only</td>
</tr>
<tr>
<td>Question complexity</td>
<td>Simple to moderate</td>
<td>Simple to complex</td>
<td>Simple only</td>
<td>Simple to moderate</td>
</tr>
<tr>
<td>Hard to recall data obtainable</td>
<td>Good</td>
<td>Poor</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>Respondent anonymity</td>
<td>Possible</td>
<td>Not possible</td>
<td>Not possible</td>
<td>Possible</td>
</tr>
<tr>
<td>Rapport with respondents</td>
<td>None</td>
<td>High</td>
<td>Moderate</td>
<td>None</td>
</tr>
<tr>
<td>Interview bias</td>
<td>None</td>
<td>High</td>
<td>Medium</td>
<td>None</td>
</tr>
<tr>
<td>Need for interviewer supervision</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Response rate</td>
<td>Low</td>
<td>Very high</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Table (6.1) Questionnaires Types (Frazer and Lawley, 2000, p 3)
As mentioned above, using these kinds of survey is considered to be controversial issue nowadays. Some researchers for example, argue about using traditional methods, such as the mail survey. Dillman (2002, p 90) emphasized this for using the mail survey and presented some of its characteristics including its low cost and the simplicity of its procedures. Sudman and Blair (2002, p 275) also promoted the use of the mail survey with special populations where good lists are available and high cooperation is possible because of the interest of the topic. In such an environment, mail surveys can be highly successful. Others argue, however, for the use of telephone surveys for two reasons: first, telephone sampling has become much more attractive; the second major reason for the shift to telephone interviewing is the steep increase in the costs of door-to-door surveys (Sudman and Blair, 2002, p 275). Backing the research aims and the statement of the problem, both the Internet questionnaire and personally administered questionnaire were used to collect the intended data in order to answer the research questions. Due to the characteristics of teleworkers, both of them were the most suitable methods for collecting data from teleworkers because they combined two views: the first, which suggested using contact teleworkers via their emails (Internet questionnaire) and the other view which was concerned with meeting teleworkers themselves since it was difficult to reach each teleworker at home, on trains, planes, client sites, etc. It was more practical to meet them in their work places (via conferences, workshops and seminars).

6.3.2 Questionnaire Design

It is important to design the questionnaire using specific formats. Coombes (2001, p 142) stated that, although the questionnaire may look impressive when it is sent, when it arrives at the other end it may look rather scrambled. So, the study adopted a suitable method for collecting data. This is most important in surveys that rely on programming languages such as HTML and JavaScript to create an attractive, interesting and compelling survey (Sheehan and Hoy, 2002, p 186). HTML was used in designing the online questionnaire.

Bradley (1999) claimed that: there are two kinds of Internet Questionnaire. Web Page questionnaires, which can be divided into three types. Type One is part of a web site “open” to any visitor, there is no control. It includes the Banner invitation. Type II is ‘closed’, and respondents are invited to visit the site to complete the questionnaire, which may be password protected. Type III is
'hidden', and the questionnaire appears to a visitor when triggered by some mechanism (eg date, visitor number, interest in specific page etc.). This type includes the pop-up survey. E-mail questionnaires can also be divided into three types. Type I is a 'simple' e-mail message with questions. Type II is an 'attachment', which is delivered with a covering e-mail letter. Type III is 'URL embedded', whereby an e-mail request for participation has a URL embedded in the message. Respondents simply click on this hypertext link, which then evokes their web browser, presenting the reader with a web-based questionnaire.

According to the opportunities for the distribution of this questionnaire, there were two options: the first one was concerned with sending it via email URL, (an email URL embedded questionnaire). The second one was concerned with a personally administrated questionnaire. These are two methods of questionnaire distribution.

The structure of the questionnaire is fundamentally based on closed questions. The main goal of this questionnaire was to investigate the information flow and to investigate the relationships with ICTs. It was clear from this goal that it should be directed to end-users (teleworkers) to ask them about the information flow in their organisations and to ask about the ICTs' impact on working in the virtual organisation. It is clear that the kind of question here should be direct. The main parts of the designed questionnaire were:

**Part One (Overview questions):** This consists of some questions that were related to obtaining an overview and eliciting information regarding the teleworkers. These questions focus on the kind of teleworker (full or part-time, employed or self-employed), the area of teleworking (home, train, telecentre, client site, hotel), the period of time that teleworkers have spent in their job. In this part of the questionnaire, all the questions were closed (See Appendix 5).

**Part Two (Information Flow):** This section has some questions that were related to data regarding the information flow in terms of receiving and sending information. First, it contains some questions regarding the integration of information flow. A scale of five options was used.

<table>
<thead>
<tr>
<th>Use of resources when teleworking</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
These questions deal with how the right, timely, appropriate channel, and trusted sources of information flow are maintained. Seven questions were used to achieve this aim. Second, the type of information that is usually used in the organisation was also determined. Three questions in this regard were used to investigate the kind of information (strategic, policy and operational information). A scale of five options was used.

<table>
<thead>
<tr>
<th>Type of information used when teleworking</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Fourth, the flow direction was made clear (vertical, horizontal or both).

Part Three (ICTs): In this part, the study tried to investigate the teleworkers’ opinions about, and the value of, various ICT tools that are associated with teleworking. The block diagram below illustrates the categorising of ICTs.

**Electronic Office Systems:** photocopier, scanner, word processor, spreadsheets, statistics packages, project management tools, audio conferencing, videoconferencing, multimedia systems, and presentation software

**Electronic Communication Systems:** electronic mail, telephone-landline, computer modem, mobile telephone, voice mail, answer machine, facsimile, multiple phone lines, ADSL, ISDN, call waiting and chat software

**Office Management Systems:** Interactive diaries/Scheduler, file systems, expensive management tools, electronic mailing list, databases, credit card verification, and workflow software

Figure (6.1) Concept Model of the ICTs in the teleworking environment

It consists of 29 questions. Each respondent was asked to vote for one of the following options. “Not used” means that this system was not used at the organisation. However, this scale aimed to investigate the satisfaction level of ICT usage.
Implementing the virtual organisation means adopting new technology. Furthermore, implementing a new approach to work requires critical requirements of ICT. These ICTs should be estimated by the users themselves, not as a compulsory addition to the work. This means that new technology should be introduced with sensitivity. To achieve this aim, a list of four questions investigated predictions regarding the adoption of new technology in the teleworkers’ opinion. A Likert-scale of five was used in this measurement.

<table>
<thead>
<tr>
<th>ICT system</th>
<th>Very Satisfied</th>
<th>Satisfied</th>
<th>Dissatisfied</th>
<th>Very Dissatisfied</th>
<th>No Opinion</th>
<th>Not Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

Part Four (Background): Part Four deals with the background of teleworking. Information such as the employer’s name, department, position and training data were gathered. Five questions were used to achieve this aim.

Part Five (Demographics): Demographic information was collected in this part, which consists of five questions: gender, age, location of living, education level, distance away, and time of day or night when teleworking was actually carried out. This information reflects the teleworker’s background. Concerning the question of “location of living”, it was used to exclude any of the TCA members who were living outside of the UK because the study was concerned with the environment and case of the UK only. According Alan Denbigh (2003), they are roughly 8 teleworkers.

For fully administering the questionnaire, two further questions were added. The first was related to the collection of teleworkers’ emails in order to be ready to carry out an interview with them later. The second was concerned to the circulation of results so it was easy for respondents to add an email contact and then the results of the study could be sent after the discussion. Furthermore, the researcher’s details were added at the bottom of the questionnaire: this was useful if there was any need for contact. After
preparing the first draft of the designed questionnaire, it was hosted on a server of Loughborough University.

6.3.3 Pre-test Stage

A pre-test, as well as the pilot-test, were combined before the distribution of the main questionnaire to the target sample. The pre-test came before the pilot-test. "It is the real test of a questionnaire is how it performs under actual conditions of data collection, it is vital" (Churchill and Lacobucci, 2002, p 351). The table below shows the distribution of pre-test participants.

<table>
<thead>
<tr>
<th>Category</th>
<th>Selected number</th>
<th>Response number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research students</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Academics from department</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Directors and managers of companies</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19</strong></td>
<td><strong>13</strong></td>
</tr>
</tbody>
</table>

Table (6.2) Pre-test participants

As can be seen above, the response rate was satisfactory and considered to be high. This test took place in April 2003 and was conducted within Loughborough University and local companies. The supervisor's personal contact was used to select the local companies. Each director of these companies received the online questionnaire through the supervisor's cover letter. The attached form (the Evaluation Form – see Appendix 6) was used to get a list of suggestions which were collected after the pre-test. Most of them related to clarifying some words and avoiding overlapping in others. These changes were made after the end of the pre-test itself. In fact, this form was used to check for the questionnaire's validity. After this phase, a meeting was held between the researcher and his supervisor when the important observations, changes and commitments were discussed and made before the pilot-test.
6.3.4 Pilot-test Stage

The second stage of questionnaire deployment was the pilot-test, which came after the pre-test, and was followed by the main survey. According to the opinion of most scholars, it is considered important to modify a convenient questionnaire that will be used in collecting related data, the analysis of which will solve the research problem. BT\(^{(3)}\) was selected to be a pilot-test case because:

- BT had the largest Intranet in Europe.
- In 1993, BT launched the work style option 2000. This flexible working program is considered the largest in Europe and saved \(£180\text{m}\).
- BT had a national program regarding e-work. For example, Microsoft\(^{(2)}\) had signed a deal with BT to offer 1,500 of its UK employees home ADSL access.
- BT is a leader in developing flexible working. It Workstyle Group is widely recognized as one of the UK's leading remote working think-tanks.
- The Workstyle Group (WG) evolved out of its Workstyle 2000 programme, which started changing the way of work in 1993.
- BT is working with the Teleworker Association to bring the latest articles from its Teleworker Magazine.

In May 2003 the pilot-test was conducted with BT teleworkers in the department of research. The contact of the supervisor was useful in distributing 10 online-questionnaires to BT teleworkers; eight of them replied. The same previous form (the Evaluation Form) was also used to check the questionnaire’s validity. The returned suggestions were useful for modifying the intended tool; most of them were related to adding some kinds of ICT that are usually used in the virtual office. Furthermore, there were some notes regarding the misunderstanding of some questions. Corrections were made after receiving the responses.

\(^{(1)}\) For more information about teleworking in BT, see Chapter Five.
\(^{(2)}\) In 2002, Microsoft came second in the Sunday Times 100 Best Companies to Work For ranking, and picked up a special award for its commitment to a work/life balance.
6.3.5 Main Survey Stage

The main survey took place at the end of 2003 and the first quarter of 2004 with Telework Association (TCA) members as the population of this study. There were 800 members. The reasons behind the selection of the Telework Association (TCA) for the main survey were:

- TCA was considered the largest association of teleworkers in Europe.
- TCA members have heterogeneous characteristics, such as full-time and part-time; employed and self-employed; and with different demographics.
- There was permission for conducting the survey.

There were two directions of distribution for the questionnaire:

(a) Email URL embedded questionnaire: The questionnaire was sent via email (URL embedded questionnaire) to all TCA members (800) which had the URL of the e-questionnaire. This electronic weekly newsletter was sent to the TCA members. It had two cover letters: a cover letter from the researcher and his supervisor, and a cover letter from the Executive Director (Mr. Alan Denbigh). Both of them were sent to clarify the need for collecting data, clarifying the confidentiality of the information used and the procedures to fill it in. The TCA Director had invited members to respond to the questionnaire because it was concerned with their real problems, such as lack of communication and technical training. They were invited to fill in the questionnaire by clicking on the attached URL, which linked via a hyperlink to the designed questionnaire, which was designed by using HTML language. After filling in each questionnaire, it needed to be submitted, which was connected internally to the researcher's email. Then it was received via email. After that, the researcher entered the received data to the SPSS manually. So, sending and receiving data was via an electronic method.

(b) Personal Administered questionnaire: A couple of workshops were held in London (17 and 18 December, 2003), both of them sponsored by the TCA and concerned with TCA members. Attendees at both workshops were invited to fill in the questionnaire but before that they were asked if they had filled in the same questionnaire (online questionnaire) before or not. This was to avoid duplication. This personally administered questionnaire was a very supportive source in raising the response rate and it was also a good opportunity to meet the teleworkers face-to-face and ask them to fill in the designed questionnaire.
Sometimes, some respondents called to ask about sending their questionnaire by post. The researcher replied to them, giving them a clear address to send their perceptions by post. Some preferred post because it was difficult for them to find free time to fill in the questionnaire while they were working on the net but when they had a hard copy version, it seemed easier to find free time. Concerning the follow-up of distribution, a few reminder emails were sent to remind TCA respondents concerning their response. The table below shows the basic indicators of response rates:

<table>
<thead>
<tr>
<th></th>
<th>Distributed</th>
<th>Returned</th>
<th>Excluded</th>
<th>Usable (Entered to SPSS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online questionnaire</td>
<td>720</td>
<td>108</td>
<td>5</td>
<td>103</td>
</tr>
<tr>
<td>Personally administrated</td>
<td>80</td>
<td>45</td>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>questionnaire</td>
<td>(for those who were excluded from the online questionnaire)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>800</td>
<td>153</td>
<td>9</td>
<td>144</td>
</tr>
</tbody>
</table>

**Response Rate**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>18%</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table (6.3) Response Rate

From the above table, it can be concluded that those who were invited to take part in the personally administrated questionnaire were excluded from the online questionnaire, but both of them represent the total population of TCA. Nine questionnaires were excluded and considered unusable because they were not completed and the main variables (information flow and ICTs) were not responded to, being left empty.

In fact, the response rate is actually calculated based on comparing the usable questionnaires with the distributed questionnaires. Several steps were undertaken to maximize the response rate. They were: a cover letter from the researcher’s supervisor was sent, cover letter was also sent from the executive director of TCA, rewards (a prize draw) was promised, a follow up plan was created, a deadline date was included in the cover letter, and a summary of the results was offered for those who were interested.

The response rates for both surveys were acceptable in scientific and practical terms. The response rate of the online questionnaire was 14.3%, which was considered acceptable. A typical response rate to an elicited questionnaire is below 5%, while an exceptionally well
designed and targeted questionnaire can achieve 15% or more (European Telework Online, 2003a). The response rate of personally administrated questionnaire was also acceptable (51.25%). Baruch (1999) found in his study, which was conducted by using a Meta Analysis of 175 studies, that the average response rate is 55.6%. Hence, it was acceptable. Concerning the general percentage, the response rate was 18%, which was considered acceptable. There is some practical evidence for accepting these percentages:

i) The population itself was considered as a sample so the representativeness is approximately high.

ii) All of the population members were invited to partake of the same opportunity.

iii) Results were generalized to all of the TCA members.

In the next chapter (Chapter 7 - Data Analysis), measuring reliability and validity tests was carried out. These helped in emphasizing the reasonability and acceptability of the survey. Furthermore, in a following chapter (Chapter 9 – the discussion chapter), a discussion of respondents' profiles also reflects a comparison with other previous studies on teleworking in the UK.

6.4 Interview Management

Two phases of interviews were used in this study. The first phase was used to support the questionnaire strategy and was also used to clarify some issues in depth while the second phase of interviews was used to collect the required data for mapping the flow of information in the virtual organisations. Below are outlined the first and second phase of interviews.

6.4.1 Types of Interview

The roots of interviews emerged in 1929 (Cannell, Miller and Oksenberg, 2002, p 3). There are two methods of collecting interview data: by face-to-face and remote interviews (via email, telephone, computer and post). Coombes (2001, pp 94-122) presented some methods to complete the interview. These are:

1. Field interviewing (the street corner).

2. Telephone methods of interviewing: Telephone surveys are considered to be a common method of data collection within sociology and survey research (Groves,
Computer-assisted telephone interviewing (CATI) can be used to facilitate the telephone interview. CATI, however, may facilitate telephone surveys being easier and faster to complete (Nicholas, 2002, p 78). The usage of telephone interviewing in surveys of the general public has been quite slow to achieve widespread acceptance in the UK (Collins, 2002, p 85).

3. Mail interviewing (by prepaid return envelope).
4. E-mail interviewing.
5. Computer-assisted personal interviewing (CAPI).

Due to the research aims and interview goals, both face-to-face interviews and telephone interviews were used. However, types of interview can also be categorized in another form. There are three types that could be used for collecting data from interviewers: structured, semi-structured and unstructured interviews. Below is a brief description of each kind.

1. The fully structured interview: This has predetermined questions with fixed wording, usually in a pre-set order. "The use of mainly open-response questions is the only essential difference from an interview-based survey questionnaire" (Robson, 2002, p 270). The main advantages of this kind of interview are that it permits examination of a wide topic area and is fast and relatively cheap to administer. To retain a sense of independence, professional organisations can be used to carry out the work. Furthermore, it is simple to analyse as tick-boxes can be used to record responses and interviewers do not need to be trained (Scottish Executive Health Department, 2002).

However, there are certain disadvantages to the fully structured interview as a technique since it cannot be used to explore people's feelings in any depth since it only allows the respondent to make a brief response. Answers may also be biased by factors such as age, gender and/or ethnicity. Moreover, it can be costly to obtain a sample that is truly representative and the interview itself is difficult to design, requiring considerable expertise if it is to be effective (Scottish Executive Health Department, 2002).

2. The semi-structured interview: This technique can be used to obtain feedback and offers the interviewer the opportunity to explore an issue or service. Its characteristics are:
• The fact that it is semi-structured allows the conversation to flow where it needs to in order to deal with issues as opposed to cutting someone off because they stray from the topic (Scottish Executive Health Department, 2002).
• The wording of questions can be changed and explanations given. An appropriate question with a particular interviewee can be omitted or additional ones included (Robson, 2002, p 270).
• "Semi-structured interviews are conducted with a fairly open framework which allow for focused, conversational, two-way communication. They can be used both to give and receive information. Not all questions are designed and phrased ahead of time. The majority of questions are created during the interview, allowing both the interviewer and the person being interviewed the flexibility to probe for details or discuss issues" (Food and Agriculture Organisation of the United Nations (FAO), 1990).
• "A semi-structured interview combines a highly structured agenda with the flexibility to ask subsequent questions. The questions for a semi-structured interview are ideally constructed some time before the interview and are sent to the expert so he/she can start to prepare responses. For an interview lasting 1 hour, around 10-15 questions would typically be asked" (Epistemics, 2002).
• A semi-structured interview involves a series of open-ended questions based on the topic areas the researcher wants to cover (Scottish Executive Health Department, 2002).
• There is a great deal of flexibility as the order/actual working of questions is not determined in advance.
• The interviewer is free to pursue certain questions in greater depth.
• Interviewees can express their opinions, concerns and feelings.
• This type of qualitative method gives the opportunity for the respondent to be involved in the research process as much as possible, although a more equal relationship between the researcher and participant is often seen as increasing the validity of the research (Westmarland, 2001).
• Bryman (2004, p 321) added that: "the researcher has a list of questions or fairly specific topics to be covered, often referred as an interview guide".

3. The unstructured interview: The main characteristics of this kind of interview are that it has very little structure, it is non-standardized, it is open-ended and in-depth. The interviewer wants to find out about a specific topic but has no structure or preconceived plan to deal with it (Scottish Executive Health Department, 2002). It can be completely
informal when the interviewer has a general area of interest which guides the conversation (Robson, 2002, p 270).

The Scottish Executive Health Department (2002) presented the advantages and disadvantages of the unstructured interview. Its advantages are that questioning can be tailored to each individual and there is greater informality than with other methods, putting participants more at their ease. Topics felt to be important can be respected by the interviewer and sensitive issues can be tackled. The disadvantages of such a technique, however, include the fact that there is a greater chance of the interviewer influencing the results and topics which do not arise during the course of the interview may be neglected.

According to the aim of this study and the questions that were presented in Chapter One, the semi-structured interview was used to collect the data needed.

6.4.2 The First Phase of Interviews: The aim of this phase of interviewing was to provide relevant data for further issues regarding information flow, training and technological change. The basic parts of the interview protocol (see Appendix 7) were:

i) Part One: Further Issues of Information Flow
ii) Part Two: Further Issues of Training
iii) Part Three: Further Issues of Technological Change

As mentioned earlier, the first phase of interviewing was used to support the main strategy (questionnaire) and so had just three parts. After its protocol had been completed, it was ready to use. Two directions were used. First, face-to-face interviews, which were conducted through two TCA workshops that were held in London in December, 2003. A tape-recorder was used to record each interview and these were transcribed after returning. Second, five telephone interviews were conducted after receiving a list of emails from people who were interested in taking part in the interview. (The last question in the questionnaire asked respondents about their ability to take part in an optional telephone interview.) The researcher made an appointment with each interviewer before conducting the interview and these were arranged previously. They had the same protocol for the face-to-face interview.
Regarding the analysis of the interview materials; there were ten interviewees. They were used to support the questionnaire data and to explain further specific issues of information flow, training and technological change in the virtual organisations. They were analysed manually because: (1) as mentioned above, their role was to support the main tool of data collection (the questionnaire); (2) they were not sufficient to use special software for analysing qualitative data such as ATLAS; (3) the researcher had sufficient ability and skills to analyse them manually; (4) In the literature review, the same quantity of interviewees were analysed manually. Therefore, an analysis plan was prepared. It relied on the interview protocol which had three parts. Each part contained some questions. After analysing each question of the ten interviews, the results were written down. Before moving on to the next part of the interview protocol, a summary of the related results was provided. A scale of measuring respondents' opinion was used, which was concerned with measuring their opinions according to a scale of 1 to 10. These were directed so that 5/10 indicated half the respondents, 6/10 and 7/10 indicated most of the respondents, 8/10 indicated the majority of the respondents, 9/10 indicated the vast majority of respondents, and 10/10 meant all the respondents.

6.4.3 The Second Phase of the Interviews: This was concerned with collecting the required data for mapping information flow in virtual organisations. Data that were collected from this phase enabled the mapping of information flow and investigated the information use while teleworkers were working outside the traditional (physical) office.

Some previous studies of information mapping were used to support the design of the interview protocol. However, some questions were derived from McInerney (1999, pp 184–222), Dow Jones & Company, Inc (1997), Henczel (2001a, pp 96–101), City University (2004), and the University of Newcastle Upon Tyne (2003). So, a designed protocol was prepared to achieve the fourth aim of this study, which was concerned with mapping of information flow. The collected data helped in drawing a “hand-drawn sketch” for information flow and then some visualisation techniques were used to map the current and the proposed flow of information. The interview protocol (see Appendix 8) consisted of four parts:

iv) Part One: Interviewer Background (Profile)

v) Part Two: Inflows and Outflows of Information
Before conducting the interviews, there was some contact via email, telephone and a copy of the interview protocol was sent to the interviewees. To get good support from teleworkers, the rational and business reasons for conducting IA were illustrated. Also, the results of the audit would be clear to all through their communication channels. Furthermore, a cover letter (see Appendix 9) was sent before conducting the interview itself and also letter was sent to each interviewee after conducting the interview itself. The allocated time for each interview was roughly 60 minutes. This time was sufficient to gain the required data from the interviewees. Swash (1997) confirmed that “interviews require structure although for best affect respondents should be allowed time to give comprehensive answers”.

Six individual interviews took place during March and April, 2005. After collecting the required data, they had to be edited to be ready for analysing. Each interview was considered as a separate individual case during the analysis so there was no need to use special software for analysis. Each interview was considered as an individual case. The mapping of all cases was based on general procedures of mapping the current information situation and mapping the proposed information situation. As Dow Jones & Company, Inc (1997) recommended, one-on-one interviews are to get people to open up and talk about how and why they use information.

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(1) For Example: The King's Fund audit was conducted by ten trained auditors who were reported to have averaged 55-75 minutes each. The participations of this audit were 240 staff at Regional Health Authority headquarters. It took several months to complete (Booth, 1994).
6.5 Summary

It is now clear that this study relies heavily on both data collection tools (the questionnaire and interviews) to find out the critical results needed by using a survey strategy method. A combination between the two methods of data collection gained the required data. However, the main method of data collection was the designed questionnaire, which was distributed in two ways: an online questionnaire where HTML language was used in the design and a personally administered questionnaire which was distributed face-to-face with the teleworkers. Concerning the scale decoding of quantitative data, a scale of 1 to 4 was used to measure the information flow and the satisfaction level of ICT usage. This scale was equal to Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

The collected data from the questionnaires were supported by another source of data: ten semi-structured interviews with teleworkers. Five of them were interviewed face-to-face and others were interviewed by telephone. Qualitative data from the interviews were coded through using a scale of 1 to 10 so that 5/10 indicated half the respondents, 6/10 and 7/10 indicated most of the respondents, 8/10 indicated the majority of the respondents, 9/10 indicated the vast majority of respondents, and 10/10 meant all the respondents.

As was mentioned above, the collected data from the first interview were used to investigate further specific issues in the information flow field. Consequent to the fourth aim of this research study, a second phase of interviews was used to collect the related data of mapping information flow in the virtual organisations. So, six teleworkers were interviewed. Half of them were interviewed face-to-face and others were interviewed over the telephone. Because the teleworkers were always busy and it was difficult to meet them, an effective management of the procedures of the survey was made. This management derives from the logic of obtaining the intended data at a convenient time. So, the survey took place after appointments and contacts with respondents.

The next chapter presents an analysis of the collected data from the questionnaire and the first phase of the interviews whereas the analysis of data from the second phase of interviews is offered in Chapter Eight.
Chapter Seven

Analysis of the Survey Data (the questionnaire and first phase of interviews) (1)

7.0 Introduction

The main aim of Chapter Seven is to present the related results from the collected questionnaires and the first phase of the interviews. To achieve this aim, two parts of this chapter are presented. Part One deals with providing the main results of the questionnaire analysis, particularly the respondents' profiles, information flow, ICT, and adopting a new technology and training. Part Two, which is entitled the interview analysis, is concerned with analysing the interviews that were completed. The main points of the interviews are to address: further issues of information flow, further issues of training, and further issues of technological change. A summary of this chapter is presented at the end. The discussion of results take place in Chapter Nine.

Part One: Questionnaire Analysis

This part of Chapter Seven presents the results of the questionnaire analysis. Basically, a few requirements of preparation are clarified before the four sections are offered. Section One covers the respondents' profiles (gender, age, education, experience, full-time or part-time work, sort of employment, working location, working days, working time and distance between the corporate office and the location of work remotely). The second covers the information flow. The satisfaction level of ICT usage is clarified in the third section. Analysis regarding adopting a new technology and its training requirements can be found in Section Four.

Before starting with the analysis itself, it is preferable to present the preparation requirements of the data analysis. This covers determining of the type of data, the statistical tools (parametric or non-parametric), reliability and validity, and the confidence level (95%).

Type of Data: Before starting the analysis, it is quite important to answer the following question: Is the data distributed normally or not? In fact, the questions of information

(1) Concerning the confirmability of this chapter, the Deputy Director/Senior Statistician (Claire Creaser) did this through a few meetings.
flow and questions regarding ICTs used the scale of (1-5) to measure the satisfaction with ICT use and the integration of information flow. This usage of an ordinal scale was enough to decide that the data were not distributed normally. This reason was enough to need non-parametric tests in the analysis. To confirm this, some tests were used.

There are two sorts of distribution: normal distribution and logistic distribution (non-normal distribution). Coakes and Steed (1997, pp 31-41) presented ways of measuring the normality of data. They are: by histogram, Stem and Leaf Plot, Boxplot, Normal Probability Plot, Detrended Normal Plot, Shapiro-Wilks and Lilliefors Statistics, and Skewness and Kurtosis. To answer the above question, Skewed\(^{(1)}\) and Kurtosis\(^{(2)}\) Tests were used to clarify the distribution curve of the data. The results of Skewed and Kurtosis tests (see Appendix 10) refers to the non-normal distribution of data. Then a non-parametric test should be used to investigate the information flow in the VOs and the relationships between ICT usage and the information flow. Black (2002, p 211) tried to find an answer to the following question: what are the criteria for choosing between parametric and non-parametric tests? Parametric tests are usually used with continuous data (scores) with normal distribution for all groups whereas non-parametric tests are used with nominal data (frequencies in categories), ordinal data (ranks), and non-normal distribution of continuous data. Therefore, a non-parametric test should be used.

