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The Effects Of Mobile Computing on