**Statistical Tools:** The suggested non-parametric tests are: Mann-Whitney Test, Kruskal-Wallis Test, and Spearman Rank Order Correlation. Because of selecting the TCA population as a study sample, it is not important to use advanced statistical tools and the analysis is mainly descriptive. The SPSS program is more convenient to analyse the collected data. Moreover, Excel is the main support for this analysis, especially with regard to the chart of the diagrams, as well as for the tables and block diagrams. However, the main statistical tools are:

1. **Frequencies and percentages:** Frequencies and percentages were used to describe the nominal and ordinal data. They are the respondents’ profiles (gender, age, etc.) and the questions regarding information flow, ICT use, adopting a new technology and

\(^{(1)}\) Skewness: A measure of the asymmetry of a distribution. The normal distribution is symmetric, and has a skewness value of zero. A distribution with a significant positive skewness has a long right tail. A distribution with a significant negative skewness has a long left tail. A skewness value greater than 1 generally indicates a distribution that differs significantly from a normal distribution (SPSS Programme).

\(^{(2)}\) Kurtosis: A measure of the extent to which observations cluster around a central point. For a normal distribution, the value of the kurtosis statistic is 0. Positive kurtosis indicates that the observations cluster more and have longer tails than those in the normal distribution and negative kurtosis indicates the observations cluster less and have shorter tails (SPSS Programme).
training. This description helps the interpretation of the results and compares them with the literature.

2. **Graphics**: Preparing the data collected, the most convenient graphics were Histograms, Pie charts and Bar chart\(^{(0)}\).

3. **The Mann-Whitney Test**: According to Sekaran (2003, p 405), and Coakes and Steed (1997, p 250), Mann-Whitney is usually used to test the differences between two groups (un-paired groups) with nominal data. This is done using an ordinal scale. So, the test variable was ordinal data and the grouping variable was nominal data with a defining group. Then, it can be concluded that Mann-Whitney U tests the hypothesis, which is concerned with two independent variables, which come from the population having the same distribution. This is equivalent to the independent group t-test (Coakes and Steed, 1997, p 250). Moreover, Lowry (2004); Hinton *et al.* (2004, pp124-129); and Vernoy (2004) presented some assumptions regarding the Mann-Whitney Test. These are clarified below:

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. One independent variable</td>
<td>Kinds of teleworker</td>
</tr>
<tr>
<td>2. Two independent samples are randomly and independently drawn</td>
<td>Full-time and part-time</td>
</tr>
<tr>
<td>3. The measures within the two samples have the properties of at least an ordinal scale of measurement, so that it is meaningful to speak of &quot;greater than,&quot; &quot;less than,&quot; and &quot;equal to.&quot;</td>
<td>Likert-scale of the information flow</td>
</tr>
</tbody>
</table>

Table (7.1) Mann-Whitney Assumptions

The Wilcoxon Mann-Whitney Test is used to test the null hypothesis that two populations have identical distribution functions against the alternative hypothesis that the two distribution functions differ only with respect to location (median). It does not require the assumption that the differences between the two samples are normally distributed. It is also applied when the observations in a sample of data are ranks, that is, ordinal data rather than direct measurements (Easton and McColl, 2004). So, the Mann-Whitney was used to test the significant differences between full-time and part-time employment concerning the flow of information. According to Sekaran (2003, p 405), Mann-Whitney can be used to investigate these differences because they have two

\(^{(0)}\) For more information about these techniques, see Buglear (2005, pp 135-176).
un-paired samples (nominal data) from the same population and a dependent variable (information flow) with ordinal data.

4. The Kruskal-Wallis Test: this is equivalent to one-way ANOVA. Tests when several independent samples are from the same population. This assumes that the underlying variable has a continuous distribution; it requires an ordinal level of measurement. According to Siegel and Castellan (1988, p 1) and Motulsky (1999), to test the relationship between independent K-sample cases with ordinal scale data, the Kruskal-Wallis test is useful. It is concerned with independent samples.

"The Kruskal-Wallis test is a nonparametric test used to compare three or more samples. It is used to test the null hypothesis that all populations have identical distribution functions against the alternative hypothesis that at least two of the samples differ only with respect to location (median), if at all. Analysis of variance tests depend on the assumption that all populations under comparison are normally distributed, the Kruskal-Wallis test places no such restriction on the comparison. It is a logical extension of the Wilcoxon-Mann-Whitney Test" (Easton and McColl, 2004).

5. Spearman's rank difference coefficient (P): this is considered to be one of the most common tests of nonparametric measures and aims to measure the correlation between two ordinal variables. "Spearman's rho is the most common correlation for use with two ordinal variables or an ordinal and an interval variable. Rho for ranked data equals Pearson's r for ranked data" (Garson, 2004). Furthermore, Spearman's test is actually used as an indicator when the two variables are jointly non-normally distributed (Easton and McColl, 2004).

Some further features of Spearman's are given below:

- When applied to ordinal data, the measure of correlation is spoken of as the Spearman rank-order correlation coefficient typically symbolized as r, (Lowry, 2004).
- Coakes and Steed (1997, p 256) stated that a Spearman test is an alternative to the Pearson test.
- According to Sekaran (2003, p 405), to measure the correlation between ordinal data with ordinal data, Spearman's rank correlation is the most suitable test.
- "The Spearman rank order coefficient should always be used in performance to the Pearson procedure if either of the sets of data to be correlated consists of measures on an ordinal scale of measurement" (Dyer, 1995, p 430).
Furthermore, Buglear (2005, p. 225) added that the correlation coefficient should be calculated to assess how closely the variables are related. In fact, correlation coefficients vary between -1.00 and +1.00; any relation close to 0.00 means there is no relationship between variables. Any value close to +1 means a positive relationship and any value close to -1 means a negative relationship. A negative correlation coefficient indicates, therefore, that the two variables covary in an opposite direction while a positive correlation coefficient suggests that the two variables covary in the same direction. Many researchers categorise the values of r into groups in order to gauge the estimated degree of a relationship between two variables. First, Cohen and Holiday (1996, p. 83) suggested the following categories: 0.19 and below is very low; 0.20 to 0.39 is low; 0.40 to 0.69 is modest; 0.70 to 0.89 is high; and 0.90 to 1.00 is very high. Second, Dyer (1995, p. 298) stated that 0 means nil or random relationship, and increased from nil to very weak, weak, some degree, strong, very strong, and lastly 1.0 means perfect correlation. Hence, the Cohen and Holliday (1996) scale was used because it was suitable and reflected the relationships between ICTs and the integration of information flow. In practical applications, Spearman’s Test was used to test the relationships between ICT tools and the integration of information flow; both of them are distributed non-normally and have an ordinal scale.

According to Hinton et al. (2004, pp. 379-380), the statistical tools used can be summarised as:

<table>
<thead>
<tr>
<th>What do you want to do?</th>
<th>Number of variables/conditions</th>
<th>Design</th>
<th>Parametric/Nonparametric</th>
<th>Recommended statistical test</th>
<th>Statistical procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Look for differences between conditions</td>
<td>1 variable 2 conditions</td>
<td>Independent</td>
<td>Nonparametric</td>
<td>Mann-Whitney U</td>
<td>Analyse, Nonparametric tests, Two independent samples</td>
</tr>
<tr>
<td>Correlate variables</td>
<td>2 variables</td>
<td>Correlational</td>
<td>Nonparametric</td>
<td>Spearman</td>
<td>Analyse, Correlate, Bivariate</td>
</tr>
</tbody>
</table>

Table (7.2) Statistical Tools’ description

Confidence Level (95%): In this research, the statistical significance is 95% under an error rate of 5% (2-tailed). So, if the Asymp. Sig. is less than 5%, the null hypothesis is
rejected and the alternative hypothesis is accepted. 95% is commonly known and used in the academic field.

**Reliability:** Reliability can be defined as the degree of internal consistency between two measures of the same thing. Reliability coefficients give a relative indication of an instrument's reliability, usually on a scale of 0.00 (not at all reliable) to 1.00 (perfectly reliable) (Black, 1993, p 73). According to Pedhazur and Schmelkin (1991, pp 81-103), the internal consistency is the coefficient of test scores obtained from a single test or survey, and Reliability is a necessary, but not sufficient, condition for validity. In fact, several models can be used to measure reliability. They are: Alpha (Cronbach), Split-half, Guttman, Parallel, and Strict parallel. Pedhazur and Schmelkin (1991, pp 81-103) stated that "Cronbach's Alpha is a reliability coefficient that indicates how well the items in a set are positively correlated to one another". Also, Coakes and Steed (1997, p 175) and Sekaran (2003, p 307) added that Cronbach's Alpha is one of the most commonly used to measure reliability as it is based on the average correlation of items within a test if the items are standardised. Moreover, it is a model of internal consistency, based on the average inter-item correlation.

So, Cronbach's Alpha was used to indicate the reliability of the designed questionnaire items. Appendix (11) shows that Alpha is equal to 0.902 for the seven items of information flow without deleting any items. All of these values are considered acceptable in the social sciences and this is really a reliable instrument was designed for investigating the information flow. Regarding ICT items, there is no need to test reliability because respondents are not responding in the same way as they are to other questions. Each item is solved in a separate or single case and not all of them were solved as a whole so each item was solved separately.

**Validity:** Validity was also measured with the reliability test. Both validity and reliability aim to investigate the designed questionnaire. According to the operational definition, the instrument must be logically consistent and cover comprehensively all aspects of the abstract concept to be studied and there are two types of validity: construct and content validity (Black, 1993, p 67). Furthermore, Sekaran (2003, p 308) stated that validity can be divided into three kinds: criterion-related validity, convergent validity and discriminant validity. So, validity can be defined as:

"the degree to which a study accurately reflects or assesses the specific concept that the researcher is
attempting to measure. A method can be reliable, consistently measuring the same thing, couple of validities should be measured, and they are internal validity and external validity” (Colorado State University, 2004).

The School of Psychology University of New England (2000) added that: “A study that readily allows its findings to generalise to the population at large has high external validity. To the degree that we are successful in eliminating confounding variables within the study itself is referred to as internal validity”.

In this research, however, validity was measured through three methods: (1) pre-test and pilot-test, both of which had an evaluation form (see Appendix 6) that aimed to evaluate the structure and the content of the designed questionnaire by asking the respondents to read the designed questionnaire and fill in the evaluation form. This evaluation is mainly concerned with the measurement of abstract concepts and traits. For example: “How is “Teleworker” defined?” “How is “ICT” defined?” “How is “Information flow” defined?” The evaluation form asked the respondents about length, layout and the colours of the questionnaire. (2) A comparison with the literature review and similar instruments. (3) By checking the opportunity for generalisability of the expected results. All of these methods revealed validity of the designed questionnaire.

According to the basic rules of research methods, a target level is required in order for an instrument to be valid and reliable. Due to the above results of reliability and validity, the designed questionnaire was reliable and valid, which is considered acceptable and usable to investigate the information flow in virtual organisations.

7.1.1 Respondents’ Profiles

This section of Part One is concerned with providing a clear picture of the respondents’ profiles: gender, age, education level, sort of employment, full-time or part-time, experience, working location, days of working, working time and the distance between the corporate office and the location of their work. All of these profile items were clarified by using frequencies, percentages and diagrams in some cases.
Appendix (12) shows the gender distribution of respondents. It seems that 59% of the respondents were male and the rest were female. This result of gender distribution reflects that more than half the respondents were male.

Concerning their age distribution, Appendix (12) also demonstrates the respondents' distribution according to their age. Roughly, two out of five were aged between 35 to 44 years, and one out of four was aged between 45 to 54 years old. The bracket of under 25 years was 3% which means that the vast majority of respondents (97%) were aged over 25 years. To be more clear, a histogram diagram is used to clarify their distribution.

![Histogram Diagram](image)

**Figure (7.1) Distribution of respondents' age**

It can be illustrated from the above figure that the distribution of respondents is approximately a normal distribution. The peak of this diagram is located within the bracket of 35-44 years.

One can deduce from Appendix (12) that the respondents' distribution according to their education explains their high level of education. It seems that more than 60% of them had at least a Bachelor's degree (or Master's degree or PhD) whereas less than 40% of them had an HND/C degree or less. According to this distribution, teleworkers followed educational courses after pursuing their A-Levels and the most common course that was chosen was the Bachelor's degree. To explain this result in depth, a histogram diagram is used below.
The distribution of respondents' education is shown by using the above histogram. Bachelor's degree scores the highest peak and the PhD has the least percentage of this distribution.

<table>
<thead>
<tr>
<th>Education</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCSE</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>A-Level</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>NVQ + HND/C</td>
<td>10</td>
<td>10%</td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>50</td>
<td>50%</td>
</tr>
<tr>
<td>Master's degree</td>
<td>20</td>
<td>20%</td>
</tr>
<tr>
<td>PhD</td>
<td>10</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table (7.3) Distribution of respondents' type

According to the above table, respondents were distributed into two categories: self-employed and employed within an organisation. It is clear that more than half of the respondents could be considered self-employed and 46.7% were employed within an organisation. This result, in fact, reflects the flexibility of teleworking. The next table reflects the other side of this flexibility.

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time employment</td>
<td>101</td>
<td>72.1</td>
</tr>
<tr>
<td>Part-time employment</td>
<td>39</td>
<td>27.9</td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table (7.4) Distribution of respondents' kind
This presents the distribution of respondents according to their kind (full or part-time). Most of the respondents (72.1%) were considered full-time employees and roughly just one out of four was considered a part-time employee because half of the respondents were employed and most of the respondents were full-time (see Tables 7.3 and 7.4).

Regarding the experience of respondents, Appendix (12) shows the distributions of respondents according to their experience as teleworkers. Three out of five did not have more than six years’ experience while 58% of respondents did not have more than 3 years of experience. It seems clear that most of the respondents did not have experience of more than 10 years. Due to this new style of work, this result is acceptable as it allows workers to complete their tasks across locations and time.

![Figure (7.3) Distribution of respondents’ experience as teleworkers](image)

The above figure illustrates that the peak value of experience distribution is the period 1-3 years, which represents one to three of the whole number of respondents. The bottom value is 7-9 years, however, which represents just 5% of the whole number of respondents.

On the subject of working location, Appendix 12 demonstrates that the vast majority of respondents (93%) worked at home. 24% of the whole respondents worked at the client’s site, which is considered to be a new change in managing the relationship with clients. One out of ten (11%) worked at a hotel, which could be called hotel teleworking.
Concerning working during train travel, roughly one out of ten (11\%) of the respondents worked on the train. This method of working is called train-teleworking. For the case of telecentres, just 4\% of the whole number of respondents worked from telecentres. The following histogram illustrates their distribution.

![Histogram showing the distribution of respondents' working locations](image)

**Figure (7.4) Distribution of respondents' working locations**

The above figure shows each location of respondents according to their working location. The most common one is working at home, then at a client's site, at a hotel, on a train, and then at telecentres. As illustrated in Table 7.3 and Table 7.4, the percentage working at home (93.1\%) is acceptable as it seems most respondents worked at home as full-time and self-employed teleworkers.

Concerning the days on which the respondents worked, Appendix (12) reveals that 40\% of respondents worked five days per week, which means full-time employment (see Table 7.4).
Figure (7.5) Distribution of Respondents' Working Time

The above figure reveals the working time for respondents. Fifteen categories were used to find out the distribution of respondents according to their working time. The above figure and Appendix (12) show that most respondents worked in the morning and afternoon. There were few respondents who worked at night time. In fact, these results confirmed again the flexibility of choosing the most convenient time for work. Moreover, the distance between the corporation office and working remotely was investigated. The figure below shows the respondents’ distribution according to the five options of distance measurement.
Appendix (12) shows the distribution of respondents according to distance between their offices and their remote work. Roughly half of them (48%) worked within less than 20 miles (that is, near to their office) whereas just 13% of the respondents worked over 100 miles from their offices. These results confirmed the results of Figure (7.4) which indicates that most respondents worked from home.

It can be concluded from the respondents’ profiles that more than half of them were male and two out of five were female. The most common age of respondents was between 35 to 44 years old and it also appears that most respondents had at least a Bachelor’s degree (or Master’s or PhD). In other words, they have higher education degrees. More than half of them were self-employed and most of the respondents were full-time, the vast majority of respondents working from their homes. Regarding their experience, most of them did not have long experience in teleworking. This is due to the recent practice of teleworking. Around half of the respondents worked five days a week, which means full-time employment. In addition, however, their work from home was so much yet the distance between their organisations and the location of their work is so little; just 13% of the whole number of respondents worked over 100 miles from their organisations. In fact, these results support the overview of teleworking statistics, particularly the teleworkers’ profiles. The next section will clarify the information flow and its main elements.
7.1.2 Information Flow

The research problem is mainly related to investigating the flow of information in the virtual organisations so it is quite important to start with clarifying the kind of information that is actually used in the teleworkers' offices, the direction of this information flow, their satisfaction with the information flow, and information flow for different categories of teleworker. First, the kind of information is clarified below in Table (7.5).

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly agree %</th>
<th>Agree %</th>
<th>Disagree %</th>
<th>Strongly disagree %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategic information</strong></td>
<td>82</td>
<td>9.8</td>
<td>59.7</td>
<td>23.2</td>
<td>7.3</td>
</tr>
<tr>
<td><strong>Policy information</strong></td>
<td>83</td>
<td>9.7</td>
<td>57.8</td>
<td>25.3</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Operational information</strong></td>
<td>95</td>
<td>14.7</td>
<td>65.3</td>
<td>14.7</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Table (7.5) Distribution of information kinds

The above table shows three kinds of information that were actually used when teleworking and sending (receiving) through the organisational layers. The above table confirmed that all the three kinds of information were used but operational information was used more than policy and strategy information. Then it is significant to clarify the direction flow of these kinds of information. Table (7.6) illustrates the direction of the flow.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vertical flow</strong></td>
<td>10</td>
<td>7.9</td>
</tr>
<tr>
<td><strong>Horizontal flow</strong></td>
<td>16</td>
<td>12.6</td>
</tr>
<tr>
<td><strong>Both of them</strong></td>
<td>101</td>
<td>79.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>127</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table (7.6) Direction of information flow

It is obvious from the above table that information in the teleworkers' offices flows in both directions (vertical and horizontal). Respondents rarely said that information
flowed just in a vertical or horizontal direction. The following analysis is concerned
with the flow of information. This flow was measured by seven criteria: sending
(receiving) information in a timely way, sending (receiving) information through
appropriate channels, sending (receiving) information to/from a trusted recipient and
sources, and information used satisfies the company’s objectives. These criteria are
measured by using the fifth scale (see Chapter Six – Questionnaire Design).

<table>
<thead>
<tr>
<th>Right Source (Recipient)</th>
<th>Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information sent is to a trusted recipient</td>
<td>N=129</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Information received is from a trusted source</td>
<td>N=124</td>
</tr>
<tr>
<td>Right Time</td>
<td></td>
</tr>
<tr>
<td>Information is sent on time</td>
<td>N=135</td>
</tr>
<tr>
<td>Information received is timely</td>
<td>N=132</td>
</tr>
<tr>
<td>Right Channel</td>
<td></td>
</tr>
<tr>
<td>Information is received through appropriate channels</td>
<td>N=132</td>
</tr>
<tr>
<td>Information is sent via an appropriate channels</td>
<td>N=130</td>
</tr>
<tr>
<td>Right Information</td>
<td></td>
</tr>
<tr>
<td>Information use satisfies the company’s objectives</td>
<td>N=124</td>
</tr>
</tbody>
</table>

* Scale is 1 for Strongly Disagree and 4 for Strongly Agree

Table (7.7) Satisfaction with information flow (seven items)

It is clear from the above table that the level of satisfaction of information flow was
“satisfactory” because most respondents “Agreed” or “Strongly Agreed”, which reflected
a satisfaction with information flow in their offices. Percentages of computing the two
options were 94.5, 91.1, 94.8, 90.1, 93.9, 93.8, 96.8 respectively. To be more clear, the
The above figure shows the distribution of respondents according to their opinion about information flow. The four scales reflect the different opinions about information flow. The point here is to see the percentages of “Strongly Agree” which are blue in colour. All seven items show a lack of satisfaction with different levels for all of them. In fact, there is a real need to investigate all of these items together. This reflects the need to investigate the integration of information flow, which will take place in the next chapter (Chapter 8). Further analysis is required to highlight the information flow according to different directions.

It is clear from the above figure that a few questions were used to measure inflows of information while others were used to measure the outflows. To see the relationship between both of them, a hypothesis was developed to measure the differences. H0 indicates “There is no significant relationship between inflows and outflows of information” and the alternative hypothesis is “There is a significant relationship between inflows and outflows of information”. The Spearman Test was adopted to test this hypothesis. Its result indicated that there was a significant relationship between the inflows and outflows of information because the Sig. (2-tailed) equaled 0.0001 and the correlation coefficient was (0.876), which means a positive relationship. So, the above
null hypothesis is rejected. The mapping of information flow in Chapter Eight will confirm these results.

Concerning the differences in information flow between full-time and part-time employment, the Mann-Whitney Test was used to investigate these differences. H0 stated that: “there is no significant difference in information flow between full-time and part-time employment”. The alternative hypothesis (H1) stated: “there is a significant difference in information flow between full-time and part-time employment”. The results of the Mann-Whitney Test showed that Mann-Whitney U= 1647.000, Z=-.813, Asymp. Sig. (2-tailed)= .416. However, these results guide us to accept the null hypothesis and reject the alternative hypothesis. Therefore, there is no significant difference between full-time and part-time employment concerning information flow; both are equal. The table below shows the results of the Kruskal-Wallis Test for the three hypotheses.

<table>
<thead>
<tr>
<th>Information flow according to different ages</th>
<th>valid cases</th>
<th>Test</th>
<th>Chi-Square</th>
<th>df</th>
<th>Asymp . Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information flow according to different age</td>
<td>133</td>
<td>Kruskal-Wallis Test</td>
<td>16.600</td>
<td>5</td>
<td>.005</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information flow according to different experience in years</th>
<th>valid cases</th>
<th>Test</th>
<th>Chi-Square</th>
<th>df</th>
<th>Asymp . Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information flow according to different experience in years</td>
<td>131</td>
<td>Kruskal-Wallis Test</td>
<td>6.018</td>
<td>4</td>
<td>.198</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information flow according to different distances of working away</th>
<th>valid cases</th>
<th>Test</th>
<th>Chi-Square</th>
<th>df</th>
<th>Asymp . Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information flow according to different distances of working away</td>
<td>129</td>
<td>Kruskal-Wallis Test</td>
<td>.416</td>
<td>4</td>
<td>.981</td>
</tr>
</tbody>
</table>

Table (7.8) Information flow according the distributions of age, experience and distance

Is there a significant difference in information flow concerning age distribution? To answer this question, the Kruskal-Wallis Test was used. A null hypothesis (H0) stated that: “there is no significant difference in information flow according to the age distribution of the respondents”. The alternative hypothesis (H1) was: “there is a significant difference in information flow according to the age distribution of the respondents”. The above table (Table 7.8) indicates that there is a significant difference
in information flow between the age distribution of the respondents because the significance level is 0.05. Then the above null hypothesis is rejected and the alternative hypothesis is accepted.

Regarding the differences in information flow between different years of experience of respondents, the Kruskal-Wallis Test was also performed to test these differences. A null hypothesis (H0) stated that: “there is no significant difference in information flow according to the respondents’ experience”. The alternative hypothesis (H1) was: “there is significant difference in information flow according to the respondents’ experience”. The above table (Table 7.8) indicates that there is no significant difference between the teleworkers’ experience in terms of information flow because the significant level is more than 0.05. It was actually .198, which leads us to accept the null hypothesis and reject the alternative hypothesis.

Flexibility of teleworking means carrying out the tasks across locations. To test the differences of information flow between distances of completing tasks remotely, the Kruskal-Wallis Test was also performed to test these differences. A null hypothesis (H0) stated that: “there is no significant difference in information flow according to the distance of working remotely”. The alternative hypothesis (H1) was: “there is significant difference in information flow according to the distance of working remotely”. The above table (Table 7.8) indicates that there is no significant difference in information flow between the distance of working remotely because the significance level is more than 0.05. Since it was .981 this guides us to accept the null hypothesis and reject the alternative hypothesis.

At the end of this section, it can be concluded that the three types of information (strategic, policy and operational) were used in the teleworking environment but operational information was the most common type that was actually used when teleworking. Also, the direction of information flow through the virtual organisational layers was in both directions (vertical and horizontal). This flow can be described as “satisfactory”. There is a significant relationship between inflows and outflows. Also, there is a significant difference in information flow between different ages. Furthermore, there is no significant difference between full-time and part-time employment in information flow. Also, there is no significant difference in information flow between different distances of working remotely. Due to the main argument of this research, ICT usage should present a targeted level of integrated information flow. The next section
covers the satisfaction level of ICT usage and its relationships with the integration of information flow.

7.1.3 Information and Communication Technologies (ICTs): This section investigates the satisfaction level of ICT usage and finds out the relationships between their use and the integration of information flow. To be understood, ICTs are divided into three categories: Electronic Office Systems, Electronic Communication Systems and Office Management Systems.

Electronic Office Systems (EOSs): Appendix (13) demonstrates the respondents' satisfaction level of ten electronic office systems. By computing “Agree” and “Strongly Agree” together, the satisfaction level of these systems were: spreadsheets (100%), word processing (99.24%), presentation software (96.59%), audio conferencing (95.59%), photocopier (94.87%), statistics packages (89.36%), scanner (89.36%), multimedia systems (85.91%), videoconferencing (80%), and project management tools (79.68%). This means that this level of satisfaction is approximately “satisfactory”. The two best tools are spreadsheets and word processing whereas project management tools and videoconferencing received little satisfaction. The next table shows the results of testing the relationship between the integration of information flow and satisfaction levels regarding the usage of these tools.
<table>
<thead>
<tr>
<th>Electronic Office Systems</th>
<th>N</th>
<th>Spearman Correlation (Significance)</th>
<th>Correlation Coefficient</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spreadsheets</td>
<td>119</td>
<td>.000</td>
<td>.406**</td>
<td>Modest</td>
</tr>
<tr>
<td>Word Processing</td>
<td>129</td>
<td>.000</td>
<td>.335**</td>
<td>Low</td>
</tr>
<tr>
<td>Presentation Software</td>
<td>85</td>
<td>.002</td>
<td>.326**</td>
<td>Low</td>
</tr>
<tr>
<td>Multimedia Systems</td>
<td>71</td>
<td>.006</td>
<td>.322**</td>
<td>Low</td>
</tr>
<tr>
<td>Audio conferencing</td>
<td>66</td>
<td>.011</td>
<td>.310*</td>
<td>Low</td>
</tr>
<tr>
<td>Scanner</td>
<td>92</td>
<td>.037</td>
<td>.218*</td>
<td>Low</td>
</tr>
<tr>
<td>Videoconferencing</td>
<td>25</td>
<td>.125</td>
<td>.315</td>
<td>---</td>
</tr>
<tr>
<td>Statistics Packages</td>
<td>47</td>
<td>.078</td>
<td>.259</td>
<td>---</td>
</tr>
<tr>
<td>Photocopier</td>
<td>78</td>
<td>.059</td>
<td>.215</td>
<td>---</td>
</tr>
<tr>
<td>Project Management Tools</td>
<td>64</td>
<td>.128</td>
<td>.192</td>
<td>---</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table (7.9) The relationships between EOSs and the integration of information flow

The above table reveals that more than half of the electronic office systems had significant relationships with the integration of information flow. All of the spreadsheets, audio conferencing, word processing, multimedia systems, presentation software, and scanner had a significant relationship with the integration of information flow because the significance of their relationship was less than (0.05); it actually varied from 0.000 to 0.037. The photocopier, statistics packages, videoconferencing and project management tools did not have a significant relationship with the integration of information flow (Sig > 0.05). The Spearman test was also used to clarify these relationships. According to the Correlation Coefficient, all of these relationships are positive because they are more than 0.000. Spreadsheets had a modest (CC = 0.406) relationship with the integration of information flow, while word processing, presentation software, multimedia systems, audio conferencing and the scanner had low (CC is less than 0.400) relationships(1). These

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(1) For more information concerning the meaning of low and modest relationships, see Ch7-page 154
devices of electronic office systems require internal and external communications so the communication systems should be investigated.

**Electronic Communication Systems (ECSs):** Appendix (13) shows the respondents' satisfaction with the twelve systems of electronic communication. The results of their frequency distributions reflect the satisfaction levels of the use of these systems as ADSL (100%), electronic mail (98.5%), multiple phone lines (97.1%), telephone-land lines (96.9%), answer machine (94.1%), facsimile (94.1%), voice mail (94%), ISDN (91.3%), call waiting (91.1%), mobile telephone (91%), chat software (85.8%), and computer modem (85.4%). The system that had the highest level of satisfaction was ADSL whereas the computer modem had the lowest level of satisfaction. To clarify the relationships between the satisfaction level of ECSs and the integration of information flow, the Spearman Test was used. Table (7.10) illustrates the results of this test.
Table (7.10) The relationships between ECSs and the integration of information flow

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Spearman Correlation (Significance)</th>
<th>Correlation Coefficient</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Waiting</td>
<td>56</td>
<td>0.000</td>
<td>0.491**</td>
<td>Modest</td>
</tr>
<tr>
<td>ADSL</td>
<td>64</td>
<td>0.000</td>
<td>0.468**</td>
<td>Modest</td>
</tr>
<tr>
<td>Chat software (eg. MSN Messenger)</td>
<td>48</td>
<td>0.001</td>
<td>0.450**</td>
<td>Modest</td>
</tr>
<tr>
<td>Voice Mail</td>
<td>100</td>
<td>0.000</td>
<td>0.425**</td>
<td>Modest</td>
</tr>
<tr>
<td>Electronic Mail</td>
<td>132</td>
<td>0.000</td>
<td>0.326**</td>
<td>Low</td>
</tr>
<tr>
<td>Answer Machine</td>
<td>99</td>
<td>0.002</td>
<td>0.311**</td>
<td>Low</td>
</tr>
<tr>
<td>Telephone-land Line</td>
<td>124</td>
<td>0.001</td>
<td>0.306**</td>
<td>Low</td>
</tr>
<tr>
<td>Facsimile</td>
<td>82</td>
<td>0.049</td>
<td>0.218*</td>
<td>Low</td>
</tr>
<tr>
<td>Mobile Telephone</td>
<td>108</td>
<td>0.351</td>
<td>0.091</td>
<td>---</td>
</tr>
<tr>
<td>Multiple phone line</td>
<td>68</td>
<td>0.525</td>
<td>0.078</td>
<td>---</td>
</tr>
<tr>
<td>Computer Modem</td>
<td>113</td>
<td>0.800</td>
<td>0.024</td>
<td>---</td>
</tr>
<tr>
<td>ISDN</td>
<td>56</td>
<td>0.905</td>
<td>0.016</td>
<td>---</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

It is obvious from the above table that all call waiting, ADSL, chat software and voice mail had positive modest relationships (Sig.<0.05) with the integration of information flow. Also, it can be illustrated that electronic mail, answer machine, telephone-land line and facsimile had positive low relationships (Sig.<0.05) with the integration of information flow. However, the mobile telephone, multiple phone line, computer modem and ISDN did not have significant relationships with the integration of information flow because Sig.>0.05. After presenting the findings regarding electronic office systems and electronic communication systems, it is also necessary to clarify the management tools of these systems.

Office Management Systems (OMSs): The third category of ICTs is the OMSs, which has seven systems. Appendix (13) obviously illustrates the respondents' satisfaction levels with these systems. This appendix noticeably reveals that most OMSs are not used as
much as communication systems and electronic office systems. This means some respondents may have not used these systems because they did not have enough knowledge about them. The satisfaction level of these systems use was “satisfactory”.

They can be arranged as: databases (95.33%), interactive diaries/scheduler (95%), file systems (94.49%), credit card verification (93.33%), electronic mailing lists (92.13%), workflow software systems (87.5%), and expense management tools (83.03%). To clarify the relationships between OMSs and the integration of information flow, the Spearman Test was performed. The table below shows the results of this test.

<table>
<thead>
<tr>
<th>OMS</th>
<th>N</th>
<th>Spearman Correlation (Significance)</th>
<th>Correlation Coefficient</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Systems</td>
<td>109</td>
<td>.000</td>
<td>.368**</td>
<td>Low</td>
</tr>
<tr>
<td>Databases</td>
<td>106</td>
<td>.002</td>
<td>.301**</td>
<td>Low</td>
</tr>
<tr>
<td>Interactive Diaries/Scheduler</td>
<td>80</td>
<td>.018</td>
<td>.264*</td>
<td>Low</td>
</tr>
<tr>
<td>Electronic Mailing lists</td>
<td>88</td>
<td>.021</td>
<td>.247*</td>
<td>Low</td>
</tr>
<tr>
<td>Expense Management Tools</td>
<td>53</td>
<td>.154</td>
<td>.198</td>
<td>---</td>
</tr>
<tr>
<td>Credit Card Verification</td>
<td>45</td>
<td>.811</td>
<td>.037</td>
<td>---</td>
</tr>
<tr>
<td>Workflow Software Systems</td>
<td>16</td>
<td>.927</td>
<td>.025</td>
<td>---</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table (7.11) The relationships between OMSs and the integration of information flow

It can be deduced from the above table that file systems, databases, interactive diaries/scheduler and electronic mailing lists had positive low relationships with the integration of information flow because Sig.<0.05. On the other hand, expense management tools, credit card verification and workflow software systems did not have significant relationships with the integration of information flow because Sig.>0.05.

To sum up this section, the Spearman Test was used to test the current relationships between ICT use and the integration of information flow. It revealed:
1. A positive modest relationship between the integration of information flow and spreadsheets, call waiting, ADSL, chat software (e.g., MSN Messenger) and voice mail.

2. A positive low relationship between the integration of information flow and word processing, presentation software, multimedia systems, audio conferencing, scanner, electronic mail, answer machine, telephone-land line, facsimile, file systems, databases, interactive diaries/scheduler and electronic mailing lists.

3. No significant relationships between the integration of information flow and videoconferencing, statistics packages, photocopier, project management tools, mobile telephone, multiple phone line, computer modem, ISDN, expense management tools, credit card verification, and workflow software systems.

However, the Information Audit (IA) Model was then used to audit the relationships between ICTs and the integration of information flow by comparing the current relationships (what is?) with the "ideal" relationships (what should be). This auditing takes place in the next chapter (Chapter Eight).

7.1.4 Adopting a new technology and identifying training needs

Each virtual organisation (VO) has its own milestones which heavily rely on using ICTs. These ICT tools allow workers to do their work across locations and time so it is important to investigate adopting a new technology for each organisation and also the required training in order for workers to work remotely.
<table>
<thead>
<tr>
<th>New technology</th>
<th>N</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>may increase flexibility</td>
<td>130</td>
<td>39.2</td>
<td>60</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>may provide better control and integration by means of better information and better error detection processes</td>
<td>116</td>
<td>33.6</td>
<td>63.8</td>
<td>2.6</td>
<td>0</td>
</tr>
<tr>
<td>may improve the quality of a product or services</td>
<td>122</td>
<td>35.2</td>
<td>59.8</td>
<td>3.3</td>
<td>1.7</td>
</tr>
<tr>
<td>may reduce operating costs of the office</td>
<td>124</td>
<td>37.1</td>
<td>53.3</td>
<td>8.8</td>
<td>0.8</td>
</tr>
</tbody>
</table>

*Scale is 1 for Strongly Disagree and 4 for Strongly Agree*

Table (7.12) Agreement for adopting a new technology

The above table (7.12) clarified that most respondents agreed with adopting a new technology and voted for predicting results which seem "may increase flexibility", the most popular reason.

No one can deny the training role, particularly while adopting a new technology so clarification of the support for training opportunities, types of training and the optional nature of training is needed.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>50</td>
</tr>
<tr>
<td>No</td>
<td>79</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
</tr>
</tbody>
</table>

Table (7.13) Support for training

The above table reveals that roughly two out of five of respondents (38.8%) got training support in their organisations. On the other hand, 61.2% of respondents indicated they did not getting training through their work. However, support for training seemed very
weak, particularly with regard to the teleworking style that actually was based on adopting technology which would allow employees to work across both locations and time. The table below shows the types of training.

<table>
<thead>
<tr>
<th>Type of training</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face training</td>
<td>23</td>
<td>16</td>
</tr>
<tr>
<td>Web-training (e-training)</td>
<td>15</td>
<td>10.4</td>
</tr>
<tr>
<td>Some programmes are face-to-face, others are e-training</td>
<td>15</td>
<td>10.4</td>
</tr>
<tr>
<td>Missing</td>
<td>91</td>
<td>63.2</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>100</td>
</tr>
</tbody>
</table>

Table (7.14) Types of training

The above table illustrates types of training. 16% of respondents got face-to-face training, 10.4% of respondents got web-based training and just 10.4% of respondents got both of them. The percentage of “Missing” responses is considered to be high (63.2%) and means that most respondents were not aware of training and that there was a lack of training support. Optional training was also measured. Table (7.15) demonstrates the responses to these questions.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compulsory</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Optional</td>
<td>12</td>
<td>8.3</td>
</tr>
<tr>
<td>Some programmes are compulsory, others are optional</td>
<td>18</td>
<td>12.6</td>
</tr>
<tr>
<td>Missing</td>
<td>112</td>
<td>77.8</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>100</td>
</tr>
</tbody>
</table>

Table (7.15) Optional and compulsory of training

On the subject of the optional or compulsory nature of training, it seems that training courses are generally optional rather than compulsory (8.3, 1.3 respectively). However, the point here is also the “Missing” item, which represents 77.8%. This means that the majority of respondents are not supported with training courses and there may be a lack of training at their work.
Regarding adopting a new technology, it is clear that most respondents agree with adopting a new technology but, as far as training is concerned, most of them do not have sufficient support for training courses from their organisations. Concerning who actually has this support, there are compulsory courses and others are optional. Furthermore, some courses are held face-to-face and others are based on an e-training approach. Some issues of training and technological change need more understanding. However, these issues are covered in the second part of this chapter.

As a conclusion to Part One, the main four points in this regard are: First, analysis of the respondents' profiles revealed that more than half of the teleworkers were male, they had a high level of education, and they mainly worked from home in full-time and part-time employment. Second, the satisfaction with information flow in the respondents' organisations was "satisfactory" but the integration of information flow needed more auditing. This will be discussed in the next chapter. Third, the Spearman Test was performed to test the relationships between ICTs and the integration of information flow. Responses revealed that most ICT tools had a significant relationship with the integration of information flow. Also, the relationships between ICTs and the integration of information flow needed auditing. Fourth, analysis showed a lack of training in the teleworking practices and agreement for adopting a new technology. The next part of Chapter Seven is related to the analysis of the first phase of interviews. These cover further issues of information flow, training and technological change in the teleworking environment.

Part Two: Interview Analysis

This part of Chapter Seven aims to provide a more in-depth analysis of the teleworking style and so it covers the additional issue of information flow, training and technological change in the teleworking environment. The first phase of interviews supported this analysis by considering the views of 10 interviewees. However, before starting the three sections in this part, details about the kinds of interviewees are provided. The table below illustrates 13 kinds of teleworking.
It is obvious from the above table that most of the respondents worked from home and worked in full-time employment. This new arrangement of work was basically intended to satisfy such social needs as family needs, flexibility, child care and activities of the local community. Entrepreneurial, Offshore and Hotel teleworking were used. These results confirmed the previous results from the questionnaire and also highlighted the picture of the teleworkers’ profiles.

7.2.1 Further Issues of Information Flow: The main issues that concern information flow are discussed below:

Mixing professional and personal information: Respondents at the interviews were asked this question: “Is your professional information mixed with your personal information during teleworking activities?”. The vast majority of respondents (9/10) confirmed that their professional information was separated from their personal information. Half of the respondents (5/10) had two PCs, in general, one laptop for professional purposes and a desktop for personal purposes. A few respondents (2/10) had a separate office (almost always the bedroom or spare bedroom) and a few respondents (3/10) had just one PC with a different password and different files.

Kinds of information that are used in the virtual office: Most of the information was used in an electronic format, particularly email, followed by telephone. It seems that most
teleworkers' communications are by electronic devices (email, image, text, and video) rather than voice devices (telephone, verbal) or in print format.

**Optimality of work:** Half of the respondents (5/10) said that they thought that they worked optimally but half of the respondents (5/10) said that they sometimes worked optimally. The main barriers that prevented optimal working were: (1) financial obstacles for getting the resources, (2) the information on the website was sometimes not good for their needs, (3) lack of integration with change, (4) sometimes they received wrong information from others which might cause a delay in their work (e.g. rubbish email), (5) sometimes stress, (6) sometimes travel, (7) lack of verbal communications (face-to-face communications), (8) colleagues did not always send the right information on time and this could cause a lack of integrated information flow so that they needed more training in how to manage their time and information, (9) lack of time, lack of people and resources, (10) missing Internet access while teleworkers were away, (11) missing the deadline of tasks, and (12) the different times worldwide. Most of these barriers are related to the communication systems and information management. Some one of respondents said:

"If I have special software that has a feature of arranging my tasks with priority, and remind me about each task's deadline, then will finish my tasks on time that could be great and useful. I think this technology will time my self" (first phase of interviews, 2003).

This reveals the little knowledge of respondents regarding special software for information flow.

**Special software for managing work (information flow):** All respondents (10/10) did not use special software for managing their work but the vast majority of them (9/10) were using general software like Outlook, project management software, people soft, spreadsheet, and netcall. It seems that Outlook was used by half of them. Regarding their knowledge of special software for workflow, it seems that most of them (7/10) did not have any knowledge about these kinds of software but a few of them (3/10) had heard about some kinds of workflow software; however, they did not use them.

**Reporting time sheets:** Basically, more than half of the respondents (6/10) used time sheets. These sheets were actually used for managing time and monitoring productivity and quality. Examples of these time sheets are: Excel, spreadsheets, electronic diary and calendar. There is a monthly revision for these time sheets.
To sum up this section, there are four results to be mentioned in this regard. In general, personal information is separated from professional information. Respondents at this interview also preferred adopting new technology, particularly special software for workflow. Regarding the format of information in the teleworking offices, it seems that most information was in an electronic format. Just half of the respondents worked optimally. Moreover, respondents had a monthly revision for their timesheets. The following section is related to training.

7.2.2 Further Issues of Training: The main issues that concern training are discussed below:

An annual plan for training: Half of the respondents (5/10) did not have an annual plan for their training but the remainder did have an annual plan. Those who did not have an annual plan had random training or training based on reaction to activities or changes.

The main subjects covered by training: The main subjects that are actually covered are:

1. Management (managing business skills, attitudes, consultancy, people management skills, personal development skills, presentation skills, self-development (skills) as management.
2. Technical training courses (Information Technology, Safety).
4. Teleworking courses: running a business from home and small business. Sometimes, reading about teleworking was undertaken.

Beside that, a few teleworkers had informal training like reading about Microsoft Excel and WinWord, and reading magazines and newsletters.

Determining training needs: There are three options for determining the teleworkers' training needs: teleworkers, their managers (or board suggestions sometimes), and their clients. Regarding respondents' answers, teleworkers and their managers mainly determine the need for training rather than the teleworkers alone. A second option was that teleworkers and their clients decided jointly.
Sponsoring training costs (if any): Concerning employed teleworkers, their company took on responsibility for sponsoring the training costs. On the other hand, self-employed teleworkers sponsored their own training costs; sometimes their clients sponsored their external training.

Issues associated with training: According to the interviewees’ views, the main issues associated with training were:

1. Cost of training and its budget. Concerning employed teleworkers, they actually have a limited budget for training and self-employed teleworkers paid for themselves so it is difficult to attend a lot of training courses; they select their training needs carefully.
2. There is little free time to do the training.
3. The successful key for each training session is that it is enjoyable. This enjoyment can be challenging because people have to have an enjoyable method.
4. Reading the courses materials at home may cut the cost of training.
5. Identifying a suitable course is useful before doing the work.
6. There is a big difference between training courses that are run by the commercial companies and the training courses which are run by the associations. The courses actually provided by the commercial institutions are expensive. On the other hand, the courses that are launched by the association are cheap and sometimes free.

It is clear that both self-employed and employed teleworkers face the same issues regarding training, which mainly focuses on cost and time. One of them said that: “Time and money are the main issues, because when you start your own business, you have to concentrate on building the business rather than developing your self” (first phase of interviews, 2003). This speech reflects the priority of budget and the expensive costs of training.

To solve this problem of adopting training programmes, they were asked about e-training which might decrease cost and save time as well. Most of them agreed and were happy about using e-training because of its feature of helping in providing online training while teleworkers were sick, cutting the costs and saving time. On the other hand, a few teleworkers were not happy with using e-training because they thought it caused more isolation. So, a few teleworkers recommended choosing this way of training just for some topics, not for all fields.
Concerning pre-training preparation, half of them (5/10) did not have an annual plan for their training. The training needs of self-employed teleworkers were actually determined and covered by the teleworkers themselves; sometimes there was cooperation with their clients for determining and covering training needs. On the other hand, the training needs of employed teleworkers were determined by the manager and the cost was covered by the teleworker's company. The main subjects of training were: management, marketing, technical expertise and teleworking. Time and the budget for training were the main issues concerning teleworkers' training. Technological changes in teleworking are covered in the next section.

7.2.3 Further Issues Regarding Technological Change

Teleworkers are basically relying on using technologies to work across time and locations so it is important to investigate the technological change in the teleworking environment. To find out their opinions on such changes in technology, some questions were asked. They were asked about the kind of connection (wired communication or wireless communication), the pleasure or dissatisfaction of working as teleworkers, whether they would like to change, whether the automation of tasks has increased or decreased over the last five years, and whether they were comfortable with technological change.

Kind of connection (wired communication or wireless communication):
Traditionally, wired communication was used before wireless communication which can be considered as a natural development of wired communication. Regarding the usage of both of them, teleworkers said that most of them (8/10) used wired communication rather than wireless communication (2/10). Which did they prefer? They voted (6/10) for using wireless communication rather than wired communication. A few respondents (3/10) voted for staying with wired communication. On the other hand, a few respondents (2/10) were already using wireless communication. It seems that the usage of wireless communication is preferable over the other.

Tasks Automation: They were also invited to answer the following question: Do you think that the automation of tasks has increased over the last five years? The vast majority of respondents (9/10) said that the automation of tasks had increased. Most of them agreed with this increasing and were happy. They clarified the benefits of automation as increased security, safety, cutting of costs, allowing individuals to work across location
and time, allowing them to work smarter, and doing more interesting work and more tasks. Someone mentioned that the automation is "a fact of life". On the other hand, a few of them focused on the social side of task automation because that may have been affected by this change.

**Trends to change teleworking:** The following question was directed to the respondents: *Are you happy teleworking or would you like to change?* The majority of respondents (8/10) were very happy as teleworkers, and would not have liked to change. A couple of them (2/10) were happy.

**Being comfortable with the changes in technology:** According to the interviews, all respondents were comfortable with the technological changes and they preferred the new technology.

**Adopting a new technology:** Most respondents (7/10) agreed with adopting a new technology in their offices and at their homes as well. More than half of them were working in companies aiming to produce a new technology. They supported the adoption of a new technology. The remainder of respondents (3/10) did not agree with adopting new technology because they basically needed to choose a convenient ICT for their tasks and would have liked to use it through someone else before they could use it themselves.

This section, however, showed that most teleworkers (8/10) used wired communication rather than wireless communication, the vast majority of respondents (9/10) said that the automation of tasks in the last 5 years has increased, most of them agreed with this increasing and were happy, and the majority of respondents (8/10) were very happy as teleworkers and would not like to change. Moreover, most respondents (7/10) agreed with adopting a new technology in their offices and at their homes as well.
7.3 Summary of Chapter Seven

In fact, the collected data from the designed questionnaire and the first phase of the interviews were used to achieve three aims of this research study. They were concerned with investigating the respondents' profiles, investigating the flow of information and investigating the relationships between ICTs and the integration of information flow.

Concerning the profile of teleworkers, the results indicated that more than half of them were male, mainly between the ages of 35 to 44 years old; they had high levels of education as most respondents had at least a Bachelor's degree; more than half were self-employed; most respondents were full-time; and the vast majority of respondents were working from their homes. Regarding their experience, most of them did not have a long experience of working in teleworking; around half of the respondents were working five days a week; the distance between their organisations and the location of their work was little. In fact, these results support the overview of teleworking statistics already presented in Chapter Five.

Pertaining to investigating the flow of information, the results indicated that the three types of information (strategic, policy and operational) were used in the teleworking environment and that information flows in both directions (vertical and horizontal). This flow can be described as "satisfactory". There is a significant relationship between inflows and outflows and there is a significant difference in information flow between different ages. On the other hand, there was no significant difference between full-time and part-time employment in information flow and there was no significant difference in information flow between different distances of working remotely. In general, personal information was separated from professional information and the most popular format was the electronic format. The point here to add is just over half of respondents worked optimally.

Regarding the third aim, which aims to investigate the relationships between ICTs and the integration of information flow, the results of the Spearman Test revealed a positive modest relationship between the integration of information flow and spreadsheets, call waiting, ADSL, chat software and voice mail. It also revealed positive low relationships with word processing, presentation software, multimedia systems, audio conferencing, scanner, electronic mail, answer machine, telephone-land line, facsimile, file systems, databases, interactive diaries/scheduler, and electronic mailing lists. Moreover, there were
no significant relationships with videoconferencing, statistics packages, photocopier, project management tools, mobile telephone, multiple phone line, computer modem, ISDN, expense management tools, credit card verification, and workflow software systems.

Additionally, the results lead us to say that there was a lack of training in the teleworking practices. The main issues regarding training mainly focused on cost and time. Some further related issues concerning training were addressed and these will be discussed in Chapter Nine. Analysis also shows enough agreement with adopting a new technology. Most of them agreed with this increasing and were happy; the majority of respondents (8/10) were very happy as teleworkers and would not like to change. Moreover, most respondents (7/10) agreed to adopting new technology in their offices and at their homes as well.

To validate these results, the IA model was used in the next chapter (Chapter Eight) to audit both the integration of information flow and also the relationships between ICTs and the integration of information flow. Furthermore, using the IA Model enabled the mapping of information flow in the virtual organisations.
Chapter Eight

Auditing and Mapping the Information Flow

8.1 Introduction

Consequent to the previous chapter which aimed to analyse the collected data from the designed questionnaire and the first phase of semi-structured interviews, it is vital now to seek to audit and map the flow of information in the virtual organisations of teleworkers in the UK. The audit itself discovers the inefficient points in the flow of information, whereas mapping displays the flow from the sources to the recipient by using visualisation techniques. The expected results of this chapter are to locate any lack in the integration of information flow, any lacks in the relationship between integration of information flow and ICTs, and secondly to map the flow of information and illustrate gaps, duplications, lacks and any other inefficiencies.

Two data sources were used to achieve these expectations. The first one was concerned with getting the results of the analysis of the questionnaire data in the previous chapter (Chapter Seven) and comparing these results with the ideal level of information flow integration and ICT impact on that integration level. In fact, Henczel (2001a, p 187) confirmed the need for this comparison between the current and ideal situation of information flow. The second source of data was mainly related to the second phase of semi-structured interviews which aimed to map the information flow in the teleworkers' offices. In Chapter Two, the Information Audit Model (IA) was selected as a model for auditing the information flow through the virtual offices of the UK teleworkers. The model developed by Henczel (2001) was used as a practical guide for auditing the following three aspects: integration of information flow, impact of ICTs on the integration of information flow, and mapping the information flow.

8.2 The Seven Stages of the Information Audit Model

Henczel's sequential model has seven stages: planning, data collection, data analysis, data evaluation, communicating recommendations, implementing recommendations, and the information audit as a continuum. According to Henczel (2001a, p xxiii) this model is not a highly structured and controlled process that operates in a tightly defined manner. This
means the components can be 'tailored' to suit the objectives of the organisation and the resources available.

8.2.1 Stage One: Planning

This is the first stage, which has five activities, most of them related to knowing what you want to do. It is associated with setting a plan for everything that is needed in the auditing of information flow. Swash (1997) stated that the project team must first identify the scope and the objectives of the project and establish its plan of action, what questions will be asked, of whom, and in what manner the responses will be recorded.

![Figure (8.1) Stage One – Planning (from Henczel, 2001a, p 173)](image)

The above figure shows five activities that should be done in the planning stage:

**Developing clear objectives:** The main objective for conducting the IA in the teleworkers' offices is to improve the flow of information through their offices internally and externally. The TCA case was studied fully by formal interviews with the executive director. Furthermore, an evaluation of the TCA website was carried out. Monitoring the electronic weekly newsletter from TCA to its members reveals that TCA could be considered as a case of information auditing. All of these above ways help in providing a clear picture of the TCA environment, and its mission, culture, history, number of members, demographic characteristics and their categories. This comprehensive picture
of TCA members surely helps in determining clear objectives. So, the objectives that can be achieved are: (1) auditing the integration of information flow, (2) auditing the relationships between the integration of information flow and the ICTs that are used in the offices of teleworkers, (3) mapping the flow of information in the TCA members’ offices.

Determining scope and resource allocation: After developing clear objectives, determining the information resources is required in terms of the physical scope (human, financial, technical) and the insource/outsource option. Concerning the scope of the audit, this is illustrated in Chapter Three, which covers all offices of TCA members. Auditing tasks cannot be done without allocating the required resources; this allocation primarily relies on the research aims, objectives and capacity. So, the researcher is playing the auditor’s role. This is a human resources need but some advice from Henczel was received and main support was given by the supervisor and also the executive director of TCA. Physical, financial and technical resources were provided by cooperation between the auditor (the researcher), the PhD research sponsor (the Jordanian Government) and the Department of Information Science at Loughborough University.

Choosing research methods\(^\text{(0)}\): The method should be able to clarify how to collect, analyse and evaluate the data. It should also be able to provide a plan for presenting conclusions and recommendations and their implementation. Swash (1997) encouraged the use of both questionnaire and interview in the survey instruments, because both would normally be combined together. Determining their style is dependent on the number of data to be gathered from and within what time constraints. In the case of TCA, and due to the audit objectives, the survey strategy was used. So both a designed questionnaire and semi-structured interviews were used to collect the required data. This selection of the survey strategy concurs with the audit objectives, audit scope and the availability of resources. The collected data were used to achieve the above objectives. The SPSS program was chosen to analyse the questionnaire data whereas interview data were analysed manually. This choice of methods and analysis is basically based on data type. After analysing the two kinds of data (questionnaire and interview) an evaluation step was made consequently. According to Henczel (2001a, p 187), this evaluation relies on a comparison of the current information situation with the “ideal” information situation. Henczel (2001a, p 176) also described the outputs of the evaluation step as the

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\(^\text{(0)}\) Henczel used “methodology”, this research would like to use “method”, it is more convenient in this regard.
recommendations. Promotion of the recommendations after their preparation is also important; this can take several forms: Email, the Internet and reports. Identifying recommendations and implementing them requires clarifying the level of support needed; this impacts on the recommendations.

**Developing a communication strategy:** this will take place before, during and after the audit. Before and during the audit, email, telephone, and face-to-face meetings were combined to clarify the aims of auditing and to develop the audit items and instruments. After auditing, email, telephone calls and reports were used.

To sum up this stage, it can be mentioned that the planning stage is the important stage, because it is concerned with defining and allocation of clear objectives, determining scope and resource allocation, choosing research methods, and developing a communication strategy. So, it is the stage of clarifying the road of the auditing and mapping of information flow. The next stage is the collection of required data.

### 8.2.2 Stage Two: Data Collection

In the second stage, the required data should be collected as planned. To do this, it is important to develop a store of information resources, preparing for the data collection via the questionnaire and personal interview. This stage is clarified in the figure below (Figure 8.2).

The above figure shows that four activities are required in this stage. They are:
Developing an information store: The collected information should have the facility to investigate the flow of information through the virtual offices of teleworkers. So, a particular store was used to find out a convenient source for auditing the flow of information. According to the U.S. Department of Commerce (2002), two methods of data collection are usually used in gathering auditing information: (1) Documents which means a metadata analysis approach. (2) Survey of questionnaire and interviews (interviews are preferable). Henczel (2001a, p 81) stated that also a focus group could be selected as a survey strategy. The organisation size is a major factor in the decision of how many people to survey (Swash, 1997). Therefore, this research study has two information stores, SPSS for the questionnaire data and Microsoft Word and Excel for the interview data (Interview Protocol).

Preparing for the survey: Audit questions should seek to identify what information is central to business needs, and what sources are actively used and how often. In this research, data that have been collected from the questionnaire were used to achieve the first and the second aims of this chapter. Data that were collected from the second phase of interviews was used to achieve the third aim (mapping information flow). Concerning the preparation of questionnaire, it was already illustrated in many situations, particularly in Chapter 6. The second phase of interviewing had many stages of preparation. It was designed and prepared before conducting the six interviews (for more information see Chapter 6).

These preparations of the questionnaire and interviews were controlled under the scope, objectives and aims of the information audit, and according to the scope, objectives and aims of the research study.

Conducting the Questionnaire: The designed questionnaire was designed using HTML language and tested twice (pre and pilot-test) before the main distribution, which itself was distributed in two ways: online and personal distribution. Details of the questionnaire design and distribution were already presented in Chapter Six.

Conducting the Personal Interview: In this research, the second phase of interviews was used to gain the required data for mapping information flow (the third aim of this chapter) by asking a list of questions. It was developed according to the aims, scope and capacity of this research. Swash (1997) confirmed for both the duration and scope of

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(1) In this research, "store" is used instead of "database", because it is more convenient.
individual interviews conducted during the survey will vary and that the information must be carefully recorded and analysed in a consistent and structured manner using predefined checklists and codings. Six teleworkers were interviewed. Half of them were interviewed face-to-face, whilst the others were interviewed over the telephone. Details of the interview design and distribution were already presented in Chapter Six.

In this stage (data collection), the information stores were determined, preparations for the questionnaire design and distribution were also clarified before in Chapter 6. The second phase of interviews was conducted at this stage. So, six teleworkers were interviewed. Now, the required data of the three aims in this chapter were ready to be analysed in the next stage.

8.2.3 Stage Three: Data Analysis

After collecting the required data, analysis of the finding from the results was needed. This stage had the following activities: inputting relevant data into the data stores (SPSS, Microsoft Word, Microsoft Excel), preparing the data, entering the data into the analysis tool, and then the data analysis itself. Figure 8.3 shows these activities.

![Figure 8.3 Stage Three: Data Analysis (from Henczel, 2001a, p 184)]
It is clear from above figure that the stage of "Data Analysis" has two steps: preparing the data and data analysis.

**Preparing the data:** the questionnaire data were already entered in SPSS and analysed in previous stages of this research (Chapter 7). The results of this analysis were listed in tables and were saved in Microsoft Word files. They were used in this stage of auditing to audit the integration of the information flow and to audit the relationships between ICTs and the integration of information flow. Concerning the data from the second phase of interviewing, they were prepared by using Excel sheets and Microsoft Word together. They were entered into the Microsoft Word and Excel files. The data of each respondent was saved in a separate file to be used in mapping the information flow.

**Data analysis:** This stage has three activities. They are: (1) Analysis of the survey data, (2) Mapping information flow, and (3) Matching information resources with organisational activities. They are clarified below.

1. **Analysis of the survey data:** As was mentioned before, the collected data needed to be analysed to achieve the three aims of this chapter. However, the auditor also played the role of analyst in addition to his external role of auditing. But in the real case of auditing, the auditor could be internal or external, the choice is actually based on the complexity of data and the level of analysis. Concerning the questionnaire data, the SPSS programme was already used to analyse the integration of information flow and the relationship between ICTs and the integration of information flow (see Chapter 7). The results of this analysis will be audited by comparing them with the ideal integration of information flow and the ideal relationship between ICTs with the integration of information flow (this will take place in the next stage, the evaluation stage). However, the qualitative data from the second phase of interview were analysed manually because there were just six interviews; this was not sufficient for the use of special software such as ATLAS or NUD*IST. However, a plan analysis was used in analysing the two kinds of data.

2. **Mapping information flow:** The collected data from the second phase of interviews was used to map the flow of information to/from the teleworkers' offices. Henczel (2001b) stated that:
"The mapping of information flows enables the identification of gaps, duplications and flow inefficiencies. It can also form the basis for a 'knowledge transfer' model by identifying where knowledge is created, where it is needed and where it currently goes (if anywhere). Visual representation of the information flows can identify bottlenecks and inefficiencies (lots going in but very little coming out), information gatekeepers (lots coming in through a single distribution point), dead ends (lots going in but nothing coming out), over provisions (services provided but not required), gaps (non-provision of critical resources), and imbalances/biases (inequalities in information provision)."

To investigate the inefficiencies in the flow of information in the virtual organisation, six teleworkers in different living and working areas, with different jobs and experience, were invited to provide their opinions of information flow, its use and behaviour while they were working remotely. The background of each teleworker, the scope of his/her job, a description of information use, resources, inflows and outflows of information in each case are clarified below. Then, a map of the current information situation and the map of the proposed information situation are included. Explanations of each map are also provided at the same time.

Teleworker A: The job title of Teleworker A is Information Officer. She was employed as a full-time worker from home and has had this job for 4.5 years. For the last 2 years she has been a teleworker and in the last six months she has worked part-time. Her business unit (BU) is called Information Services. The main customers for her BU were the internal consultants within her company which provided consultancy services to new organisations. Teleworker A has to provide information services for those consultants so her customers are people within the consultancy who require information.

Her job has three main objectives: (1) To provide information. The critical success factor (CSF) for this objective is the accuracy and timelines of information. Her task is concerned with providing information to the consultant within the company. (2) To manage and organise information within the company. The CSF is to access information and to know what information is available on the company. The task is managing information, providing indexes and symbols to internal resources and providing additional keywords to databases to enable efficient searching of internal database, and (3) To train consultants. The CSF understands the information needs of the consultants and understands the level of information literacy that they have. The task is concerned with delivering training over the phone, speaking to consultants and showing them some resources available on the Internet. Her use of information involves the following issues:
Accessibility (availability, convenience), accuracy, adequacy/relevance, delivery methods and timeliness are the most important criteria for choosing/using information resources.

Her company has an annual revision of information needs and she is actually participating in her company's yearly decisions on what information resources they need.

She receives different kinds of reports from her company. They are journal materials, financial information, publications, memos, internal notes and administrative printed materials. Most of the thing that she receives are accessed electronically.

Regarding outflows of information, four types of information resources are provided (1) Information guidance notes, which are provided to anybody within the company in electronic format (in Word) and they are sent based on need on a weekly basis, (2) Statistical Data which are provided to anybody within the company in electronic format (Excel and Word), and they are sent, when necessary, on a weekly basis, (3) A current awareness report is prepared that, after receiving it from an Information Broker, it is then distributed to a certain number of consultants in the company. It is in electronic format and sent weekly, and (4) Email or resources, which are actually sent to the consultants in the company after delivering a training session. It contains a list of resources (websites, journals, books, etc) that are useful for completing their job. It is also in electronic format and is sent after delivering each training session (once or twice a week).

Quite a bit of information is obtained from the corporate information centre staff, company intranet and websites outside the company. Some information is obtained from the company website and from Information Brokers while a little information is obtained from commercial information services, CD ROMs and College/University Libraries. Public libraries are not used.

Concerning information storage and disposability; the electronic format is already backed up on the company intranet in London and in email boxes, but the paper based version is not duplicated elsewhere. It is actually saved in files in Teleworker A's office.

Teleworker A belongs to a work team. She communicates most often with her information manager in the company.

Both the terms 'information need' and 'teleworker (or any other synonym)' are not mentioned clearly in any plans, teleworker contracts or brochures about teleworking.
training programmes, the information centre's strategic plan, or other planning documents. They are just mentioned in the general notes in the business plan.

- The flows of the Internet connection is the biggest barrier to getting information that she needs for her job when teleworking. On the other hand, the ability to access the company intranet is the biggest help to her in finding information she needs for her job when teleworking.

- On the subject of opportunities for improving the flow of information in her organisation, she said that she has a "Blog". This is a web-based resource that can be updated daily and is based on resources, opinion, etc. It is a tool for information sharing.

**Current Information Situation:** Figure (8.4) illustrates the current flow of information in and out of the office of Teleworker A. (1) The Inflows Information figure reflects different sources of information: her company, her manager, information broker, business databases, outscores websites and the storage system. The storage system itself consists of a back-up system and the box files. These sources provide various kinds of information resources like formal reports, requests, access to the intranet, training materials, etc. These resources help her in some way to do the job of Information Officer. Each resource has a colour coding (for more information about the meaning of each colour, see Appendix (14). (2) The Outflows Information figure shows that the Information Officer just sends information out to her company. (3) The Figure of Use Cases Modelling confirmed that most of the relations between actors and use cases are one-way relationships. There are four use cases for the job of Information Officer. (4) The Flow Chart figure reflects the sequence of information flow from different resources to the office of the Information Officer. The start point is "Ask for consultancy" and the last point is "Consultancy Report is Ready".

**Proposed Information Situation:** Figure (8.5) shows the proposed map of information flow in the office of Teleworker A. Analysis of the current situation of the Information Officer reveals that she takes up a place between the consultants within the company and the different sources of information so some improvement could be made by: (1) Using an Information Sharing System. (2) Using a "Blog" which aims at information sharing, (3) Using a "Document Management System" (DMS), particularly to convert print format to electronic format so her response time to the request will be better. And (4) Using a "Walk Through Guide". This will also improve the use of training materials that are actually retrieved from the outsourcers' websites.
Figure (8.4) Current Information Situation (Inflows, Outflows, Use Case Modelling and Flow Chart Modelling)
Figure (8.5) Proposed Information Situation (Inflows, Outflows, Use Case Modelling and Flow Chart Modelling)
Teleworker B: The job title of Teleworker B is Finance Coordinator. She is self-employed and has been working from home for 3 years in this job as a part-time worker. Her customers are people (patients) who have financial problems. Health agents in the Health Sector are the main suppliers for her job. The job of Teleworker B is concerned with just two main objectives: (1) To prepare for the telephone calls. The CSF has a clear and updated list of people and the task is preparing the list. (2) To apply the call list of people. The CSF understands the real situation (customer needs) and the task is doing a series or list of calls between 5pm to 9pm. Below are the issues relating to information use:

- Accessibility (availability, convenience), comprehensive, currency and delivery method are the most important criteria for choosing/using information resources.
- Her agent does not determine her information needs.
- There are no routine reports from her agent, the agent just lets her know when the customer signs a request with them. This means extra money for her.
- Concerning outflows of information, there are three types of report that are provided outside: (1) Confirmation email to the agent to confirm receiving the “list of people”. It is in electronic format and is sent by email on a monthly basis. (2) Telephone conversations which take place with the customers on the “list of people”. It is an audio conversation and 30 to 40 people are called per night. (3) Investigation report, which is actually sent to the agent. This report is sent after evaluating each customer’s case and is in electronic format. Three or four reports are sent per night.
- Quite a bit of information is obtained from the agent’s information centre staff whereas public libraries, the company website, the company intranet, websites outside the company, commercial information services, CD ROMs, Information Brokers, and College/University Libraries are not used.
- Concerning information storage and disposability, a backup system for electronic format files is used and the print format files are stored in box files. Telephone calls are not stored at all.
- She does not belong to a work team and communicates most often with the agent.
- Both terms of 'information need' and 'teleworker (or any other synonym)' are not mentioned in any internal guidelines concerning teleworking, IT plans, training programmes or in the information centre’s strategic plan or other planning documents.
To the question of whether she was satisfied with information retrieval for her job, she replied "half and half". Why? Because she has not much information on her computer from the agent. She needs more information about services, prices and placements from her agent. That means she does not have updated information about her agent. She needs more sharing of information with her agent. Also, she added that sometimes she faces a critical situation with customers when she mentions old information from her agent which leads to wasted time and money. She also added "The problem is the situation between the agent and the client, the agent seeks to find the clients, when I phone them out, they have not".

The biggest barrier to getting information that she needs for her job when teleworking is the information from the agent. It is not updated to meet her needs and accessing online information is not available to her. The biggest help in finding information she needs for her job when teleworking is the clear and updated list of people (patients) from the agent.

On the subject of any opportunities for improving the flow of information in her organisation, she suggested an up-to-date list that should be checked before she receives it from her agent. Also, increasing the existing number of clients per night to gain extra money. The aim is to raise the number of clients from 3-4 per night to 5-6 clients per night.

**Current Information Situation:** Figure (8.6) illustrates the current flow of information in and out of the office of Teleworker B. (1) The Inflows Information figure shows simple and clear sources of information. They are mainly a "list of people" and telephone calls with customers. The list is actually received via attachments on email. This reflects the lack of updated information from the agent and the telephone calls are not saved at all. (2) The Outflows Information figure illustrates that, besides the telephone calls, there are two reports actually being sent to the agent. They are a confirmation email and an investigation report. (3) The Figure of Use Cases Modelling shows that the vast majority of relationships between the actors or between actors and use cases are one-way relationships which leads to a lack of information sharing. (4) The Flow Chart figure reveals independent sequences between processes. They begin with sending the list, then receiving it, the preparation for the call, applying the call and lastly the preparation of the report itself for those who need more than £3000 and have serious interest in solving their problem. Also, this figure reveals that there is a one-way direction flow of information and that there is no interaction between the agent and the finance
coordinator. This reflects a lack of understanding of the information needs and of information sharing.

**Ideal Information Situation:** Figure (8.7) shows the proposed map of information flow in the office of Teleworker B. It reflects the need for three solutions. They are: (1) Using an online information strategy. The list of people could be in an online form and the finance coordinator could access that form online, filling out the response of the customer while the telephone call is being made. This means the information will be more structured. Telephone information will be stored and there will be no need to send investigation reports; it will be necessary just to submit the form when it needs to be addressed in the company and to save it (if it is important) if that is what is decided. With using the online form, a follow-up report could be sent to the finance coordinator. This would be easier by using an online form. (2) Some related updating is important in this job so the agent should send any related updating of products, prices, etc. That leads to more understanding and the application of information needs and sharing. (3) Emails and post could be used besides the telephone calls. They will help to gain more information from the customer and to give more options to the customers to reply to the request. All of these suggestions seek to raise the number of clients per night from three or four to five or six per night. This means solving more problems and makes extra money for both the health agent and the finance coordinator.
Flow Chart Modeling

Use Case Modeling

Outflows Information

Inflows Information

Figure (6.7) Proposed Information Situation (Outflows, Outflows, Outflows, Flow Chart Modeling)

[Diagram showing flowchart and use case models with various nodes and connections]
**Teleworker C**: The job title of Teleworker C is Project Manager. He has been working, sometimes from home and mainly from the centre, for 16 years in this current job on a full-time basis. His customers, (the local population and small companies), are the local community within 5 miles distance His business unit is not a commercial unit but a sort of community resource (a non-profit organisation). Teleworker C has four main objectives: (1) To provide leisure activities to the local community. The CSF for this objective is to satisfy the needs of the local community. The task for achieving this objective is sending a letter to the local community organising the groups, receiving the response from the community, and launching some courses such as painting, dealing with road accidents, etc. (2) To provide training. The CSF is to satisfy the needs of the local community. The task is to arrange a convenient location for training which is actually delivered by the local educational college. (3) To provide some local services, such as scanner, fax, print and (4) To help small businesses to grow. His use of information involves the following issues:

- **Accessibility (availability, convenience), accuracy, cost, currency, delivery method, technical accuracy and timeliness are the most important criteria for choosing/using information resources. He has no clear perception of determining his information needs. Regarding the reports that are actually received routinely from his company, there is a service level agreement report. It is actually received from his employer.**

- **Concerning outflow information, two types of reports are provided outside his office: (1) a quarterly progress report to the local authority, a written report in print format, and (2) an annual report which is sent to the Charity Commission. This is also written.**

- **Quite a bit of information is obtained from the project officer in the local authority, from websites outside the centre and commercial information services. Some information is obtained from the college/university library and a small amount of information is obtained from CD ROMs.**

- **There are three types of information format used in his office: verbal (face-to-face), print and electronic. Concerning their storage and disposability, most items are not duplicated and stored at all because there is no backup system for the electronic format. Concerning information in print format, he has a lot of information like the financial information that is saved.**

- **Teleworker C does not belong to a work team. He communicates most often with the project officer in the local authority.**
Regarding both the terms 'information need' and 'teleworker (or any other synonym)', they are rarely mentioned in the contracts, brochures and IT plan.

Lack of access to information while he works at home is the biggest barrier to getting information that he needs for his job when teleworking. Search engines (such as Google) are the biggest help to him in finding the information he needs for his job when teleworking.

On the subject of opportunities for improving the flow of information in his organisation, he added that secure access of information is the most important solution for allowing more open access to information sources.

**Current Information Situation:** Figure (8.8) illustrates the current flow of information in and out of the office of Teleworker C. (1) The Inflows Information figure shows that Teleworker C has various sources of information (small businesses, local authority, etc.). The format most used is verbal communication. (2) The Outflows Information figure demonstrates a clear flow of information from the project manager to the charity commission, small businesses, and to the local community, college, and local authority. Comparing the inflow figure with the outflow figure reveals that his job is more to do with "pushing" information to the local community and small businesses, rather than "pulling" in information. In fact, it is one of his job goals to improve the local community's activities. (3) The Use Cases Modelling figure shows the two way relationships between actors and use cases but there are no relationships between the use cases themselves. (4) The Flow Chart figure reflects a general sequence flow of information that is associated with doing the main job of supporting the local community and small businesses. In fact, this general sequence is not supported by enough suitable sources of information, particularly in training tasks. Because trainees do not have enough online information, they are not motivated. **Ideal Information Situation:** Figure (8.9) shows the proposed map of information flow in the office of Teleworker C. It reflects the following suggestions: (1) Because the target is to increase the number of trainees, this goal can be achieved through using online information access to the information sources in the college because trainees are not able to access the website of the college. The security issue can be solved by using a security system such as VPNs. This suggestion will save time and will encourage the trainees to attend more courses. (2) For his professional information, online information will help him to access the information sources while he is working at home. This suggestion reflects the need for a special system of information retrieval which will enhance the flexibility of his work.
**Teleworker D:** The job title of Teleworker D is Technical Director. He is self-employed and works both from home and the client’s site. He has had this job for one year and has a part-time arrangement with his customers. He is mainly working in the telecommunications market. His job has four main objectives: (1) To create a strategy. The CSF understands the market knowledge and the task is to understand the current markets, to do essential market research, and to narrow down business requirements. (2) To create techno-commercial business models. The CSF is a vision of a business model while the task is to analyse technology and business models, and define and implement a new model. (3) To design and architect solutions. The CSF gets the right scope of design and the task is designing new solutions. And (4) To provide high level recommendations successfully. The task is to compile or to list the scope and carry out a high level of design. So, objectives 1 and 2 are related to the analysis stage. Objective 3 deals with the designing stage and objective 4 provides implementing recommendations. His use of information involves the following issues:

- Accessibility (availability, convenience), accuracy, cost and timeliness are the most important criteria for choosing/using information resources.

- Concerning outflows of information, four types of reports are provided outside his office (1) Request from the Market Research company. This is in an electronic format or paper format and is sent twice a day. (2) Follow-up Report to the previous request; this could be in either an electronic or print format and is sent five times a day. (3) Final Report which is sent to the customer. It notifies the customer of the suggested solutions and designs. It is in an electronic format and is sent once a month. And (4) Follow-up Report which is also sent to the customer in an electronic format once a month.

- Quite a bit of information is obtained from the company’s website, the company intranet, websites outside the company, and commercial information service. Some information is obtained from corporate information centre staff, public libraries and Information Brokers while a small amount of information is gained from CD ROMs and College/University Libraries.

- Concerning information storage and disposability, electronic format information is stored in a back-up system, on the Internet, and in computer files. Print format information is stored in the business library (office). There is also a soft back-up system which is concerned with scanning the print papers and sending them to be saved in the library in an electronic format.
• Both the terms 'information need' and 'teleworker (or any other synonym)' are not mentioned so much in the IT plan, training programmes and the information centre's strategic plan or other planning documents. He is satisfied with the information retrieval for his job.

• The biggest barrier to getting information that he needs for doing the job when teleworking is the communication and security barriers. He confirmed that everything should be online. This is a recommended opportunity for improving the flow of information in his organisation.

Current Information Situation: Figure 8.10 illustrates the current flow of information in and out of the office of Teleworker D. (1) The Inflows Information figure shows the different resources and sources of information. The problem here is accessing and retrieving information resources happens many times. This reflects the need for determining the real needs for information and the real need for structured information. This suggestion will save time and improve the flow. (2) The Outflows Information figure is associated with a simple and clear picture of information flow from the technical director to the customer and the business company for market research. The storage system here is different in some ways. In addition to the back-up system for electronic format and box files for print format, there is a soft back-up system which converts the print format into an electronic format by using a scanner. (3) The Use Cases Modelling figure shows that all relationships are one-way relationships. The scenario for doing this job starts with receiving a request from the customer, then analysing, designing and providing some implementation recommendations at a high level that are actually sent to the customer. (4) The Flow Chart figure indicates a flow sequence. The start point is receiving a request from the customer and the last point is sending the proposed design solution and its high level recommendations to the customer. Different information sources support this flow.

Ideal Information Situation: Figure 8.11 shows the proposed map of information flow in the office of Teleworker D. It can be seen that the access and retrieval of information takes a lot of time (e.g. 50 times a day, 40 times a day, etc) so two suggestions could be addressed: (1) It reflects the need for using more structured systems such as databases and using online information resources such as information brokers. (2) Recruiting an information officer will retrieve the right information at the right time through an appropriate channel. This will save time and money and will allow more interactions with the information resources (two directions).
Teleworker E: The job title of Teleworker E is Proprietor. He has been working from home as a self-employed person for 14 years. Some time he works part-time, at others he works full-time. His customer is any business who needs marketing, digit mapping, databases, etc. The job of Teleworker E has four main objectives: (1) To analyse the customer needs. The critical success factor (CSF) for this objective is defining the real needs. The task is defining objectives, expectations, the job and the problem itself. (2) To develop appropriate solutions that meet the customer's needs. The CSF gets a very high recommendation from the customer and the task is to develop solutions that meet the defined needs before providing the solutions (e.g. drawing the scheme, extracting the information, collating the information in a certain form, such as creating databases). (3) To implement and adopt an improvement or development that has been decided. The CSF is related to satisfying and achieving the objectives of the customer and the task is implementing and submitting the project for use by the customer. (4) To maintain the search for new business and customer opportunities. The CSF is to find real customers. The task is searching for new customers during the project. His use of information involves the following issues:

- Accessibility (availability, convenience), accuracy, adequacy/relevance, comprehensiveness, technical accuracy and timeliness are the most important criteria for choosing/using information resources.
- Concerning outflows information, three types of reports are provided outside his office (1) A progress report, which is concerned with the progress of the project. It is sent to the customer in either an electronic or print format once a week (2) The final report is actually sent after finishing the project (and receiving the invoice, bill, etc.). It is sent to the customer in either electronic or print format at the end of the project. (3) A follow-up report, which is concerned with asking the customer about any new problems (to find new business opportunities). The customer receives it in either electronic or print format 2 to 3 weeks (maximum after 2 months) after the project’s end.
- Quite a bit of information is obtained from the corporate information centre staff (the customer centre). Some information is obtained from the customer's company website, the company intranet and websites outside the company. A little information is obtained from commercial information services, CD ROMs, Information Brokers, and College/University Libraries.
• Concerning information storage and disposability, the electronic format is stored in a secure back-up system elsewhere. Print format is stored in the business library (office).
• Both the terms 'information need' and 'teleworker (or any other synonym)' are not mentioned much in the IT plan, training programmes and the information centre's strategic plan or other planning documents.
• Concerning the biggest barrier to getting information that he needs for doing the job when teleworking is the online intrusion and the limitations to open access of information. The biggest help is the freeing up of time.
• Availability of information (electronic and print format), building their own database, having more directories and magazines, and having good training for teleworkers are the recommended opportunities for improving the flow of information in his organisation.

Current Information Situation: Figure 8.12 illustrates the current flow of information in and out of the office of Teleworker E. (1) The Inflows Information figure shows that most of the information resources are derived from the customer and the others are derived from different sources of new business opportunities. (2) The Outflows Information figure demonstrates a simple and clear outflow of information. There are three types of reports that are actually sent to the customer. (3) The Use Cases Modelling figure shows that some relationships between actors and use cases are two-way relationships which reflect some kind of interaction between Teleworker E and his customer. The point here is using different sources to search for new business opportunities. These could be right or could be a waste of time and money. (4) The Flow Chart figure indicates that there are two sequences of information flow. One is concerned with designing solutions and the second one is associated with maintaining the search for new business opportunities. The point here is the delay symbol. It indicates the delay of the manager's (or boss's) response in solving the new problem after the implementation itself.

Ideal Information Situation: Figure 8.13 shows the proposed map of information flow in the office of Teleworker E. Some suggestions could be addressed: (1) Sources of information in the customer’s site should be more open to access. This is associated with getting the right information that will seriously help in designing to meet the real need. (2) Learning how to build the search strategy will save time and increase the opportunity of finding new business opportunities and new customers. (3) Add a training stage. This
is important in adding more interaction with the designed solutions and with the customer. (4) Teleworker E should be informed about the updating of the catalogue, which also means more sharing. (5) To implement a right solution, support from the manager is very important and is required. The response time to solve the problem is also important because the manager is busy and solving the problems takes a long time. There is a gap between information availability and information needs.
Teleworker F: The job title of Teleworker F is Director. She is employed with her own company and has been working from home for 2 years in this current job on a full-time basis. The job of Teleworker F has three main tasks: (1) To arrange travel bookings for travellers who are looking for holidays and also to send a monthly report to the travel client, (2) To create databases for the marketing client. The task starts with preparing a clear and correct Excel data sheet of companies' managers, CEO, etc. details. It is then sent to the marketing client and (3) To create a presentation for the client which is prepared in Power Point format. Her use of information involves the following issues:

- Accessibility (availability, convenience), accuracy, adequacy/relevance, comprehensiveness, cost, currency, delivery method, technical accuracy and timeliness are the most important criteria for choosing/using information resources.
- She participates with her customers in the revision of determining the information needs. For example, the travel clients ask her when they need to set up a new change in the online system of booking.
- Concerning outflow information; two types of report are provided outside her company: (1) Results of bookings which are sent to the traveller and (2) An analysis report that is sent to the traveller client. This is in an electronic format. (3) Power Point presentations to the client, also in an electronic format, and (4) Excel sheet databases which are sent to the marketing clients in an electronic format. Concerning the frequency of delivery, all of them are sent based on need.
- Quite a bit of information is obtained from websites outside the company. Some information is obtained from the company intranet and commercial information services while a little information is obtained from the company website whereas corporate information centre staff, public libraries, CD ROMs, Information Broker, and College/University Library are not used.
- Concerning information storage and disposability, electronic format materials are actually stored in the Back-up system and the print format is stored in box files.
- Teleworker F belongs to a work team with several teams and communicates with different people.
- The terms 'information need' and 'teleworker (or any other synonym)' are not mentioned in any plan, brochure or training programmes.
- She is quite satisfied with the information that she is able to retrieve for her job.
- Concerning the biggest barriers when she teleworks, accessing paper information is difficult for her so she needs somebody to send it to her. Hence, she needs an
online information system that allows her to access the information resources at any time and from any location whereas team people are the biggest help when teleworking.

**Current Information Situation:** Figure 8.14 illustrates the current flow of information in and out of the office of Teleworker F. (1) The Inflows Information figure shows that teleworker F receives three requests from the traveller, marketing client and the presentation client. To satisfy these requests, different sources of information are used. They are: a printed directory of companies, different websites and the online database of the traveller client. (2) The Outflows Information figure demonstrates a clear flow of information from the director to the traveller, the traveller client, the marketing client and the presentation client. (3) The Use Cases Modelling figure shows different types of relationships between use cases and the actors. There are no relationships between use cases. This reflects an ad hoc information flow which leads to a study of the integration of information between different tasks for the single worker. The point here is there are three scenarios so there is a need to find an integration between these scenarios to avoid any delay in the sending and receiving of information. (4) The Flow Chart figure reflects a three sequence flow of information that is associated with the main job of Teleworker F. Hence, the point here is to manage these different sequences and avoid the chance of overlapping between them.

**Ideal Information Situation:** Figure 8.15 shows the proposed map of information flow in the office of Teleworker F. It reflects the following suggestions: (1) Converting the printed directory of companies will solve the biggest problem of retrieving information from printed sources. This suggestion will save time on the day and will also cut the opportunity for any overlapping between the three tasks. (2) Attending training courses on information use will also enhance a new method of time management and will enable learning how to build the search strategy. (3) Using special software for transferring the presentation from the presentation client to her office over the Internet will save time for her and also for the presentation client. This kind of software aims to transfer audio information from A to B and the receiver (B) can save it in a file. It is then easy to manage. The main benefit of this software is to send and receive the right information because, since the presentation is sent via hand-written paper (fax or email), sometimes it is not clear.
Figure (8.15) Proposed Information Situation (Malicious, Outflow, Use Case Modeling and Flow Chart Modeling)
Figure (8.14) Current Information Situation (Inflows, Outflows, Use Case Modelling and Flow Chart Modelling)

**Inflows Information**
- Traveller
  - Telephone call (a)
  - Email (e)
  - Presentation - handwritten (fax)
- Client presentation
- Printed directory of companies
- Different websites
- Marketing client

**Outflows Information**
- Traveller
  - Result of search
  - Presentation is ready - power point (c)
- Presentation client
- Marketing client
- Travelling client

**Use Case Modelling**
- Traveller
  - Arrange travel booking
- Marketing client
  - Creating database
  - Creating presentation
- Different websites
  - Printed directory of companies

**Flow Chart Modelling**
- Traveler
  - Receiving the request
  - Arrange the booking
  - Monthly report
- Marketing client
  - Receiving the request
  - Creating database
- Different websites
  - Telemarketing campaign
  - Excel sheet
- Printed directory
- Presentation client
  - Receiving
  - Power point presentation
  - Creating presentation
3. **Matching findings with organisational objectives**: This process of matching information resources with organisational objectives is done in each case of teleworkers (A to F). Once the objectives of the business unit and their critical success factors (CSFs) have been determined, the task to achieve these objectives should be also determined and the task needs at least one information resource. Using use cases modelling shows the relationships between these resources and each use case. Each information resource is addressed according to its importance to the task and a scale of colour was used to reflect this (to understand the meaning of each colour, see Appendix 14). Matching tasks reveals some current problems of information flow in the teleworkers' offices.

In the above section (on data analysis), the data from the questionnaire were analysed in the previous chapter (Chapter 7). Data from the second phase of interviews were analysed to map the current and the proposed situations of information flow of six teleworkers. Evaluating results from these maps leads to a few proposed solutions in addition to an evaluation of the integration of information flow and the relationships between ICTs and the integration of information flow in the next stage.

### 8.2.4 Stage Four: Data Evaluation

Evaluating data in this model comprises the following activities: evaluating any gaps and duplications, interpreting information flows, evaluating the problems, and developing strategies. The following figure (Figure 8.16) illustrates this.

![Flowchart of Stage Four: Data Evaluation](image)

**Figure (8.16) Stage Four: Data Evaluation** (from Henczel, 2001a, p 186)
Each evaluation stage should have one of the following evaluation levels: (1) Holistic evaluation studies the case in general and (2) Embedded evaluation studies the case in depth. Both of them can be adapted and applied to the study of teleworking. Holistic evaluation was used to audit the integration of the information flow and relationships between this integration and ICTs. Embedded evaluation was used to audit the maps of information flow in six cases of teleworkers' offices in different jobs, living areas and demographics. Henczel (2001a, pp 186-189) said that problems and opportunities can be identified and then interpreted and evaluated within the context of the organisation after collecting and analysing data. Not every problem will need to be addressed and some will not be able to be addressed due to organisational constraints such as insufficient resources (people, money, technical or physical resources).

As mentioned previously, the evaluation stage comprises the following activities:

1. Analysis of gaps in the integration of the information flow and their relationship with the ICTs used: Gap analysis can be defined as:

   "a tool for assisting the agency to understand what it has and where it needs to improve. An initial information gap analysis should be performed as part of the Information Inventory activities, as described in the Information Inventory Guideline. Subsequently agencies may also use gap analysis in reviews of their business systems, as an audit tool" (U.S. Department of Commerce, 2002).

This means gap analysis could be used to find out or to check the current situation, comparing it with the ideal situation. It reflects any deviation from the targets and objectives. Information gap analysis is used in this research as a tool to discover (audit) any significant differences between the current situation of information flow "What is" and the ideal situation "What should be". It is also used to check the relationships between ICTs and the integration of information flow because the main milestone of implementing any teleworking programme is the advancement of ICTs. So, it is very important to check the role of ICTs on the information flow in the teleworking environment. According to Henczel (2001a, p 187), once the two situations (current and ideal information situations) are clear, the gap in information flow is easy to determine. The table below shows an auditing of the integration of information flow by comparing the physical inventory (current inventory) with the conceptual inventory (targeted checklist) and finding the gaps between both of them. Physical and conceptual inventories are referenced according to the scale of 1–4, which was used in the designed
questionnaire and which has already been explained in depth in Chapter Three (see pages 51-53) and in Chapter Six (see pages 136-137). The integration of the information flow was represented with seven items of information use.

<table>
<thead>
<tr>
<th>Items list</th>
<th>Conceptual Inventory(1)</th>
<th>Physical Inventory(2)</th>
<th>Is there a gap?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sending information on time</td>
<td>3.25</td>
<td>3.27</td>
<td>No</td>
</tr>
<tr>
<td>Receiving information on time</td>
<td>3.25</td>
<td>3.26</td>
<td>No</td>
</tr>
<tr>
<td>Sending information through appropriate channels</td>
<td>3.25</td>
<td>3.16</td>
<td>Yes</td>
</tr>
<tr>
<td>Receiving information through appropriate channels</td>
<td>3.25</td>
<td>3.17</td>
<td>Yes</td>
</tr>
<tr>
<td>Sending information to a trusted recipient</td>
<td>3.25</td>
<td>3.34</td>
<td>No</td>
</tr>
<tr>
<td>Receiving information from a trusted source</td>
<td>3.25</td>
<td>3.27</td>
<td>No</td>
</tr>
<tr>
<td>Information used satisfies the company’s objectives</td>
<td>3.25</td>
<td>3.21</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3.25/4</strong></td>
<td><strong>3.24/4</strong></td>
<td><strong>Yes</strong></td>
</tr>
</tbody>
</table>

Table (8.1) Auditing the integration of the information flow

As can be seen in the above table, seven items of the information flow are investigated. A comparison of the current “Mean” of each of them against the ideal “Mean” is addressed. The Mean of each item is used just for displaying the level of integration and not for the analysis itself; it is just for making the comparison. The meaning of Mean was already illustrated in depth in Chapter Three (see pages 51-53). In general, the above table indicates that there is a lack of integration in the information flow. This lack is particularly concerned with sending and receiving information through appropriate

(1) Conceptual Inventory was already illustrated in Ch3 (see pages 51-53), which means the “ideal” situation of information flow. It reflects the target level of integration of information flow. 3.25 of the scale 1-4 indicates to the lower level of “Strongly Agree” option, which is already chosen to be the target level of integration of information flow. So, voting for any item of the integration of information flow reflects the level of integration, if the mean of any item or the total of items is more than 3.25, there is integrated information flow. Otherwise, there is a lack in integration of information flow. Henczel (2001) recommended to judge if there are no clear standards for measuring information flow. Also, the U.S. Department of Commerce (2002) confirmed that and stated “Where the information has not been documented by the Information Inventory, the information auditor may need to make some judgment as to whether a particular individual system contains valuable information which should be recognized and adopted at the corporate level”.

(2) Physical Inventory reflects the current situation of information flow, which was investigated throughout the collected data from the designed questionnaire. It reflects the current mean on the scale 1-4.
channels (the Mean is less than 3.25). Because the Mean of the total items of integration of information flow (3.24) is less than 3.25, it is described as a semi-integration of information flow. Some strategies and recommendations will be provided to solve this problem.

Regarding the evaluation of the relationships between ICTs and integration of information flow, ICTs are divided into three kinds: Electronic Office Systems (EOSs), Electronic Communication Systems (ECSs) and Office Management Systems (EMSs). The table below (Table 8.2) shows the auditing of relations between EOSs and the integration of information flow.

<table>
<thead>
<tr>
<th>Items list</th>
<th>Conceptual Inventory</th>
<th>Physical Inventory</th>
<th>Is there a gap?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spreadsheets</td>
<td>Significant relationship</td>
<td>Modest</td>
<td>No</td>
</tr>
<tr>
<td>Audio conferencing</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Word Processing</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Multimedia Systems</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Presentation Software</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Scanner</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Photocopier</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Statistics Packages</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Videoconferencing</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Project Management Tools</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table (8.2) Auditing relationship between EOSs and the integration of information flow

(1) **Conceptual Inventory**: this term indicates the "ideal" situation of the realtionship between ICTs and the integration of information flow. As was mentioned in the previous page, both of Henczel (2001) and U. S. Department of Commerce (2002) recommended to judge if there is no clear standards for measuring information flow. Therefore, it was decided to select the "significant relationship" to be the target of the relationship between ICTs and integration of information flow. If the significant relationship between ICTs and the integration of information flows more than 0.05, that indicates to lack of relationship. Because the significance of relationship was already defined as 0.05 (see chapter seven). In fact, the vast majority of researchers confirmed the significant role of ICT in the virtual organisations, such as Travica (2002) and Wijk, Geurts and Bultje (1998).

(2) **Physical Inventory** reflects the current situation of the relationships between ICTs and the integration of information flow, which was investigated throughout the collected data from the designed questionnaire. It reflects the current significant relationship according the 95% of confidence level.
The above table shows that four tools of EOSs do not have a significant relationship with the integration of information flow. They are the photocopier, statistics packages, videoconferencing and project management tools. Beside that, others tools do not have a strong relationship with the integration of information flow so there is a lack in the relationships between four of the EOSs and integration of the information flow. Some strategies and recommendations will be provided to solve this problem. The next table (8.3) is related to the systems of communication.

<table>
<thead>
<tr>
<th>Items list</th>
<th>Conceptual Inventory</th>
<th>Physical Inventory</th>
<th>Is there a gap?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Waiting</td>
<td>Significant relationship</td>
<td>Modest</td>
<td>No</td>
</tr>
<tr>
<td>ADSL</td>
<td>Significant relationship</td>
<td>Modest</td>
<td>No</td>
</tr>
<tr>
<td>Chat software (eg. MSN Messenger)</td>
<td>Significant relationship</td>
<td>Modest</td>
<td>No</td>
</tr>
<tr>
<td>Voice Mail</td>
<td>Significant relationship</td>
<td>Modest</td>
<td>No</td>
</tr>
<tr>
<td>Electronic Mail</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Answer Machine</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Telephone-land Line</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Facsimile</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Mobile Telephone</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Computer Modem</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Multiple phone line</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>ISDN</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table (8.3) Auditing relationships between ECSs and the integration of information flow

The above table (Table 8.3) shows the communication systems which are represented by twelve tools. It illustrates that five of them do not have a significant relationship with the integration of information flow. They are facsimile, mobile telephone, computer modem, multiple phone line and ISDN tools. Beside that, the remaining tools do not have a strong relationship with the integration of information flow. It can be said that there is a lack of relationships between the five systems of communication and the integration of information flow. Some strategies and recommendations will be provided to solve this problem. The next table is associated with EMSs.
<table>
<thead>
<tr>
<th>Items list</th>
<th>Conceptual Inventory</th>
<th>Physical</th>
<th>Is there</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Systems</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Databases</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Interactive Diaries/ Scheduler</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Electronic Mailing lists</td>
<td>Significant relationship</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Expense Management Tools</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Credit Card Verification</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
<tr>
<td>Workflow Software Systems</td>
<td>Significant relationship</td>
<td>Not significant</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table (8.4) Auditing relationships between EMSs and the integration of information flow

It is clear from the above table (Table 8.4) that three tools of OMSs do not have a significant relationship with the integration of information flow. They are expense management tools, credit card verification and workflow software systems. Beside that, others tools have a low relationship with the integration of information flow. Some strategies and recommendations will be provided to solve this problem.

It can be concluded that there is a lack in the integration of information flow. Also, it can be added that there is a semi-integrated information flow in the teleworkers’ offices. This is mainly due to the lack of sending and receiving information through appropriate channels. Also there is a lack in the relationships between most ICTs and the integration of information flow. Some strategies and recommendations will be provided to solve these problems.

2. Interpreting information flows: As was mentioned above, IA reveals a lack in the integration of information flow and also a lack in the relationships between a few ICT systems and the integration of information flow. Furthermore, mapping the information flow revealed a few problems and, subsequently, a few suggested solutions. They are listed below according to each case (Table 8.5).
<table>
<thead>
<tr>
<th>Problems</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> Access to Internet connection when teleworking; some information in print format; need more sharing; most relationships are one-way</td>
<td>Using Walk Through Guide; using DMS and Blog, using “push” strategy instead of “pull” strategy; using Information Sharing System</td>
</tr>
<tr>
<td><strong>B</strong> Lack of updated information, lack of information sharing; lack of online access to the agent’s information; lack of understanding the information needs</td>
<td>Updating of information, using online information strategy; more sharing of information; more understanding of information needs; greater use of emails and post.</td>
</tr>
<tr>
<td><strong>C</strong> Some difficult in access to information sources, particularly online information. There is no backup system. There is a lack in accessing information while working from home</td>
<td>Using a secure system will allow the trainees to access the sources of the college. System of retrieval information online will allow Teleworker C to complete tasks from home.</td>
</tr>
<tr>
<td><strong>D</strong> Unstructured information, information needs to be online; accessing information resources many times a day; information needs required to be determined soon; vast majority of relationships are one-way.</td>
<td>Using more structured information systems; recruiting an Information Officer to manage the information resources and needs.</td>
</tr>
<tr>
<td><strong>E</strong> Using different (many) resources for searching for new business opportunities; delay in customer response through the implementation stage; limitations in access of information about the customer; lack of sharing; lack of informed updating of information; gap between information needs and information availability.</td>
<td>Need to learn how to build search strategy; need more support from the manager; more open access of information of the customer; adding training strategy increases interaction and confidence of the customer; updates of catalogue should be sent.</td>
</tr>
<tr>
<td><strong>F</strong> The directory of companies is in print format, which means lack of updated information; lack of relationships between use cases.</td>
<td>Using special software for IR regarding the directory of companies; attending training courses; using special software for transferring the presentation to be online.</td>
</tr>
</tbody>
</table>

Table (8.5) List of problems and suggestions of the interviewed teleworkers
From the above table, it can be seen that the main three problems are concerned with not understanding the information needs of teleworkers, lack of information sharing and lack of information access to customers' sites when teleworking. Mapping the information flow of teleworkers' jobs (Figures 8.4 to 8.15) reveals that some problems are concerned with the customer or the provider of the teleworker, others are associated with the teleworkers themselves. The following paragraphs will list the problems and evaluate them.

3. Evaluating the problems: Basically, the following question should be asked: Does the problem have strategic significance? The results drawn from this study are important to the decision makers and takers in teleworking practices. It could be considered as a milestone for further studies in virtual organisations in the future. However, applying an IA model for auditing the integration of information flow, auditing the relationships between ICTs and the integration of information flow, and mapping the information flow reveals the following problems:

- Problems related to the integration of information flow: there is a lack of integration of the information flow. In the current situation, the flow of information in the teleworkers' offices could be described as a semi-integrated flow. This lack is mainly due to the lack of sending and receiving information through appropriate channels.

- Problems related to the relationships between ICTs and integration of information flow: there is a lack of relationship between a few ICT systems and the integration of the information flow. ICTs that do not have significant relationships with the integration of the information flow are: photocopier, statistics packages, videoconferencing, project management tools, facsimile, mobile telephone, computer modem, multiple phone line, ISDN, expense management tools, credit card verification, and workflow software systems.

- Problems discovered by the mapping of the information flow include: there is mainly a lack of understanding of information needs, a lack of information sharing and a lack of information access. In fact, these results from the information mapping confirmed that the above result in a lack of integration of the information flow and a lack of relationship between ICTs and the integration of the information flow.
The revealed problems are important and need solving. The cost of addressing them is not heavy compared with the expected results in the short and long term. Furthermore, ignoring them means an increased lack of communication and an increase in the isolation of teleworkers. Neither teleworkers nor employers need teleworkers to work in isolated offices. Hence, solving these problems is vitally important. On the practical side, several solutions can be presented for each problem but the most appropriate solution is recommended. However, an integrated information flow can be achieved through a few strategies. They are listed in the next section.

4. Developing strategies: this activity is related to developing some strategies that are concerned with finding solutions to the stated problems. To get an integrated information flow, the research would like to suggest the following strategies. They will be discussed in depth in the next chapter (Chapter Nine):

- Training Strategy
- Strategy of Online Information
- Strategy of Workflow Software
- Strategy of Upgrading the Speed of Connection
- Information Policy\(^{(1)}\) Strategy
- Strategy of Information Sharing System
- Strategy of Information Needs
- Strategy of Information Open Access

The strategies suggested above are derived from the revealed problems. To complete the story, some recommendations should be provided. A discussion of the above proposed strategies will take place in the next chapter (Chapter Nine) and recommendations will also be offered in Chapter Ten. The proposed recommendations should be achievable and manageable so they should be acceptable to the TCA and its members and also for other teleworkers in the UK. One of the interviewers received a copy of the current and

\(^{(1)}\) A governing principle, plan, or course of action concerning information resources and technology adopted by a company, organisation, institution, or government, for example, the political decision to use public funds to subsidize Internet access for schools and public libraries (Reitz, 2004).

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proposed situation regarding information flow in his organisation after visualising it. He was happy with the proposed solutions and started to implement them.

Implementing the proposed solutions needs an action plan for change after formulating the proposed recommendations. These formulated recommendations need to be presented in an action plan. The point here is some recommendations need to be solved in the short term (like implementing systems of information sharing, determining information needs specifically, more open access of information and training programmes). Others (upgrading the speed of connection, using workflow software, and formulating an information policy) could be achieved in the longer run.

To sum up this stage, there is a semi-integrated information flow in the virtual organisations, a lack of a relationship between a certain ICT systems and the integration of information flow, a lack of understanding of the information needs of teleworkers, a lack of information sharing in the teleworking environment, and a lack of information access and online information. Proposed solutions were developed during the analysis, the evaluation and mapping the information flow context. They are: formulating a training strategy, strategy of online information, strategy of workflow software, strategy of upgrading the speed of connection, information policy strategy, strategy of information sharing system, strategy of information needs, and strategy of information open access. A discussion of these solutions will be in the next chapter (Chapter 9) while the recommendations can be found in Chapter Ten.

8.2.5 Stage Five: Communicating Recommendations

The results of the IA can be promoted through different sources. They could be by written report, corporate intranet/web sites, and personal feedback to participants and stakeholders.
Communication with respondents is important. Henczel's view (2001a, pp 149-150) is that this is important because:

i) Communication strategies are important throughout the entire information audit process.

ii) It is critical that once the recommendations have been formulated, they are communicated to the people who are integral to them being implemented.

iii) Many of the recommendations will represent an element of change to the resources and services available in the organisation they may affect the daily work processes of some, if not many, employees.

iv) It is critical that the changes are communicated in a positive way, and in a way that guarantees management support for their implementation.

v) If successful communication channels are established and maintained throughout the audit process, the employees will recognize the validity of the process that has been worked through to reach the final recommendations.

vi) Displaying the organisational information needs assists the comprehensive analysis required to fulfill the advisory role of an information audit (Huotari and Wilson, 2001).
On the same subject, Swash (1997) also stated that the prime benefit of an audit is not the report or information map itself but the recommendations for rationalization and improvement that arise out of the analysis of the results. So, the following proposed communication channels are offered for promoting the results:

1. **Written report**: Henczel (2001a, p 150) confirmed that the most common method of communicating the recommendations is via a written report. According to Swash (1997), Henczel (2001a, pp 150-152) and (the U.S Department of Commerce, 2002), the final report (1) should document the findings of the assessment, (2) should contain recommendations to address deficiencies found by the assessment, (3) not highlight the failings of particular individuals, (4) should include recommendations or changes to, or new elements of, the agency's information policy and guidelines, (5) should show a snapshot of information resources, activity and flow, frozen at a given point in time, (6) should have the number, format, the nature and frequency of the resources used, and (7) should map out how information flows, or fails to flow, around the organisation and confirm who owns and who manages the critical resources. A hierarchy of needs and organisational priorities will begin to emerge.

2. **Corporate intranet/web site**: A copy of results and recommendations will be placed on the TCA website. Each member of the TCA (and also other teleworkers round the UK) will be invited to visit this website to navigate through conclusions and recommendations. Such arrangements are required so that the format of the conclusions and recommendations will be ready for hosting before sending it to the Executive Director.

3. **Personal feedback to participants**: All of the participants in this research study will receive a copy of the conclusions and recommendations through their weekly newsletter, which is actually sent via the TCA executive director.

4. **Publishing articles**: Publishing a few articles is the main aim after interpreting the findings. Journals relating to teleworking, work studies, integration of information flow, reengineering processes, information science and management will be chosen to promote the results of this research study.

The above stage covers the methods of communicating recommendations. They are mainly by writing a report, using the corporate intranet/web site, giving personal feedback to participants and publishing articles. The next stage is concerned with highlighting brief detail about implementing recommendations.
8.2.6 **Stage Six: Implementing Recommendations**

Implementing recommendations means finding out a clear plan for carrying out the change. According to Henczel (2001a, p 159) there are two levels of changes. Minor and major change. Thus, activities that should be carried out at this stage are: (1) Understanding the change process, (2) Developing an implementation programme, and (3) The implementation phase. They are clarified below.

![Diagram](image)

**Figure (8.18) Stage Six - Implementing Recommendations (from Henczel, 2001a, p 192)**

From the above figure, three activities should be undertaken. They are:

**a- Understanding the change process:** Henczel (2001a, p 192) stated that nothing can be changed in isolation. This change needs to be understood when formulating the recommendations and also during the implementation process. Furthermore, developing a comprehensive implementation plan and a post-implementation review strategy will facilitate the changes and minimize resistance. Actually change faces challenge: this is a fact of life, but it is the responsibility of the developer (s) to take care of managing the change and to solve any problems raised. In the case of the integration of information flow projects, Steven Institute of Technology (2004) stated that, in the commercial world, integration of information flow projects get mired down in detail and have the potential to become as complex and rigid as the ERP systems they are trying to augment. So, auditors, system analysts, developers, decision makers and decision takers are invited to
understand each component of the current system and the new system as well and focus on the social side as well as the technical side. Focusing on the human side means decreasing the resistance and the change itself will be manageable. Therefore, Henczel (2001a, pp 192-193) provided a few points that should be taken into consideration when understanding the change process. They are: clearly to state the goals, clearly to state the process, understand reactions to the change (shock, denial, depression, optimism and acceptance), understand who will be affected and how they will be affected, understand the culture and the expectation of management, understand the level of support, introduce the change formally, communicate openly (before, during and after the change process), consider the timing of the implementation, anticipate events that might affect the change quality, and become a ‘change agent’.

b- Developing an implementation programme: Change can be slight or radical. Henczel (2001a, p 193) stated that: “The implementation programme is a schedule for introducing the recommendations. It breaks them down into activities and processes and describes how they will be incorporated into existing workflows”. Also, she (2001 a, p 194) defined three levels of change: (1) critical change means it has to be incorporated immediately, (2) important change means it has to be incorporated as soon as possible, and (3) suggested change means it can be incorporated as time and resources become available. Henczel (2001a, pp 191-195) clarified the stages of developing findings to be a plan in four stages: findings, strategies, recommendations and planning respectively. Moreover, she (2001a, p 193) added that the development of the implementation programme has four tasks: (1) clarity of the objectives, which means identifying the problem to be overcome, identifying the solution, describing implementation, explaining the cost, and giving a time scale. Furthermore, giving piloting details and priority recommendations; (2) determining the impacts of change and cost and effective analysis; (3) setting parameters, which means establishing boundaries for the changes in terms of people, products and equipment, and (4) Developing a communication strategy.

c- Implementation: Implementing a new development or a new system means doing something new. So, it needs planning which has to be: time-scheduled for implementing, have scope of implementation, consider audiences (target audiences for each strategy),
and address resistance to change, cost and moving to the knowledge society. According to the capacity and availability of human resource, cost and time, the research is not able to accomplish stages 5, 6, and 7. In fact, Henczel (2003) confirmed that.

The above stage focuses on understanding the change process, developing an implementation programme and the implementation itself. The point here is the focus on the social side of change as well the technical side. This research study, however, covers the first generation of information audit. Hence, there is a need for implementing further generations of information audit. The next stage is concerned with the information audit as a continuum.

8.2.7 Stage Seven: The Information Audit as a Continuum

This is the last stage of IA. Henczel (2001a, p 195) stated that this stage aims to: (1) describe ways of measuring and assessing the changes introduced as a result of an information audit, (2) introduce ways of developing an ongoing process to ensure that information services match information needs, (3) look at the ancillary benefits to be gained by conducting the information audit on a regular basis, (4) look for ways in which the process can be tailored to suit the specific needs of individual organisations. So, auditing information flow can be described as an iterative process. Henczel (2001b) also described this stage by the following items: (1) IA has provided us with a rich dataset that presents a 'snapshot' of where the organisation is in regard to its information - this is the first information baseline, (2) Once the initial information audit is complete, a decision must be made about how the datasets can be maintained and built on with subsequent information audits to regularly review the information environment (3) Each subsequent information audit (2nd generation and beyond) need not be conducted using the same framework, (4) The methodology used could also vary according to the objectives of a specific audit, which is known as 'tailoring' the audit to suit the objectives. (5) The conducting of 2nd generation audits will not only ensure that resources meet needs but will also ensure that the data gathered during the 1st generation audit are built on, (6) 2nd generation information audits must not be conducted in isolation and must measure and

0 Henczel S., 2003, Conducting IA in the teleworking studies, face-to-face interview, London.
account for any changes that have occurred since the previous audit, and (7) Each information audit that is conducted adds to the information resource database. It can be summarised that by stating the description of Buchanan (1998) that "the initial information audit is the 1st generation information audit".

Figure (8.19) Stage Seven - IA as a continuum (from Henczel, 2001a, p 195)

As can be seen from the above figure, there is feedback within the first stage (planning), which means understanding the change and its effects. This understanding surely leads to knowledge which needs management. Swash (1997) stated that: "The information audit is a management tool which can help an organization to begin to understand how its information assets are being put to use and how these can be more effectively harnessed to achieve optimum productivity and strategic advantage". Hence, the auditing of information is a rotating process.
8.3 **Summary:** Seven stages of IA were used to achieve three goals: investigate any gaps and lacks in the integration of information flow, investigate the relationships between the integration of information flow and ICTs, and also map the flow of information in the virtual organisations. Three findings were found: **First:** there is a lack of integration of information flow. It could be described as a semi-integrated information flow in the teleworkers' organisations. This is mainly due to the lack of sending and receiving information through appropriate channels. **Second:** there is a lack of relationships between a few ICT systems and the integration of the information flow, specifically, photocopier, statistics packages, videoconferencing, project management tools, facsimile, mobile telephone, computer modem, multiple phone line, ISDN, expense management tools, credit card verification, and workflow software systems. **Third,** mapping the information flow revealed a lack in understanding information needs, a lack in information sharing and a lack in information access. Some strategies should be adopted both in the short and long term: implementing a system of information sharing, determining information needs specifically, more open access of information and training programmes should be taken into account in the short term. Upgrading the speed of connection, using workflow software and formulating information policy should be considered in the long term. On the subject of auditing itself, criteria were developed in this investigation, such as scale measurement, relationship strength and gap analysis. The next chapter is concerned with the discussion of the findings of Chapter Seven (Data Analysis) and Chapter Eight (Auditing and Mapping the Information Flow).
Chapter Nine

Discussion of Results

9.1 Introduction

In previous chapters (Five, Seven and Eight), three types of data were collected from: document analysis, questionnaires and interviews in order to achieve the research aims. The analysis of these data produced significant results which need to be discussed and interpreted accurately to achieve the research aims. This discussion is linked to the aims, objectives and questions of the research and is also linked to the related literature. This chapter covers six sections: teleworking throughout the world (including teleworkers' profiles in the UK), information flow, ICTs, mapping of information flow, soft and hard proposed solutions, and indicators of the research's limitations.

9.2 Teleworking throughout the world: A broad overview of teleworking was the first aim of this research and this was achieved through an analysis of 24 cases of teleworking in the USA, Canada, Latin America, Europe, Asia and Australia. An in-depth analysis was carried out on teleworking in the UK (for more information see Chapter 5, Part Two). Reports, projects and national statistics were the main sources of this overview. The figure below shows a conceptual map of the world and information flows to and from different locations worldwide.

Figure (9.1) Information flow throughout the world (The map itself is adapted from the Michigan University Website, 2002)
As was mentioned above, teleworkers work across different locations and time. The above figure (9.1) shows that flexibility of completing tasks from different locations can be achieved. The selected 24 case countries, which are concerned with teleworking, have some similar characteristics, such as the vast majority of cases are high-tech countries, all of them are seeking to be information and welfare societies, they mostly have cold weather, they are industrial countries, they face air pollution which is caused by industrial and vehicle emissions and, in general, they have enough infrastructure for implementing teleworking projects. This reflects the need of teleworking to satisfy individual, organisational and social benefits.

A few problems were revealed after analysing the selected cases. They are:

- The definition of teleworking: there is an overlap in the definition of teleworking, such as teleworking, home working, e-work, etc. This issue may be considered a significant limitation in adopting teleworking studies because the definition is not clear and the statistics regarding teleworking are also not clear.

- There is lack of legislation concerning teleworking. There is poor application of teleworking in the rest of world, particularly in Africa and the Middle East. This study confirmed the results of Nortje’s study (2003), which found that most of the research conducted in the field of teleworking was conducted in Europe and the USA. Thus, many opportunities for further research exist within the South African context, for example.

- There is a need to manage the different locations, different cultures, time zones and languages. The world is like a small village but the difference in these areas is likely to be a limitation for teleworking practices. The point here is to ask the following question: Is information flowing freely through the worldwide locations?

- There is a lack of teleworking statistics. There are two sources of statistics: real statistics and estimated statistics. Concerning teleworking statistics and due to the analysis of documents in Chapter Five, it seems that the vast majority of teleworking statistics worldwide are estimated because of many reasons. In fact, European Telework Online (2000d) stated that the estimation of teleworking (telecommuting) varies widely because of differences in definitions and methods of collecting the data. However, the published statistics have three levels:

(1) Surveying teleworkers worldwide: Global statistics are estimated from national statistics so there are many reasons for not conducting a real teleworking study to elicit
statistics worldwide. For example, the Gartner Group predicts that, by 2003, there will be over 137 million global teleworkers (Canadian Telework Association, 2005).

(2) Surveying teleworkers at the national level: There are also many reasons for not conducting real statistical studies at a national level. There are estimated models, such as the JALA model in the USA and the ETD program in Europe. ITAC and AT&T forecast the number of telecommuters in the USA based on the JALA Model. The Office of National Statistics in the UK also estimated that teleworkers in the UK number 2.2 million (Hotopp, 2002). Furthermore, European Telework Online (2000d) stated that:

"Some surveys at national level in the European Union have investigated only "employed people who work at home more than three days a week in an organised telework programme managed and supported by their employer". This very narrow definition misses out the many employed people who telework at home through informal agreement with their manager in the absence of a company scheme, and those who work at home regularly but less than three days a week, as well as the many self-employed people who use technology to deliver services to their customers and regard themselves as teleworkers".

(3) Surveying teleworkers at a sub-national level (companies and associations): Some companies have teleworking schemes so it is easy for them to provide clear statistics on their teleworking schemes, numbers, categories and also future plans. Others, on the other hand, do not have clear statistics. At this level there are two preferable sources of clear data regarding teleworking: (a) Corporations with clear, strong teleworking schemes, like BT and BAA in the UK, Continental in Germany, Lambordia in Italy, and Oracle in the Netherlands. For example, teleworkers in the Nortel Network number about 12,000 from 35,000 employees (Walker-Okeover, 2005). (b) Teleworker (Telecommuter) associations like TCA in the UK, ITAC in the USA, and the Canadian Telework Association. These associations, as well as others, have hundreds or thousands of members and are supported by governments to enhance and promote teleworking practices and the flexibility of programmes. They actually publish some estimated and real statistics on teleworking.

Teleworkers in the UK were estimated by the Department of National Statistics in 2002 at 2.2 million (Hotopp, 2002) and there are also many previous studies concerning the profile of teleworkers in the UK. However, this research study investigated the characteristics of the UK teleworkers' profiles so a designed questionnaire was distributed to collect relevant data of their gender, age, education, employed or self-
employed, full-time or part-time, experience, working across location, and working across time.

Three demographics characteristics need to be addressed in this research: gender, age and education. Concerning the gender of teleworkers, the research results indicated that 59% of respondents were male and the others were female. These results are similar to previous studies allowing direct comparisons and generalisations to be made that cross the studies. Hopkinson, Trout and James (2003) found that UK teleworkers were divided into 67.4% males and 32.6% females. Hopkinson and James (2001) also found that teleworkers were represented by 67% males and 33% females but Illegems and Verbeke (2003, p 107) stated that it is not yet clear whether gender is a discriminant in teleworking.

The age of the respondents was also analysed. Results of this research show that roughly two out of five were aged between 35 to 44 years, the peak value age range. One out of four were aged between 45 and 54 years old. The age range of under 25 years had the smallest percentage (3%) which means that vast majority of respondents (97%) were aged over 25 years. These figures produce an approximate normal distribution curve. It is also confirmed in the previous studies of Huws, Korte and Robinson (1993) that the age category 30–39 has stronger positive attitudes toward the adoption of teleworking.

In addition, the education of teleworkers was investigated. The survey showed that 60% of teleworkers held at least a Bachelor’s degree whereas fewer than 40% of them had an HND/C degree or less. Thus, they were educated to a high level. The most common course was the Bachelor’s degree which had the highest peak while the PhD had the lowest percentage of this distribution. Luukinen (1996) confirmed this finding in his study that teleworkers’ education varies considerably but on average he found that teleworkers had a higher level of education than non-teleworkers. Furthermore, Illegems and Verbeke (2003, p 109) stated that: “in the future, most teleworkers may be highly-skilled workers”. They also added that: “if most employees in an organisation have a high education level, the organisation is more likely to have implemented telework” (Illegems and Verbeke, 2003, p 63).

Three professional characteristics were also investigated. Whether teleworkers were employed or self-employed was the first one. The survey results indicated that more than half of the respondents could be considered self-employed and just 46.7% were employed within an organisation. The second characteristic concerned full-time or
part-time working. The results of this research study showed that most respondents were considered full-time employees (72.1%), and just one out of four was considered as a part-time employee. This result was expected in the light of half of the respondents being employed. Therefore at least half of the respondents were full-time. Hopkinson and James (2001) found in their study that 97% of teleworkers were working in full-time employment and 3% were working in part-time employment. In another study, Hopkinson, Trout and James (2003) found that 90% of teleworkers were working in full-time employment. Experience as teleworkers was also studied. The results of the questionnaire analysis confirmed that a third of respondents had 1-3 years' experience. Three out of five had no more than six years of experience and 58% of respondents had not more than 3 years' experience. It seems clear that most respondents did not have experience that exceeded 10 years. Due to this new style of work, this result is acceptable because this new style of work allows workers to complete their tasks across locations and time. The amount of experience of the respondents can be additionally explained; a third of teleworkers had been working for less than three years. According to Fulton (2002), teleworkers had, on average, approximately three years' experience working from home. Moreover, Hopkinson and James (2001) added that 48.4% were relatively new to teleworking, having done it for less than one year. So, the teleworking approach can still be considered as a new style of working.

As was mentioned before, the teleworking approach allows workers to complete their tasks across locations and time. Working location as one of these parameters was investigated. Results point to a vast majority of respondents (93%) working at home. 24% of the whole of the respondents worked at the client's site, which is considered to be a novel change in managing the relationship with clients. One out of ten (11%) worked at hotels; this could be called hotel teleworking. Concerning working during travelling by train, roughly one out of ten (11%) of the whole number of respondents worked on the train. This method of working is called train-teleworking. Just 4% of the respondents worked from telecentres. The percentage of working at home (93%) is acceptable as it seems most respondents work at home as full-time and self-employed teleworkers. Because the cost of buying ICT tools has decreased, the role of the telecentre has also decreased. There are many studies confirming this increase in home working. These workers receive benefits such as reduced travel time, cost, stress and an associated increase in family benefits (Hopkinson and James, 2001). The ITAA found that 54% of U.S. employees thought that telecommuting would improve the quality of their lives (Greenspan, 2002). A virtual organisation means working across time and
locations so teleworkers actually work in flexible arrangements of time and location (space). ICTs are considered as the milestone of this flexibility because they allow teleworkers to work remotely. Providing and supporting these ICTs can be costly so the key question is whether system savings at an office offset the system and infrastructure costs of teleworkers (SUSTEL, 2003). It is difficult to focus attention on the cost alone because there is a social side to teleworking.

The distance between office and the place of remote working was also investigated. Roughly half of the respondents (48%) worked less than 20 miles from their offices whereas just 13% of respondents worked over 100 miles from their offices. It could be said that more than half of the respondents worked as self-employed (55.1%) and 44.9% worked within an organisation. Most teleworkers worked from home. The results of the first phase of interviews confirmed this result which showed that most respondents were employed full-time and worked at home. Offshore and hotel teleworking were seldom used. The greater the distance between work and home, the greater the willingness to telework (Illegems and Verbeke, 2003, p 105).

The second parameter was working across location and time. The results of the survey confirmed the concept of flexibility in teleworking. The results of this study show that 40% of respondents worked five days per week, which is equal to full-time employment. The question here is concerned with increasing or decreasing working hours after making the decision to telework. Hopkinson, James and Maruyama (2002b) found that in 68.5% of cases teleworkers’ working hours increased and 29.5% of teleworkers’ hours remained the same. Furthermore, Hopkinson and James (2001) found that 97% of teleworkers worked in full-time employment, which means five days a week. Flexibility in completing tasks means choosing the time during the day in which to work; it could be morning, afternoon, evening or at night. In order to gain this information, respondents were asked to answer the following question: What time of day or night do you usually work when you work away from the company? Results to this question show that most respondents worked in the morning and afternoon. Few respondents worked in the evenings. James (2003) found that 34-91% of respondents worked more in the evenings, with 15-82% working at weekends and 42-81% working earlier. Additionally, Hopkinson, James and Maruyama (2002b) stated that extending working hours means starting earlier or finishing later. On the other hand, “The duration of the morning and evening commute is not yet very important in the decision to telework but may become more important in the future” (Illegems and Verbeke, 2003, p 106).
To sum up this section, an analysis of the collected data reveals that there are a few problems with teleworking statistics, which indicates a lack of understanding regarding the real needs of teleworkers. So, determining clear statistics about teleworkers' numbers and ICT infrastructure will lead to the provision of a clear and vital information policy. Teleworking gives the workers more choice to select the most convenient location and time for work but there remains a vital question. Under teleworking conditions, is the right information flowing to/from the right recipient (sources) through the appropriate channels and is it timely? The next section contains the answer to this question.

9.3 Information Flow

Flexibility of completing tasks does not mean sacrificing the standard of work. Information is considered one of the main elements of the production. Hence, this research study investigates the flow of information in the teleworking environment. This section deals with highlighting the issues of: the kind of information, the direction of flow, satisfaction with information flow, the flow of information in different environments of teleworking (inflows and outflows, full-time and part-time, age, experience, and distance), the lack of integration of information flow, and optimizing work.

Concerning the kind of information that is currently used in the teleworking environment, the results indicate that most respondents said that operational, strategic and policy information are used respectively. This means that operational information is used more than others. The interview analysis showed that most information used in the teleworking environment is in an electronic format, particularly email, followed by telephone. Print communication is avoided because it needs a special kind of storage system and the associated space is a resource burden. An electronic format is easy to access and this kind of information flows in both directions: vertical and horizontal.

Satisfaction with the information flow was also investigated. Seven items concerning the information flow were used to highlight the flow situation. They were concerned with the sending and receiving of the right information in a timely fashion through the appropriate channel and to/from the right recipient (sources). The results of the questionnaire analysis illustrate that the satisfaction level of sending information to a trusted recipient was 94.5%, information received is from a trusted source (91.1%),
information is sent on time (94.8%), information received is timely (90.1%), information is received through the appropriate channels (93.9%), information is sent via appropriate channels (93.8%), and information used satisfies the company’s objectives (96.8%). In fact, these results indicate a satisfactory level of information flow because the lowest level is 90.1%, which is concerned with receiving information on time. The remaining results indicate some kind of lack of service. In order to check the importance of this lack of service, the information flow was audited.

Auditing of information flow is based on a comparison of the current mean of each item against the ideal mean. Using the mean of each item displays the level of integration between these items. This method is not used for the analysis itself but is just for making the comparison. Auditing results indicate that there is a lack in the integration of information flow. This lack is particularly concerned with sending and receiving information through appropriate channels (the mean is less than 3.25). Because the mean of the total items of integration of information flow (3.24) is less than 3.25(1), it can be concluded that there is a lack in the integration of the information flow. It can be said that there is a semi-integrated information flow in the teleworkers’ offices. In real cases of teleworking, it is difficult to find a fully-integrated information flow. The human being is not able to carry out a fully-integrated information flow but the ideal level of integration that is used in the comparison is the satisfactory integration of information flow (any item that scores more than 3.25/4). If the mean is less than 3.25, this indicates some kind of lack. Improvements in the integration of the information flow starts with defining the lack and then identifying improvement opportunities. This lack of integration needs proposed solutions and these solutions will be outlined at the end of this chapter. However, auditing the integration of information flow seeks to find the gap between the current situation of information flow and the ideal situation. This method of finding the differences aims to find the requirements of the system.

To understand the environment of information flow, some items have been investigated. Results of the study confirm that there are significant relationships between inflow (received) and outflow (sent). It is clear to say that each one of them is independent of the other; information mapping confirmed this. This result reflects the need to determine the information needs of teleworkers, particularly those who are working outside the physical offices. Furthermore, there is no significant difference in information flow

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(1) For more information concerning choosing 3.25 to be as a reference point for measuring the integration of information flow, see Ch3.
between full-time and part-time employment, and also between different ages of teleworkers. It is clear that the information flow of the full-time teleworker’s office is similar to the part-time office. The results of this study also confirmed the importance of investigating the flow of information in virtual organisations.

Optimal work is the target for each worker. The interview results reveal that half of the respondents (5/10) said that they thought they worked optimally, but half of the respondents (5/10) said that they only sometimes worked optimally. That reflects some kind of lack of integration of information flow and this is confirmed in the results of the questionnaire, as well as the results of the auditing approach. The interviewees were asked about the main problems of optimal work and they stated that these were: lack of verbal communication (particularly when teleworkers were working away from their homes); lack of timely information (because of different time zones); financial obstacles; lack of ability to adapt to change; lack of receiving the right information; stress; travel; lack of training, time and resources; and the unavailability of Internet access when working away. These results confirmed the previous study of McInerney (1999, p 159). A study of information needs found that electronic access to networks is still a major problem and some indicated frustration due to the speed of connection and bandwidth, so information barriers still exist. As a result of the above mentioned obstacles, there is an important need for the information format to be electronic. This will avoid many deadlines for tasks being missed. Most of these barriers are related to communication systems and information management. One of the respondents said:

“If I have special software that has a feature for arranging my tasks with priority, and remind me about each task’s deadline, then I will finish my tasks on time, that would be great and useful. I think this technology will save time”.

This reveals that respondents have little knowledge regarding special software for workflow.

According to the above results, it can be concluded that there is a semi-integrated information flow in the teleworking environment, which reflects such a lack of integration between sending (receiving) the right information in a timely way to/from the right recipient (source) through the appropriate channels. To improve the level of integration, two directions can be mentioned: hard and soft solutions. But, before that, an investigation of the impact of ICT and the mapping of information flow are very
important to find out the opportunities for innovative solutions. However, the second section is related to the impact of ICTs.

9.4 Information and Communication Technologies (ICTs)

ICTs should allow workers to complete their tasks across locations and time. ICTs of different types are used in sending and receiving information. Therefore, they should have an effect on the information flow in the teleworking environment. SUSTEL (2003) described the use of ICTs in teleworking stating that: (1) teleworkers are very dependent on ICTs and would not exist without them, (2) it is important to ask whether equipment savings at an office offset the equipment and infrastructure costs of teleworkers, and (3) different arrangements of teleworking highlight different kinds of ICTs. In this study, 29 ICT systems were divided into three categories: electronic office systems, electronic communication systems and office management systems. In this section, satisfaction with ICT use, the relationship between them, and the integration of information flow are discussed.

Electronic Office Systems (EOSs): Ten tools of EOSs were investigated. The satisfaction level of their usage was: spreadsheets (100%), word processing (99.24%), presentation software (96.59%), audio conferencing (95.59%), photocopier (94.87%), statistics packages (89.36%), scanner (89.36%), multimedia systems (85.91%), videoconferencing (80%), and project management tools (79.68%). It is clear that the satisfaction level of use of the traditional tools of office systems (spreadsheets and word processing) is high; less high are audio conferencing and presentation software. Auditing the relationships between the ten tools and information flow showed that spreadsheets, audio conferencing, word processing, multimedia systems, presentation software and scanner had significant relationships with the information flow but there is a lack of relationship between photocopier, statistics packages, videoconferencing, project management tools and the information flow. All of the significant relationships were positive and can be considered low relationships. Spreadsheets had a modest relationship with information flow. This means that spreadsheets were used in an efficient way and significantly participated in achieving an integrated information flow. Concerning the case of videoconferencing, according to the analysis, it was not used as widely as audio conferencing. Audio conferencing can also help to keep teleworkers in touch with their offices and each other. The reason behind a non-relationship between videoconferencing
and the information flow could be referenced to the lack of knowledge about it or could be put down to a lack of infrastructure. SUSTEL (2003) found that videoconferencing systems were widely adopted but mostly at an organisational level, and the transfer speed, particularly when using ISDN, did not make personal videoconferencing feasible. Another study, aimed at testing the usage of videoconferencing, found just 13.2% of respondents had taken part in videoconferencing and just 11.8% intended to use videoconferencing to facilitate communication at a distance (Layoun et al., 1998).

Electronic Communication Systems (ECSs): Twelve tools were used to investigate the communication systems. The results showed the satisfaction level of their usage as: ADSL (100%), electronic mail (98.5%), multiple phone lines (97.1%), telephone-land line (96.9%), answer machine (94.1%), facsimile (94.1%), voice mail (94%), ISDN (91.3%), call waiting (91.1%), mobile telephone (91%), chat software (e.g. MSN Messenger) (85.8%) and computer modem (85.4%). It is obvious that the satisfaction level of ADSL and email usage is high. It is an acceptable result because ADSL is used instead of ISDN and, since the vast majority of respondents worked from home they needed a higher speed of connection with their external environment. Concerning the relationships with the information flow, the results of auditing and analysis indicated that call waiting, ADSL, chat software (e.g. MSN Messenger), voice mail, electronic mail, answer machine, and telephone-land line had significant relationships with the information flow; this relationship is positive whereas there is a lack of relationship between facsimile, mobile telephone, computer modem, multiple phone line, ISDN and the information flow (they have no significant relationship). The strongest relationship came from Call Waiting and ADSL respectively and the weakest relationship was with ISDN and multiple phone lines respectively. According to the above results, two issues can be addressed:

- Telephone-land lines (PSTN phone) and mobile phones: From the results, it can be concluded that the PSTN phone is used more than the mobile phone and the satisfaction with its use is greater than with mobile use. There is a low relationship between PSTN phone and the information flow but there is a lack in the relationship between the mobile and the information flow. In fact, both of them are used by teleworkers but which one is selected depends on the need and the situation of teleworking arrangements. Previous studies concluded that the mobile phone would be used a lot instead of a PSTN phone. Home teleworkers need PSTN, whereas mobile teleworkers need a mobile connection. In the Danish survey, a few respondents mentioned that mobile technology enabled them to work while commuting (on trains) (SUSTEL, 2003). Layoun et al. (1998) found
that 76% of companies interviewed used several phone lines and 42% had ISDN access in their companies. According to the teleworkers' profiles, most teleworkers worked from home so they were considered as home workers more than mobile workers. Hence, the above results were expected and acceptable because home workers need PSTN phones more than mobile phones.

- ADSL and ISDN: No one can deny the importance of the Internet as a channel of information for teleworkers. Both ADSL and ISDN can be used to carry the Internet signal to/from the teleworker to the ISP. ADSL is a digital channel and ISDN is an analogue channel. SUSTEL (2003) found that there is a wide penetration of ISDN. The reasons behind that may be that broadband Internet was more widely adopted and telework was implemented at a stage where the fastest and more secure Internet connection was ISDN (the only alternative being 56kbps modems). From the results, it can be concluded that ADSL was used more than ISDN and the satisfaction with its use was more than with ISDN use; there was a modest relationship between ADSL and information flow but there was no significant relationship between ISDN and information flow. However, both of them are communication tools but the difference is mainly in the speed of up-stream and down-stream information. In the future, broadband will be the main method of connection. James (2003) found that only a small proportion of respondents communicated with their offices over broadband links. Respondents in their study stated that there were some problems with the transfer speeds (most respondents used ISDN), which did not make personal videoconferencing feasible (SUSTEL 2003). "However, we can conclude that the main connection technology used by the case study companies is currently ISDN. From the cases there is some indication that companies are moving down a path replaing ISDN with xDSL" (SUSTEL 2003). The results of this research confirmed this.

Office Management Systems (OMSs): Seven tools were used to investigate the OMSs. The satisfaction level of them is stated as: databases (95.33%), interactive diaries/scheduler (95%), file systems (94.49%), credit card verification (93.33%), electronic mailing lists (92.13%), workflow software systems (87.5%), and expense management tools (83.03%). The highest satisfaction level was with using databases, electronic mailing lists and interactive diaries/scheduler. Concerning auditing the relationships between OMSs and the information flow: results showed that file systems, databases, interactive diaries/scheduler and electronic mailing lists had a positive significant relationship (Sig. <0.05) with the information flow. On the other hand, expense management tools, credit card verification, and workflow software systems
lacked any significant relationship with the information flow. The first phase of interviews confirmed these results. When interviewees were asked about the tools of OMSs (like workflow software, e-diaries, etc.) the results showed that they did not have enough knowledge about them and they had not used most of them.

To sum up, results of the analysis and auditing demonstrated that most ICT tools had a significant relationship \((p>0.05)\) with the integration of information flow and so this can be considered as a weak relationship. The figure below illustrates the different categories of ICTs and their relationship with the information flow.

![Figure (9.2) Relationships between ICTs and the information flow](image)

The above figure (Figure 9.2) reflects the need for managing information use. This is an important issue in the teleworking approach as well as in other styles of working. The point here is to define the most convenient ICTs for working remotely. This will help in managing information use, such as creating, sending, receiving, accessing, retrieving and storing information. For instance, James (2003) stated that broadband could open up new opportunities for teleworkers because it becomes feasible to transfer, or be able to access, data and documents more easily and cheaply than over ISDN and ordinary telephone lines. Also, Illegems and Verbeke (2003, p 57) added that: “Electronic
communication has eliminated boundaries of space and time, making an increasing number of tasks location-independent. They further added that: “The underlying factor may be that potential teleworkers are mainly knowledge workers, they mostly work in teams and can effectively communicate electronically” (Ilegems and Verbeke, 2003, p 60). To improve the participation of ICTs in information flow, it is vital to suggest some strategies. They are proposed at the end of this chapter. The next section, however, is concerned with providing an in-depth analysis of information flow in six individual cases of teleworking. Information maps are an example of IA model output.

9.5 Mapping of Information Flow

As mentioned before, the audit discovers the inefficient points in the flow of information, whereas mapping displays the flow from the sources to the recipient by using visualisation techniques. Huotari and Wilson (2001) confirmed this when they stated that:

“It is evident that to gain and provide a comprehensive information map organizational information needs should be analysed by e.g. classifying them according to the most appropriate criteria for the organization in question”.

So, information mapping was used according to each case of teleworkers and the flow of information was visualised through using four concepts: inflows, outflows, use cases modelling and flow charting. They helped in displaying the lacks, inefficiencies, relationships and the sequence of flow. However, this section covers the discussion of information maps and some lessons that can be derived from this mapping. However, the proposed solutions for the discovered problems are found in the next section.

Mapping of inflow and outflow information revealed that the teleworkers use different sources of and resources for information retrieval. They are based on the job scope (tasks and objectives). Some evidence of lack of information sharing was found, and also some evidence of a lack of determining the real information needs. According to the importance of each information resource, it is understandable that electronic information is more important than print, audio and verbal information. So, more determination of information is needed and more access to information resources, which is easy when the format of information is in electronic rather than in print, verbal or audio forms. In a few
cases, because the information need was not determined clearly, accessing of information resources was more than expected (many times per day). This reflects the need to determine information needs clearly. In general, the inflow figures showed lacks and problems more than the outflow figures. This result confirmed the previous result of the questionnaire analysis, which revealed a significant relationship between sending and receiving information. Tapaswi (2001) argued that a piece of internal information helps in decision-making processes at various stages, and it is valued as much as that of external information because the right policy/management decisions can be taken only if this information is maintained and kept up-to-date.

For that reason, both internal and external information should flow efficiently. That means that information should flow from the right sender to the right recipient through the appropriate channel at the right time, otherwise, decision-making and taking is not efficient.

Mapping by using Use Case Modelling revealed the relationships between actors and use cases, which were one-way relationships. Relationships between use cases themselves are also one way. When the teleworker has different types of tasks, there is a dis-joining between use cases. So, the teleworker in this situation uses different sources of information. It is obvious that most of the relationships are one-way relationships. This leads to the need for more interaction or sharing (more two-way relationships), and more training on how to integrate different tasks.

Mapping the sequence of flow by using the Flow Chart showed a clear sequence of flow in most cases. Teleworkers know there are some lacks in this sequence of flow and problems like:

“lack of understanding the information needs, need for more sharing of information and knowledge, particularly in the follow-up stage, and also a need more support from the manager, delay in customer response through the implementation stage; gap between information needs and information availability”
(The interviewees of the second phase of interviews, 2005).

The point here is related to the job design itself. Two cases confirmed that teleworkers are used to support from the physical offices with such services as information services, finding solutions, design solutions, or contact with customers. This reflects the need of information sharing to avoid the isolation of teleworkers. They need to be informed with updated information and the sharing of information is very important.
Regarding storage systems, maps of information flow indicated using a back-up system for storing the electronic information (there is just one case that does not have this kind of back-up system), and box files for storing the printed information. Audio and verbal information are not stored in any way. The point here is the overlap between personal and professional information. To investigate this overlap, respondents of the first phase of interviews were asked this question: Is your professional information mixed with your personal information during teleworking activities? The vast majority (9/10) confirmed that their professional information was separated from their personal information. Fulton (2002) added three points about the storage of information: (1) teleworkers did not always have large home workspaces at their disposal, in spite of their desire to duplicate office documents and tools in their work, (2) they frequently attempted to recreate the organisation of the office in their homes and stored printed items, such as reports, reference books and memos, in their home workspaces, (3) long-term storage of information was often most useful to full-time teleworkers, whose information needs required them to access a wide range of information to perform a greater number of tasks. When BT replaced a printed file of internal job vacancies with an online version it saved 1.25 million pages of paper a week (James, 2003). It is right to say the systems of information storage in teleworkers' offices need more study and investigation.

Derived lessons from mapping information flow: The mapping of information flow revealed three main problems:

- A lack of information access: mapping information flow showed the real need for more open access to the information resources, particularly when teleworkers were away (e.g. on a client's site). Clients in some cases were not able to open their sources (e.g. databases) to the teleworkers to do their jobs, so some projects failed. This problem caused delay in response because information was not received at the right time and also the information itself was not the right information. Hopkinson, James and Maruyama (2002b) confirmed that a final reason for increased productivity was easy access to information and other resources. Moreover, Fulton (2002) added that: "remote access to an organisation's networked system did not necessarily guarantee access to all resources available at the central office". So, teleworkers live in an isolated environment and they fail in some cases to complete their tasks efficiently. Regarding connection to the Internet while teleworkers are working away, it was a problem for all of the six interviewees. Using a mobile Internet was discussed in SUSTEL (2003) although it was not very widespread because it was too expensive and too slow. Usage of mobile Internet connections were not very
common in the British Telecom survey which is also a mobile teleworking\(^1\) arrangement that highlights this particular type of technology.

- A lack of information sharing: the mapping information flow also revealed this problem and the need to implement a system of information sharing because it is concerned with cutting the possibility of teleworkers’ isolation and letting teleworkers share more with their colleagues, customers and managers. The main expected benefit of implementing a sharing system is to increase the number of two-way relationships.

- A lack of understanding of information needs reflects the need of an information policy for teleworkers and also the need of an information officer consultancy.

### 9.6 Proposed Solutions

The collected results from the document analysis, the questionnaire and the interviews (phases one and two) indicated many issues to solve in the teleworkers’ work in the UK. The basic problems were: lack of integration of information flow, lack of relationships between ICTs and integration of information flow, lack of information sharing, lack of understanding of information needs, and poor access to information. The proposed solutions below are discussed according to these problems. Then, each teleworker\(^2\) should choose the most convenient solution which matches the problem that he/she has. Solutions are divided into two categories: soft solutions and hard solutions.

#### 9.6.1 Proposed Soft Solutions: according to the above current problems, three proposed soft solutions can be suggested. Determining the information needs of teleworkers, developing information policy and training are required to improve the flow of information in the teleworking environment.

**Understanding Information Needs:** This strategy aims to understand the real needs for information. This means more understanding of the system requirements then deciding whether the information system in the teleworking environment is acceptable and adaptable to other systems of work. Understanding the real needs of information

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\(^1\) A mobile teleworker is one who has a laptop computer, which he/she can connect to the organisational Intranet or the Intranet using a variety of connecting technologies (SUSTEL, 2003).

\(^2\) Mapping of information flow revealed a real need for solving the problems of information use. For example, one of the interviewees was interested in finding a solution for his problems. The auditor (researcher) provided some solutions and did a few calls with him. Some proposed solutions were attached via email to the teleworker. The point here is that solutions were derived from the case itself and also from the further calls between the auditor (researcher) and the teleworker. The teleworker was happy with these solutions, and to start to implement them.
extends to understanding the available sources of information and carrying out a comparison between what teleworkers need and what they actually use.

**Developing Information Policy**: The study would like to recommend more focus on an information policy which could be useful in the long term. In fact, information policy is useful in finding clear contexts for information use in remote offices. It will significantly participate in determining the information needs and information sharing of teleworkers. There are three levels of implementing information policy: individual (the teleworker), organisational and national (and international) levels.

**Training Solutions**: The results of this research showed that most teleworkers do not have sufficient support in the form of training courses from their organisations (there is a lack of training opportunities in both theory and practice). Those who do not have support have some compulsory courses and other optional courses. Furthermore, some courses were held face-to-face, others were based on an e-training approach. This lack of training caused a lack of integration of the information flow, which increased cost and delay in achieving the goals. Bartolomeo (2004) stated that one concern about teleworking has been that it results in lowered access to training and development opportunities. Also, the Small Business Research Trust (2000) found that some members of rural communities faced barriers in accessing the Internet; these barriers were the cost of ICT equipment and ICT training. Respondents in the first interviews stated the main issues associated with training: they were time and the cost of training. The cost of training is an obstacle for teleworkers, especially for self-employed teleworkers, because there is a very limited budget for training. One of interviewees said that:

"Time and money, because when you start your own business, you have to concentrate on building the business rather than developing yourself".

Also, the results showed that the main subjects covered by training were: management, technical training, marketing and teleworking courses. Beside that, a few teleworkers had informal training like reading about Microsoft Excel and Microsoft Word, and reading magazines and newsletters. Who determines the need for training? According to the results, teleworkers, their managers or their clients mainly determine the need for training rather than the teleworkers themselves.

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(1) It is defined as: "A governing principle, plan, or course of action concerning information resources and technology adopted by a company, organization, institution, or government, for example, the political decision to use public funds to subsidize Internet access for schools and public libraries" (Reitz, 2004). Also, Henczel (2001a, p 195) defined it as "the document that contains the procedures for controlling and coordinating the management of information".
Concerning the experience of teleworkers, most of them did not have more than three years experience so they may need more training, particularly in information use otherwise the integration of the information flow will not improve. Swash (1997) confirmed that by stating:

"businesses need to ensure that even the newest staff is quickly aware of what constitutes the important information, how to get it, how to handle it once it has been acquired and are speedily assimilated into the information gathering and disseminating processes".

Furthermore, in spite of the respondents having a high level of education, they do not have sufficient support in training. This reflects a real need for the joining of education and training.

"Training for on-line workers might be best achieved on-line through a variety of media, as this will provide experience with the context of telework and the media that will be used eventually for work" (Salmon, Allen and Gilles, 2000, p 212).

The results of this study indicate that limited time and the cost of training to be the main issues regarding teleworkers’ training. Hence, some solutions can be addressed:

- Planning: results indicated that half of the respondents (5/10) did not have an annual training plan. This mirrors the randomly produced knowledge which did not match with the concept of integrated information flow in the virtual organisation.
- Finding the successful keys: results indicated that the successful keys for training are enjoyment, challenge, reading the courses materials at home, and identifying a suitable and useful course before doing the work itself.
- Sponsoring the training costs: cost is the main issue regarding training. The results showed that, concerning employed teleworkers, their company are taking on the responsibility for sponsoring the training costs but they only have a limited budget for training. On the other hand, self-employed teleworkers pay for their own training costs and sometimes their clients sponsor their external training. This reflects the need for sponsorship for training costs. A joining between the TCA and the training companies could be a good approach to launch different types of training course with a discount for TCA members.
- Implementing e-training courses: respondents were asked about using e-training, which may decrease the cost and save time as well. Most of them agreed and were happy about
using e-training because of its features for helping in online meetings, training while teleworkers are sick, cutting costs and saving time. On the other hand, a few teleworkers were not happy with using e-training because they thought it caused more isolation so few teleworkers recommended choosing this method of training. Layoun et al. (1998) stated that respondents in their study were asked the following question: “The reasons why small firms do not intend to use tele-training”, 60.5% of respondents choose not to answer. This reflects the argument of using e-training or a lack of knowledge in understanding the benefits of e-training. But, as mentioned before, teleworking application can be applied to different arrangements so there are different styles of using training delivery. E-training can be useful to one participant but not useful to another.

9.6.2 Proposed Hard Solutions

As well as the soft proposed solutions, hard solutions can also be suggested. They are mainly concerned with adopting new technology (hardware or software). Before producing these solutions, some basic points should be highlighted.

Concerning being comfortable with technological change, the results indicated that all of the respondents (10/10) were comfortable with technological change and they preferred the new technology. Also, a majority of respondents (8/10) were very happy as teleworkers and would not like to change. They were also invited to answer the following question: Do you think that the automation of tasks has increased over the last five years? The vast majority of respondents (9/10) said that the automation of tasks has increased. Most of them agreed with this and were happy. They clarified the benefits of automation as increased security, safety, cutting of costs, allowing individuals to work across location and time, and allowing them to work smarter and to do interesting work with more tasks. Someone mentioned that automation was “the fact of life”. On the other hand, a few of them focused on the social side of task automation as this may have been affected by the change.

Analysis of the questionnaire data revealed that respondents said that technology may increase flexibility (99.2%), may provide better control and integration by means of better information and better error detection processes (97.4%), may improve the quality of a product or services (95%), and may reduce operating costs of the office (90.4%). Interview analysis also showed that most respondents (7/10) agreed with adopting new
technology in their offices and at their homes as well. The remainder of respondents (3/10) did not agree with adopting new technology because they basically needed to choose the most convenient ICT for their tasks and would like to see it being used before they tried it themselves. That reflects the "Pull" and "Push" argument between the two groups. Group One argued for adopting new technology while the other argued against adopting new technology. For instance, Palmer and Speier (1997) found there was still significant use of older technologies, including fax, which was significantly higher than the use of email or the Internet. On the other hand, James (2003) asked this question to the teleworkers from five European countries: will advanced Communication Technologies (ICT) improve your work performance and/or quality of life? Yes: Denmark 19.1%, Germany 24.2%, Italy 28%, Netherlands 77.3%, UK-BT 94.8% and UK-BAA 100%. It is clear that the teleworkers in the UK are interested in implementing new technology. Moreover, SUSTEL (2003) added that some organisations are currently replacing desktop computers with laptops and this can explain the fact that some respondents have both desktop and laptop computers. Furthermore, this research found just (2/10) used wireless communication, but most of them (6/10) voted for using wireless communication rather than wired communication. It seems that the usage of wireless communication is preferable.

In two previous studies, a large majority of respondents felt that their performance, productivity, satisfaction and quality of life had improved (Bartolomeo, 2004; Hopkinson, James and Maruyama, 2002b). It is clear from the interviewers' perceptions that they agree to the increased automation of tasks. Also, in the future, mobile work, the fastest growing form of telework, will have a different and more radical impact than other types (Bartolomeo, 2004). There has been technology savings of 1200-1300 euros per person at work. This is in the SVI company in Germany (James, 2003). To sum up, implementing a new technology does not mean ignoring the role of ICTs but emphasising again implementing ICTs. Teleworking would not exist without ICT (SUSTEL, 2003). The interest in new and emerging technologies is quite high, especially with the Dutch and British (both British Telecom and BAA) cases (SUSTEL, 2003). To get an integrated information flow, the research would like to suggest the following solutions:

1. Upgrading the speed of connection: according to the results of the analysis in Chapter Seven, roughly 40% of teleworkers still use ISDN, which nowadays is not efficient enough, whereas ADSL was used by roughly half of the respondents. There is a
relationship between ADSL usage and improving the integration of information flow but there is no relationship between ISDN usage and improving the integration of information flow (for more information see Chapter 7, p 171). So respondents who were still using ISDN were invited to upgrade their connection speed to broadband (128, 150, 300, 500 Byte or more if needed). This upgrading helps in improving the integration by decreasing the time delay in sending (and receiving) information through the appropriate channels, which is the main problem in the lack of integration of information flow for teleworkers in the UK.

"The introduction of ADSL is reducing ISDN use for data transfer and internet access, although it is still common in more rural and outlying areas. ADSL as compared to other forms of DSL, ADSL has the distinguishing characteristic that the data can flow faster in one direction than the other, i.e., asymmetrically. Providers usually market ADSL as a service for people to connect to the Internet in a relatively passive mode: able to use the higher speed direction for the "download" from the Internet but not needing to run servers that would require bandwidth in the other direction" (WordiQ, 2004).

There are two connection methods: analog and digital connections. ISDN and Dial-up are the main sources of analogue connection, which are mainly concerned with downloading more than uploading, so they focus on the down-streaming speed more than up-streaming speed. Digital connections focus on both directions (up and down) but there are users for both of them. A proposed suggestion could be mentioned in this regard. TCA could launch a joining offer with any Internet provider (ntl for example) to broadband. To confirm that, Harris Miller, president of the ITAA stated that:

"Studies show the frustration of slow speed network connections is one of the biggest show stoppers to widespread adoption of e-work. If the employers feel that their employees are losing productivity at home, they will shun this option. The good news is that high speed Internet access is now widely available. Putting broadband and e-work together is a winning combination" (Greenspan, 2002).

2. Using Online Information: This research found that the information in teleworkers' offices is commonly in an electronic format but, in some cases, they are still using print format. Printed information means that it is still a time consuming process to send and receive information. Tapaswi (2001) added to that:

"The technological advancement has speeded up the information generation and it is becoming increasingly difficult to wait and distribute in print media. The information available in the form of electronic media,
especially, over the Internet is huge and needs meshing before use even though one can believe that it is authentic."

In fact, online information is easier to handle, access, store and retrieve. Most of the teleworkers are working in a mid-point between information resources and the customer. So, online information means more efficient responses to the customers’ demands. There are a couple of stages for converting the print and video information to online information. The first stage is to convert it into an electronic format and then host it online. The suggested tools for implementing the strategy of online information are: content management solutions, document management solutions and epublishing solutions. Moreover, subscribing to online databases means two types of information handling. The first is concerned with database access any time with a target number of users (or unlimited users) of the same company; this requires annual fees (e.g. www.newscientist.com). The second one is related to structured information needs which are all sent automatically (this could be daily, weekly, monthly); this depends on the need and the ability to pay (e.g. www.factiva.com). This type of subscribing basically relies on using the “Push”(1) strategy. However, these solutions focus on information retrieval. To gain an efficient use of an information retrieval (IR) system, we need to focus on the required training which will guide users to a better flow of information. Ahmed, McKnight and Oppenheirn (2004) confirmed that by summarising that Web-based IR interfaces would indeed improve users’ searching ability but there are some fundamental difficulties in online searching with the Web-based versions. They suggested that, despite the development of Web-based IR systems over the years, user interfaces for these systems continue to be difficult to use and the need remains for IR interfaces that contribute as much as possible to ease of use and ready learnability of these systems.

3. Using an information sharing system: This strategy aims to find satisfied interaction between teleworkers and their physical companies, customers and suppliers. Sharing systems surely works against the isolation of teleworkers, which is considered as one of the biggest disadvantages of teleworking. Most of the teleworkers in the second round of interviews confirmed the need for a sharing system. Mapping the information flow also confirmed this. For example, adopting an Information Centre (IC) in the TCA site would

(1) Push-pull strategy: It is concerned with information use. Push strategy means receiving information from the original source, the user systematically and automatically receives his/her needs of information according to the defined profile, using an alert system. So, the information pushes from the source to the user. Whereas, the Pull strategy means accessing and retrieving the information needs from the sources directly. So, information is pulled by the user from the source.
improve the integration of information flow. This centre could be used through a password and user name for each member. It also has the following items: (1) Information about “How to manage your information” (2) A chat room divided into groups, (3) FAQs in managing data, information, images, video and audio. (4) A forum which is divided into subjects, and (5) Basic guidelines to show teleworkers how to map their information flow and to find points of inefficiency. This system could be free from TCA. Implementing the intranet and extranet systems wherever they are useful will enhance the sharing of information as well.

4. More open information access: The analysis results confirmed that the accessibility of information was poor, particularly on the customer site. So, where is the right information? Open access means getting more of “the right information”, which leads to good services and good design if the service is concerned with designing software, for example. The analysis also shows that this problem applies to the self-employed more than employed teleworkers. Therefore, teleworkers need more access to the physical companies and to the sites of customers. In fact, Swash (1997) stated that information in the large organisation is more structured than information in the small organisation, because there is a routine procedure. If the employer or the client is afraid of security issues, there are a few special innovated software solutions regarding more open information access to the teleworkers. One of these solutions is using VPNs.

5. Using Workflow Software: implementing special software for managing information flow helps in getting an integrated information flow and then delay in completing tasks is cut. Consequently, the right information is sent (received) to/from the right recipient (sources) at the right time and through the right channels. The results of this research showed that all respondents (10/10) do not use special software for workflow but the vast majority of them (9/10) use general software for managing their process (workflow), like Outlook, project management software, people soft, spreadsheets, and net-call. Furthermore, the questionnaire analysis indicated that 16/144 used workflow software. Both results suggest there is a lack of understanding of the benefits of and the need for workflow software. So, using this type of software can help in improving the flow of information. In fact, the structured level of information is different from one teleworker to another.

(1) which means learning how to access, retrieve, and store information. This item should be divided according to a few subjects of the member’s fields (e.g. software design, marketing, technical design, and developing products).
At corporate headquarters, information gathering and dissemination procedures can be highly structured and formalized (Swash, 1997).

In other words, a structured system has more ability to adopt new software for workflow and greater ability to be more automated than an unstructured system. This analysis leads to data administration and document management. The U.S. Department of Commerce (2002) stated that:

"data administration primarily involves database systems used to hold and process structured data, and includes the content of the databases. Document management involves sometimes paper documents only, sometimes all forms of documents, including databases. It is usually concerned with tracking documents through an agency, not so much their content. Often, the information may be held in a form not directly accessible by automated systems, for example video and sound recordings, and document images".

In 1998, Sengupta and Zhao analysed the e-mail messages between team members. The results indicated that the team adopted a "hub-and-spoke" communicational structure, which created bottlenecks, thereby impairing the team's communicational effectiveness. They promoted workflow software as a solution for this problem.

9.7 Research Limitations: The main limitations for this study were: (1) the limited teleworker statistics. Statistics were sometimes not found and sometimes were not clear, neither in the UK nor the rest of world. As Fulton (2002) confirmed for the difficulty of estimating the size of the population involved in working from home. This problem reflects a limitation of accessing the real teleworkers in some cases. (2) There is not enough literature concerning teleworking, particularly with using the information-driven approach for solving the teleworkers' problems, (3) From an academic perspective, getting permission from cases was very difficult, so the Telework Association (TCA) was selected because TCA has a weekly newsletter to its members. As a result the sample size, particularly the interview sample was small. This obviously has implications for the degree of generalisation that can be made. Furthermore the choice of the TCA membership may also limit the representativeness of the findings. However the researcher did feel that the make up of the TCA membership did at least represent a relatively broad range of organisations.
In fact, the study derives its importance from its field of study (teleworking). Nowadays, teleworking is becoming more important, both from a scholarly, as well as a professional point of view. This study derives its significance from the need to find a new style of working that will decrease the cost of production. It is therefore doubly significant: firstly, it has theoretical significance which derives from the field of the virtual organisation itself; secondly, its practical significance is related to the presentation of a proposed model for improving the integration of information flow in the virtual organisation. This dual significance is highlighted in the conclusions and recommendations in the next chapter.
Chapter Ten

Conclusions and Recommendations

10.1 Introduction:
The findings from the survey questionnaire, the two phases of interviews, the analysis of related statistics of teleworking, and other feedback have been corroborated to give vital conclusions which will be addressed in this chapter. In addition, a few recommendations have been based on these conclusions and are also provided here. Moreover, both research contributions and a few proposed future directions are also provided at the end.

10.2 Conclusions: According to the aims of this research, there are some conclusions regarding teleworkers' profiles, information flow, ICTs, information mapping and the proposed solutions.

The first aim of this study concerned providing a broad overview of teleworking, particularly in the UK. Two sources of data were used to achieve this aim. An analysis of related teleworking statistics from 24 countries revealed (1) a lack of modern statistics, which is considered as a big limitation in adopting teleworking studies, (2) an overlapping in the definition of teleworking, (3) a lack of legislation concerning teleworking, (4) poor application of teleworking in the rest of world, particularly in Africa and the Middle East, and (5) a need to manage the different locations, different cultures, time zones and languages. All of these problems cause a lack of teleworking progress, particularly concerning the statistics of teleworking. In general, there are two sources of statistics: real statistics and estimated statistics. In fact, due to the analysis of documents in Chapter Five, it seems that the vast majority of teleworking statistics worldwide are estimates. So, the profile of teleworkers worldwide is still not clear and requires more study. The point here is, because the profile is not clear, the information needs are not clearly determined, and the information does not flow freely.

On the subject of teleworking in the UK, the results of this research revealed concerning the respondents that: (1) more than half of them (59%) were male and the remainder were female, (2) two out of five were aged between 35 to 44 years, (3) 60% of respondents held at least a Bachelor's degree which meant that they were educated to a high level, the most common qualification being a Bachelor's degree, (4) more than half
of them were self-employed and just 46.7% were employed within an organisation, (5) most respondents (72.1%) were considered full-time employees and just one out of four was considered as a part-time employee, (6) a third of teleworkers had been working for less than three years, (7) the vast majority of respondents (93%) worked at home, 24% of the whole of the respondents worked at the client's site, and most worked in the early morning or in the late afternoon, and (9) 40% of respondents worked five days per week, which means full-time employment. These results confirmed the meaning of flexibility because the respondents were approximately normally distributed according to their need, and they were distributed at different locations and different times. Hence, there is a real need for more support for teleworking practices, particularly from governments. Investigating statistics regarding teleworking will also help in conducting further studies, particularly in information needs.

The second aim of this study relates to determining the teleworkers' opinions on the information flow in their organisations. Results indicated that information flow in teleworking organisation is largely in an electronic form and it flows in the both directions, both vertically and horizontally. Print information is avoided because it needs a special kind of storage system with high costs. Operational, strategic and policy information is used respectively which means operational information is used more than others. Most respondents did not use workflow software which indicated a gap in knowledge and a missed opportunity to deliver enhanced services. Furthermore, the following conclusions were also found:

1. Although the level of satisfaction concerning information flow is "satisfactory", it did not reach the target level (integrated information flow). Auditing results indicated that there was a lack of integration of information flow. It can be said that there was a semi-integrated information flow in the teleworkers' offices.

2. Concerning the differences between the various characteristics of teleworkers, it is clear to say that there is no significant difference in information flow between full-time and part-time working. There is also no significant difference in information flow between different categories of experience and distance between the corporate office and working remotely.

3. Half of the respondents do not have an optimal working environment. The reasons behind this were: lack of verbal communication, lack of timely information, financial obstacles, lack of ability to adopt to change, lack of receiving the right information,
stress, travel, lack of training, lack of time, resources, and unavailability of Internet access when working away.

The above results revealed a real need for improvement of information flow by means of, for example: delivering training programmes, understanding information needs, developing information policy and using workflow software.

The third aim deals with investigating the impact of ICT on the integration of information flow in the virtual organisations. Although the level of satisfaction concerning ICTs is “satisfactory”, ICTs do not have strong relationships with the information flow, which means a lack of integration of information flow. Spreadsheets, call waiting, ADSL, chat software and voice mail have a modest relationship with the information flow. Word processing, multimedia systems, presentation software, scanner, audio conferencing, electronic mail, answer machine, telephone-land line, file systems, databases, interactive diaries/schedulers and emailing lists have a low relationship with the information flow. On the other hand, photocopiers, statistic packages, videoconferencing, project management tools, facsimile, mobile telephones, computer modems, multiple phone lines, ISDN, expense management tools, credit card verification and workflow software have no significant relationships with information flow. Specifically, the results showed that the PSTN phone was used more than the mobile phone and the satisfaction of its use was more than with mobile use. There was a low relationship between PSTN phone and information flow but there was no relationship between mobile use and the information flow. The above results were expected and acceptable because the vast majority of respondents are home workers. In addition, ADSL was used more than ISDN and the satisfaction of its use was more than with the use of ISDN. Furthermore, there is a modest relationship between ADSL and information flow but there is no significant relationship between ISDN and information flow.

These results reflect the need to upgrade the speed of Internet connection and also to use special software systems to support teleworking (such as sharing systems, workflow software and online information systems).

To respond to the fourth aim, which covers mapping the flow of information in virtual organisations, different sorts of visualisation techniques were used. In fact, information mapping displays the flow from sources to the recipients by using...
visualisation techniques: (1) Mapping of inflows and outflows information revealed the use of different sources and resources of information, lack of information sharing, and lack of determining the real information needs. It is understandable that electronic information is more important than print, audio and verbal information. There is a need for more access to information resource. (2) Mapping by using use case modelling revealed that most relationships were one-way relationships. This leads to the need for more interaction or sharing (more two-way relationships). (3) Mapping the flow sequence by using the Flow Chart showed a clear flow sequence in most cases. (4) Maps of information flow indicated using a back-up system for storing electronic information and box files for storing the printed information. Audio and verbal information are not stored in any way. The vast majority confirmed that their professional information was separated from their personal information.

To sum up, mapping information flow revealed three main problems: a lack of information access (need for more open access to the information resources, particularly when teleworkers were away); lack of information sharing (implementing this system is concerned with cutting the possibility of teleworkers' isolation; letting teleworkers share more with their colleagues, customers and managers, and also increasing the number of two-way relationships; and a lack of understanding of the information needs (which reflects the need of an information policy for teleworkers and also the need for an information officer consultancy).

From the above conclusions, the main problems which were revealed are: lack of integration of information flow, lack of relationships between a few ICTs and information flow, lack of information sharing, lack of understanding of information needs, and a lack of information access. A few proposed solutions can be provided. They are divided into two categories:

(1) Soft Solutions, like training, understanding information needs, and developing an information policy. Concerning the training of teleworkers, the main issues are costs and time. Most respondents agree with and are happy to embark upon e-training and a few teleworkers are not happy with using e-training because they think it causes more isolation. Roughly half of them do not have an annual plan for their training. The training needs of self-employed teleworkers are actually determined and covered by the teleworkers themselves. In contrast, the training needs of employed teleworkers are
actually determined by the manager. The main subjects of training are: management, marketing, technical skills and teleworking.

(2) Hard Solutions: results indicated that all respondents were comfortable with the technological change at their offices. For the most part they were enthusiastic about the increasing automation of tasks. They display good management skills in separating their personal information from professional information. To sum up, implementing new technology does not mean ignoring the role of ICTs but emphasises again the implementation of ICTs. To get an integrated information flow, this research would like to suggest the following hard solutions: using online information, using workflow software, upgrading the speed of Internet connection, using an information sharing system, and having more open information access.

10.3 Recommendations: Due to the above conclusions, the following recommendations have been developed for individual teleworkers, the Telework Association (TCA), employers of teleworkers, academics, software companies, training companies, ISPs, and governments (particularly the UK government).

- Give more attention to the statistics of teleworking in the UK and in the rest of the world so that their value-added component can be judged.
- Improve the integration of information flow from a semi-integrated flow towards a fully integrated information flow. This improvement can be achieved through soft and hard solutions. Soft solutions can be achieved through training, understanding information needs and developing information policy. Hard solutions can be achieved through using online information, using workflow software, upgrading the speed of Internet connection, using information sharing systems, and offering more open access to information.
- Give more attention to investigating the infrastructure requirements of ICTs to achieve efficient teleworking practices.
- Give more priority to using electronic information.
- Investigate further the systems of information storage in teleworkers’ offices.
- Use the Internet as a working platform as a means to cutting costs, while at the same time adding value by enhancing information flow.
• Transfer the knowledge of the teleworking approach to different cultures and societies.

10.4 **Research Contributions:** The major contributions of this research can be summarised as follows:

• This research study has provided a detailed review of the literature related to teleworking (or telecommuting) in the UK and in the rest of world.
• This research study has also provided a detailed analysis of teleworker statistics (or telecommuting) in the UK and in the rest of world.
• One of the major strengths of this study derives from its research methodology. It has applied methods for Information Audit and Mapping of Information Flows to discover and display the information flows in virtual organisations which has added vital value to the overall research.
• According to Henczel's (2001b) view, using her Information Audit Model to investigate information flows is the first step in developing a strategy for the application of Knowledge Management (KM) practice to teleworking.
• This research suggests some proposed soft and hard solutions for improving the flow of information in virtual organisations.
• To the best of the researcher's knowledge, this is the first study of its kind that uses an information-driven approach and that maps information flows in virtual organisations.

10.5 **Future Research:** Figure (10.1) illustrates the revealed problems, proposed solutions and the future research. It covers the research outputs and links to Figure (1.2) which covers the research workflow. Both figures (1.2 and 10.1) obviously highlight using the information-driven approach for solving some of the teleworkers' problems; this approach is a new field and practice. Hence, there is a need to follow-up this study:

1. To conduct the second generation of information audit in teleworking practice.
2. To study the application knowledge management (KM) practices in teleworking.
3. To develop information policies to enhance teleworking practices.
4. To study the information needs of teleworkers.
5. To evaluate the impact of software applications, such as workflow software.
6. To implement information sharing systems.
7. To study the impact of training courses, particularly training on information retrieval and use.

The conclusions and recommendations from this and other teleworking studies should be no longer ignored. It is time to make plans for carrying out improvements to information flow in virtual organisations.
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Appendices
Appendix (1) Guidelines for conducting Information Audit (IA) Model

U.S. Department of Commerce (2002) stated the following guidelines for conducting the IA model.

1. Elements of the examination and assessment should be done at the same time.
2. Each item of information of the Information Inventory should be compared against the information audit checklist.
3. Developed during the planning step.
4. Record an assessment against each checklist item.
5. Information Audit primarily as a review and assessment of information.
6. Information Inventory is addressed as a separate Inventory Guideline.
7. Information Audit is the assessment of the information held by an agency and of its information management activities.
8. Information Audit is frequently described in terms of an 'inventory' or 'stocktake' of the information collected and maintained by an agency.
9. In practice, an agency would only perform this inventory process once. After it has been performed for the first time, subsequent efforts would only be an update of the original inventory. Nevertheless, the size of this inventory task seems to have dominated thinking on Information Audit.
10. The primary input for the Information Audit is the Information Inventory.
11. The Information Inventory may contain reference to data dictionaries, data directories and a thesaurus.
12. Information Inventory (Inventory Guideline) may be composed of the Conceptual inventory (mission, vision, function of the organisation [what should be?], Physical inventory (the current information inventory [what is?], and the Knowledge inventory.

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**Appendix (2) Statistical Packages**

<table>
<thead>
<tr>
<th>Package</th>
<th>Description</th>
<th>UNIX</th>
<th>MS Windows</th>
<th>Macintosh</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMDP</td>
<td>general purpose statistics package</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>EQS</td>
<td>structural equation modelling and path analysis</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>GAUSS</td>
<td>mathematical and statistical programming</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>IMSL</td>
<td>statistical and mathematical subroutine libraries</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>LIMDEP</td>
<td>LIMited DEPendent variables econometric regression models</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>LISREL and Prelis</td>
<td>LInear Structural RELationships, with PRE-LiSrel processor</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>Minitab</td>
<td>general purpose statistics package</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>RATS</td>
<td>Regression Analysis of Time Series data</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>SAS</td>
<td>Statistical Analysis System -- comprehensive statistics and data manipulation</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>SAS/JMP (SAS/INSIGHT*)</td>
<td>statistical visualization software</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>SCA</td>
<td>Scientific Computing Associates -- time series and general purpose statistics</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>Speakeasy</td>
<td>basic programming package for statistics and mathematics</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>S-Plus</td>
<td>statistical and exploratory data analysis programming</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences -- general purpose</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>Stata</td>
<td>Stata -- general purpose</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
<tr>
<td>TSP</td>
<td>Time Series Processor</td>
<td>🟩</td>
<td>🟩</td>
<td>🟩</td>
</tr>
</tbody>
</table>

Source: ISDweb, 2003
Appendix (3) Issue from France, Germany and Netherlands

France (Some changes in France’s legislation regarding ework): Several decrees have adapted French legislation to the development of information technologies: (1) the law of 13 March 2000, concerning proof and the electronic signature right. This law recognizes the signed electronic act as the same value of proof as an act signed on a paper, (2) by opening the local network of France Telecom to competition, the decree of 12 September 2000 facilitates the distribution of Internet broadband (ADSL technology), that opens many new service perspectives, particularly multimedias, (3) the law of 15 November 2001, concerning daily security, gives judges a way of controlling criminal use of IST, and (4) the project of law on information society, presented in June 2001, aims to guarantee the liberty of on-line communication, to clarify the legal bounds of electronic commerce and to promote confidence in network use. It also aims to democratize Internet use by improving the digital information access and by furthering the territorial dissemination of network systems (Johnston & Nolan, 2002, p 87).

Germany (Trend towards mobile eWorking): It also appears from anecdotal evidence that the trend towards mobile eworking is gaining speed in Germany with an increasing number of people working at various work locations. Very often this is the result of organisations closing down their branch offices in the regions to save on cost. As an alternative, they implement home offices for their staff members who used to work in the branch offices and equip them with portable ICTs to enable them to work directly at the customers premises while being mobile (Johnston & Nolan, 2002, p 104).

The ICT-related framework conditions for eworking in Germany are positive and have received further improvements. For the first time there are more mobile phones in use in Germany than fixed-net access points. The roll-out of ADSL is making good progress and the number of subscribers has reached more than 2 million with 2.2 million ADSL users already being Telekom customers. However, the ADSL service is still restricted to specific urban areas only. Customers in peripheral regions will have to wait for some time to be able to make use of this service (Johnston & Nolan, 2002, p 105).

Netherlands (Telewerk prize: Solvision BV): Solvision is a consultancy organisation and part of The Vision Web, a network company without a hierarchical structure. It was founded in 1996. The employees are organised in teams according to projects and they define their own labour conditions. Only 18 employees, out of 500 employees have a fixed workplace. In Delft Dordrecht, Groningen en Veldhoven grand-cafés are used as meeting places for employees and customers. The Intranet is the core of the business and supports the work environment and the maintenance of personal contacts. Solvision is leading with this new business model and has had much press coverage. They won the teleworkprice 2001 because of the creativity and the good business example, as well as good presscoverage. Also the fact that Solvison has mainly eworkers was crucial in the decision (Johnston & Nolan, 2002, p 143). eWork aspect prize : Annie Connect: Annie Connect is a call center supporting companies with telephone services. It is special in that an call centre employees work from home and that 80% of the employees are reintegrated (they were unsuited to labour due to illness). A lot of attention is paid to personal contacts and training. Annie Connect developed the technical infrastructure needed for ework. The employees and the customers have direct access to all relevant information. Annie Connect gave an important impulse to the reintegration of people not fit for labour by giving them ework opportunities (Johnston & Nolan, 2002, p 143).
Appendix (4) Cases from the UK

BT (2003c) provided the following BT customers benefits; improved customer service because of increased availability of better motivated account and technical supplier staff, and faster responses to queries and complaints – both individually and by teams put together quickly by audio conference. Moreover, BT is also benefiting from:

1. Savings on property costs of £180 million a year (a 50 per cent reduction versus pre Workstyle 2000).
2. Capital injection: having reduced the property portfolio, BT has sold it to a specialised company and now leases it back. £2.38 billion of capital is released into the business.
3. Staff retention: BT has one of the highest levels of women returning after maternity leave or longer child-rearing periods (96 per cent).
4. Staff recruitment: a survey of recent graduates shows they put work – life balance at number one in the priority list ahead of career development and salary.
5. Productivity increases of up to 20 per cent. Home workers have shown an increase of between 15 and 31 per cent.
6. Work – life balance for staff, able to better balance work with domestic and personal commitments.

**John Laing Property (JLP):** JLP’s customers benefit from: (1) JLP’s enhanced knowledge of the benefits of office innovation, drawn from its own experience, (2) A more responsive and flexible staff. Furthermore, JLP is also benefiting from: (1) New market opportunities of corporates seeking offices based on technical innovation, (2) Image improvement by moving to the centre of London’s corporate real estate community with limited impact on overall costs, (3) Improved staff productivity through increased flexibility, (4) Cost savings from efficiently deployed office space, (5) No capital expenditure costs for wiring and infrastructure, and (6) Hot desk capability for JLP colleagues (BT, 2003a).
TEXT BOUND INTO
THE SPINE
Appendix (5)

The questionnaire comprises five parts which when combined will provide a picture of teleworker user files, the technologies used and their perceived effectiveness and efficacy. To complete the questionnaire should not take more than 10 minutes. Your confidentiality will be assured at all times.

Please respond to the questions as best you can for which your cooperation is greatly appreciated.

Thank you

Sh Alhalalat, Loughborough University

One: Overview Questions

Information is requested to complete a user profile and to indicate the advantages and disadvantages of working. Here, a broad definition of teleworking is adopted to mean any work undertaken outside offices of your employer.

Are you:

self employed?

employed within an organisation?

Are you in:

full-time employment?

part-time employment?

Where do you usually work when you are away from the office?

Please check all that apply
Appendix

at home

at hotel

on a train

at telecentre

at client site

Other, please specify

3 How long have you been employed as a teleworker?

Less than one year

1 - 3 years

4 - 6 years

7 - 9 years

10 years or over

4 How often do you work away from the physical company office?

Please check the most appropriate amount of time.

One day per week

Two days per week

Three days per week

Four days per week

Five days per week

Other, please specify

A Two: Process Change

We are seeking information related to the effectiveness of teleworking in terms of receiving and sending documents/data etc. To provide some context, we also wish to obtain further information and type of employment that you are in.
The table below indicates questions related to the use of resources when teleworking. Please indicate the option that most closely matches your opinion:

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information received is timely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information is sent on time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information is received through appropriate channels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information is sent via an appropriate channels</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information used satisfies the company’s objectives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information received is from a trusted source</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information sent is to a trusted recipient</td>
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<td></td>
</tr>
</tbody>
</table>

The table below indicates questions related to the type of information used when teleworking. Please indicate the option that most closely matches your opinion:

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teleworking provides the organisation with strategic information</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Teleworking provides the organisation with policy information</td>
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<td></td>
</tr>
<tr>
<td>Teleworking provides the organisation with operational information</td>
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</tbody>
</table>

How does information from the teleworker flow through the organisation? Please indicate the most appropriate choice.
**Vertical flow** (from superior to subordinate or from subordinate to superior)

**Horizontal flow** (between people at the same hierarchical level)

**Both of them (Vertical and Horizontal)**

---

**Part Three: Information & Communication Technology Tools**

We wish to investigate your perceptions about, and the value of, various hardware and software tools that are associated with teleworking. If you find some questions in 3.2 and 3.3 that do not relate to your deployment, please select the "not used" option.

**How satisfied are you with the following hardware tools?**

*Please indicate the option that best indicates your level of satisfaction*

<table>
<thead>
<tr>
<th>Question</th>
<th>Very Satisfied</th>
<th>Satisfied</th>
<th>Dissatisfied</th>
<th>Very Dissatisfied</th>
<th>No Opinion</th>
<th>Not Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSL</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>Radio conferencing</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>Computer Modem</td>
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<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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<td>DN</td>
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<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
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<td>Mobile Telephone</td>
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<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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<td>⬜</td>
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<td>⬜</td>
<td>⬜</td>
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<tr>
<td>Scanner</td>
<td>⬜</td>
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<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>Telephone-land Line</td>
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<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>Teleconferencing</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
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<tr>
<td>Others (Please specify)</td>
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</tbody>
</table>

**How satisfied are you with following software tools?**

*Please indicate the option that best indicates your level of satisfaction*

<table>
<thead>
<tr>
<th>Very Satisfied</th>
<th>Satisfied</th>
<th>Dissatisfied</th>
<th>Very Dissatisfied</th>
<th>No Opinion</th>
<th>Not Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
<td>Satisfied</td>
<td>Satisfied</td>
<td>Dissatisfied</td>
<td>Dissatisfied</td>
<td>Opinion</td>
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<tr>
<td>Answer Machine</td>
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<tr>
<td>Call Waiting</td>
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<tr>
<td>That software (eg. MSN Messenger)</td>
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<tr>
<td>Credit Card Verification</td>
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<tr>
<td>Databases</td>
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<tr>
<td>Electronic Mail</td>
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<tr>
<td>Electronic Mailing lists</td>
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<tr>
<td>Expense Management Tools</td>
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<tr>
<td>File Systems</td>
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<tr>
<td>Interactive Diaries/Scheduler</td>
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<tr>
<td>Multimedia Systems</td>
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<tr>
<td>Presentation Software</td>
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<tr>
<td>Project Management Tools</td>
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<tr>
<td>Spreadsheets</td>
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<tr>
<td>Statistics Packages</td>
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<tr>
<td>Voice Mail</td>
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<tr>
<td>Word Processing</td>
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<tr>
<td>Workflow software systems</td>
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<tr>
<td>Others (please specify)</td>
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<td></td>
</tr>
</tbody>
</table>

This question deals with adoption of new technology:

<table>
<thead>
<tr>
<th>general, new technologies</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>if reduce operating costs of the office?</td>
<td></td>
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<tr>
<td>if increase flexibility?</td>
<td></td>
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<tr>
<td>if improve the quality of a product or services?</td>
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</tr>
<tr>
<td>if provide better control and integration by means of better information and better error correction processes?</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Part Four: Background

Part Four focuses on some professional characteristics of teleworkers, it deals with your experience and training needs.

Name of employer (if appropriate and Optional)

You are self-employed, please go to Q 4.5

How long have you worked for your current employer?

- less than 1 year
- 1 year to 3 years
- 4 years to 6 years
- 7 years to 9 years
- 10 years or over

In which department do you work?

What is your present position/job title?

Has your organisation supported you with any training programme to develop your skills teleworking?

Yes

No

Yes, indicate type of training

- Face to face training
- Web-training
- Some programmes are face to face, others are optional

And, this training is

- Compulsory
- Optional
- Some programmes are compulsory, others are optional

Five: Demographics

Conclude the questionnaire by asking for further details about yourself.
Appendix

1. What is your gender?
   Male
   Female

2. What is your age?
   Under 25 years
   25 - 34 years
   35 - 44 years
   45 - 54 years
   55 - 64 years
   65 years or over

3. Where do you live?
   UK
   Abroad

4. What level of education have you completed?
   Please indicate the highest level achieved:
   GCSE
   A-Level
   NVQ
   HND/C
   Bachelor's degree
   Master's degree
   PhD

5. How far away from the corporate offices are you when you work remotely (usually)?
   Under 5 Miles
   6 - 20 Miles
   21 - 50 Miles
Appendix

51- 100 Miles

Over 100 Miles

6 What time of day or night do you usually work when you work away from the company?

Please tick all that apply

Morning (8am-12 noon)

Afternoon (12 noon - 6pm)

Evening (6pm-10pm)

Night-time (10pm-8am)

Please, tick all that apply below, add your email if appropriate:

I would like to take part in the interviews

I would like to receive a copy of the collated results of this survey

I would like to take part in the draw prize of £100 in vouchers

Contact e-mail is

Any other comments:

We will only use the data collected for the purpose of evaluating effective workflow in your virtual office. We will not make your data available to third parties.

Thank you for your help!
For more information, please do not hesitate to contact:

Aisha I. Alhalalat

Email: sa_he@yahoo.com

Phone: +44 7788 948215

Fax: +44 1509 223053

Thank you for your help.

Submit or reset the form
Appendix (6) An evaluation form of the designed questionnaire

Completing these few questions would be greatly appreciated in order to optimise the design of the enclosed questionnaire. Your support will help this study significantly.

1. How long did it take you to complete the questionnaire?

2. Are the instructions clear?

3. Were any of the questions unclear? If so, will you say which and why?

4. Did you object to answering any of the questions?

5. In your opinion, has any major topic been omitted?

6. Was the layout of the questionnaire clear/attractive?

7. Were the colours of the questionnaire clear/attractive?

8. Any other comments?

Thanks again for your help.

Submit or reset the form.
Appendix (7) First Phase of Interview – Protocol

This interview aims to support the designed questionnaire, which you got part of it. However, it comprises three parts for further issues in information flow, training, and technological change. To validate the teleworker’s profile, could you start with the first question, which covers various kinds of teleworking.

Interview Number:
Name (optional)
Position:
Time:
Location:
Contact details (optional):

What kind of teleworker are you (Please, select from the list)?

<table>
<thead>
<tr>
<th>Kind of Teleworkers</th>
<th>✓</th>
<th>Kind of Teleworkers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home-based</td>
<td>✓</td>
<td>Self-employed teleworker.</td>
</tr>
<tr>
<td>Employed</td>
<td></td>
<td>Client site</td>
</tr>
<tr>
<td>Full-time</td>
<td></td>
<td>Part-time</td>
</tr>
<tr>
<td>Mobile</td>
<td></td>
<td>Entrepreneurial</td>
</tr>
<tr>
<td>Concentrative</td>
<td></td>
<td>Offshore</td>
</tr>
<tr>
<td>Satellite teleworker.</td>
<td></td>
<td>Hotel (some times).</td>
</tr>
<tr>
<td>Informal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Part One: Further Issues of Information Flow

1. Is your professional information mixed with your personal information during teleworking activities?
2. What kinds of information are used in your office (Verbal, print, electronic, etc.)?
3. Do you think you work optimally? If not, could you tell me what are the main barriers that prevent optimal working?
4. Is there any special software for managing your process (workflow)?
5. How do you report your time sheets (if your company uses them)?

Part Two: Further Issues of Training

1. Do you have an annual plan for your training?
2. What are the main subjects covered by your training (management, teleworking, etc.)?
3. Who determines your needs for training?
4. Who sponsors your training costs (if any one)?
5. What are the issues associated with training?

Part Three: Further Issues of Technological Change

1. Which kind of connection do you prefer: wired communication or wireless communication? (if you have experienced both)?
2. Do you think that the automation of tasks has increased over the last five years?
3. Are you happy teleworking, or would you like to change?
4. Are you comfortable with the technological change?
5. Do you prefer to adopt a new technology in your office or at home?

Thanks indeed for getting part in this interview
Appendix (8) Second Phase of Interview – Protocol

Dear Sir/Madam: You have an opportunity to take part in the third phase of our research study, it is semi-structured interview, which is concerned with investigation of information flows in virtual organisations. The study is being performed by researchers from Loughborough University. It is acknowledged that not all activities of teleworking take place in the home, so some interest is devoted to finding out where work 'outside the Office' actually takes place. At the end of this interview, you will be invited to add your knowledge and experience in charting a simple “Hand-drawn sketch” for information flow concerning your job. The total time of this interview is expected to be roughly 30 min. The first two phases look for checking the information integration in the virtual organisation, the concept of “getting right information from/to the right source (recipient) through the right channel and at the right time” reveals that there is a lack in information flow integration, and a weak relationship between Information and Communication Technologies (ICTs) and the integration of information flow. So, the Information Audit Model will be used to map an information flow to find out the inefficiencies points in the flow of information. In fact, Information Audit is used as a management technique for identifying the way in which employees use information in order to perform their tasks (Alexopoulos and Theodoulidis, 2003). Data that you provide will enable the mapping of information flow(*) and to investigate your information use while you are working outside the traditional (physical) office. A proposed model of your information flow will be mapped and you will receive a copy of it when it is ready. Your responses to all of the questions will remain anonymous, and confidentiality will be respected at all times.

Section One (Interviewer Background/Profile): let us answer the following short questions:

- What is your position/job title?
- Are you employed or self-employed (or both)?
- Do you work from home?
- How long have you been working in your current job?
- Do you work full-time or part-time?
- What is the name of your company? (optional)
- What is the name of your business unit? (optional)
- Who are your main customers?

(*)Information map covers the three formats of information (electronic, print and verbal format) and internal and external information.
<table>
<thead>
<tr>
<th>Situation</th>
<th>Current Information</th>
<th>Required Information</th>
<th>Scope of Your Job</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section Two: (Needs and Outcomes of Information) Please, clarify below the scope of your job, information required, current, and ideal information.
Please rate the importance of the following characteristics when choosing/using information resources.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>1 Unimportant</th>
<th>2</th>
<th>3</th>
<th>4 Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility/availability/convenience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequacy/relevance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehensiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery method</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical accuracy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeliness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How does your company (you) determine your needs for information? Do you participate?

- Are there any reports received routinely from your company (if you are employed teleworker)?

- What reports or other types of information does your business unit or section make available to other sections of the organisation, or to entities outside the organisation?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Provided to (Business Unit/ Section, External Entity)</th>
<th>Format</th>
<th>Frequency of delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* e.g. of resources: advertising report-daily or weekly, marketing plan, advertiser database, activity report. They can be delivered daily, weekly, annually, quarterly or online.
Where do you get the information you need (Please answer as best as you can)?

<table>
<thead>
<tr>
<th>Amount of Information</th>
<th>None</th>
<th>a little</th>
<th>some</th>
<th>Quite a bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate information centre staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public library</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company website</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company intranet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Website outside the company</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial information service</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD ROMs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Broker</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College/University Library</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section Three (Technological and Human Relations and Evaluation):

- Is any of your information duplicated elsewhere?
- What happens to used information resources after they have been accessed? Where do they go?
- Do you belong to a work team?
- With whom do you communicate most often in the company?
- To your knowledge, are information needs covered in any plans, e.g. your contract or brochures about teleworking in your company?
- Do any teleworker training programmes mention information needs specifically?
- Is 'teleworker' (or any other synonym) mentioned in the information centre's strategic plan or other planning documents?
- How satisfied are you with the information you are able to retrieve for your job?
- What is the biggest barrier to getting information that you need for your job when teleworking?
- What is the biggest help to you in finding information you need for your job when teleworking?
- Could you tell me any opportunities for improving the flow of information in your organisation?

Section Four (Charting the Information Map): Let us try to map a simple hand-sketched figure that describes information flow in your office, based on your current job. Do you have any stories about providing services to teleworkers that you have not mentioned?
Is there anything else you would like to add?

Thanks for your participation

Guide of the importance of the current information resources:
1 – not presently used or no perceived benefits to the task
2 – provides indirect or minor support to the task
3 – contributes directly to the task but is not essential
4 – contributes directly to the task and provides some benefits
5 – provides significant benefits or adds to the task
6 – critical to the task

* Importance of resources (current and ideal) is reflected by using colours, bold, italic, etc.

Guide of the importance of the ideal information resources:
1 – not task-specific but of general benefit to business unit
2 – provides indirect support to the task
3 – contributes directly to the task but is not essential
4 – contributes directly to the task and is essential for some activities
5 – provides significant benefits or added value to the task
6 – critical to the task
Appendix (9) The cover letter in the second phase

Loughborough University

Dear Sir/Madam:

You have an opportunity to take part in the third and final phase of our research study. We wish to conduct a semi-structured interview, which will explore information flows in virtual organisations. It is acknowledged that not all activities of teleworking take place in the home, so some interest is devoted to finding out where work 'outside the Office' actually takes place. At the end of this interview and given time, you will be invited to add your knowledge and experience in charting a simple 'hand-drawn sketch' of information flows concerning your own employment. The total time of this interview is expected to be roughly 30 minutes and will take place at a location suitable to you.

Data that you provide will help build an information map and will investigate your use of information while teleworking. *A benefit of your participation in this study is a personal copy of your individual information map when it becomes available.*

Your responses to all of the questions will remain anonymous, and confidentiality will be respected at all times. To take advantage of being a respondent, please reply to this email notifying us of your postal address, contact number and an indication of your free time when you are available for interview.

Best Regards,

Saleh Alhalalat
Professor Ron Summers

Research School of Informatics
Holywell Park
Loughborough University
Loughborough
Leicestershire
LE11 3TU

Phone: 07788 948215
e-mail: S.Alhalalat@lboro.ac.uk

(*) Information map covers information in all format, including email, database, plans, paper files, websites, intranet communications, etc.
### Appendix (10) Normality Tests

<table>
<thead>
<tr>
<th>Information sent is to a trusted recipient</th>
<th>Skewness Statistic</th>
<th>Skewness Std. Error</th>
<th>Kurtosis Statistic</th>
<th>Kurtosis Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information is sent on time</td>
<td>-.208</td>
<td>.213</td>
<td>-.661</td>
<td>.423</td>
</tr>
<tr>
<td>Information is sent via an appropriate channels</td>
<td>-.618</td>
<td>.209</td>
<td>1.622</td>
<td>.414</td>
</tr>
<tr>
<td>Information received is from a trusted source</td>
<td>-.507</td>
<td>.212</td>
<td>2.283</td>
<td>.422</td>
</tr>
<tr>
<td>Information received is timely</td>
<td>-.712</td>
<td>.217</td>
<td>.841</td>
<td>.431</td>
</tr>
<tr>
<td>Information is received through appropriate channels</td>
<td>-.497</td>
<td>.211</td>
<td>.097</td>
<td>.419</td>
</tr>
<tr>
<td>Information used satisfies the company's objectives</td>
<td>-.502</td>
<td>.211</td>
<td>2.237</td>
<td>.419</td>
</tr>
<tr>
<td>Information used satisfies the company's objectives</td>
<td>-.098</td>
<td>.217</td>
<td>2.110</td>
<td>.431</td>
</tr>
</tbody>
</table>
# Appendix (11) Reliability Test of Information flow Items (7 items)

### Reliability Statistics

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.902</td>
<td>.903</td>
<td>7</td>
</tr>
</tbody>
</table>

### Item-Total Statistics

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Scale Mean if Item Deleted</th>
<th>Scale Variance if Item Deleted</th>
<th>Corrected Item-Total Correlation</th>
<th>Squared Multiple Correlation</th>
<th>Cronbach's Alpha if Item Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications received are timely</td>
<td>19.6396</td>
<td>7.724</td>
<td>.660</td>
<td>.669</td>
<td>.894</td>
</tr>
<tr>
<td>Communications are sent on time</td>
<td>19.6396</td>
<td>7.669</td>
<td>.747</td>
<td>.734</td>
<td>.883</td>
</tr>
<tr>
<td>Information is received through appropriate channels</td>
<td>19.7477</td>
<td>7.663</td>
<td>.721</td>
<td>.589</td>
<td>.886</td>
</tr>
<tr>
<td>Information is sent via an appropriate channels</td>
<td>19.7477</td>
<td>7.663</td>
<td>.721</td>
<td>.589</td>
<td>.886</td>
</tr>
<tr>
<td>Information used satisfies the company's objectives</td>
<td>19.7117</td>
<td>8.352</td>
<td>.653</td>
<td>.561</td>
<td>.894</td>
</tr>
<tr>
<td>Information received is from a trusted source</td>
<td>19.6486</td>
<td>7.885</td>
<td>.653</td>
<td>.726</td>
<td>.894</td>
</tr>
<tr>
<td>Information sent is to a trusted recipient</td>
<td>19.6126</td>
<td>7.676</td>
<td>.757</td>
<td>.723</td>
<td>.882</td>
</tr>
</tbody>
</table>
### Appendix (12) The respondent's profile

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>140</td>
</tr>
<tr>
<td>Male</td>
<td>82</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>58</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td>138</td>
</tr>
<tr>
<td>Under 25 years</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>25-34 years</td>
<td>21</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>35-44 years</td>
<td>54</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>45-54 years</td>
<td>36</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>55-64 years</td>
<td>18</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>65 years or over</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td>138</td>
</tr>
<tr>
<td>GCSE</td>
<td>17</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>A-Level</td>
<td>11</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>NVQ + HND/C</td>
<td>21</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>57</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Master's degree</td>
<td>26</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>PhD</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Experience as a teleworker</td>
<td></td>
<td></td>
<td>137</td>
</tr>
<tr>
<td>Less than one year</td>
<td>39</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>1-3 years</td>
<td>41</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>4-6 years</td>
<td>22</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>7-9 years</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10 years or over</td>
<td>28</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Working Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At home</td>
<td>134</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>At client site</td>
<td>35</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>In hotel</td>
<td>16</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>On a train</td>
<td>16</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>In telecentre</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Working Days</td>
<td></td>
<td></td>
<td>134</td>
</tr>
<tr>
<td>One day per week</td>
<td>12</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Two days per week</td>
<td>28</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Three days per week</td>
<td>27</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Four days per week</td>
<td>13</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Five days per week</td>
<td>54</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Distance of Working</td>
<td></td>
<td></td>
<td>133</td>
</tr>
<tr>
<td>Under 5 Miles</td>
<td>35</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>5-20 Miles</td>
<td>29</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>21-50 Miles</td>
<td>33</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>51-100 Miles</td>
<td>19</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Over 100 Miles</td>
<td>17</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

Total respondents: 309
## Appendix (13) Satisfaction level of ICTs use

<table>
<thead>
<tr>
<th>Electronic Office Systems (EOSs)</th>
<th>N</th>
<th>Very Satisfied %</th>
<th>Satisfied %</th>
<th>Dissatisfied %</th>
<th>Very Dissatisfied %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Processing</td>
<td>133</td>
<td>45.86</td>
<td>53.38</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spreadsheets</td>
<td>123</td>
<td>38.21</td>
<td>61.79</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Audio conferencing</td>
<td>68</td>
<td>30.88</td>
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<th>Satisfied %</th>
<th>Dissatisfied %</th>
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<table>
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<th>Very Satisfied %</th>
<th>Satisfied %</th>
<th>Dissatisfied %</th>
<th>Very Dissatisfied %</th>
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* Scale is 1 for Strongly Disagree and 4 for Strongly Agree
## Appendix (14) A guide of information mapping

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<th>Symbol</th>
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<td>P</td>
<td>Print information</td>
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<td>A</td>
<td>Audio information</td>
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<td>V</td>
<td>Verbal information</td>
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<td>F2F</td>
<td>Face to Face information</td>
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<td></td>
<td>Actor</td>
</tr>
<tr>
<td></td>
<td>Use Case</td>
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<tr>
<td></td>
<td>One-way flow or One-way relationship</td>
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<tr>
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<td></td>
<td>Alternate process</td>
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**Colour Guide:** Each colour in Inflows Information figures indicates to the importance of information resource. The guide below displays the meaning of each colour.

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<th>Colour</th>
<th>Meaning</th>
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<td>1</td>
<td></td>
<td>not presently used or no perceived benefits to the task</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Provides indirect or minor support to the task</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>contributes directly to the task but is not essential</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>contributes directly to the task and provides some</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Provides significant benefits or adds to the task</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>critical to the task</td>
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</table>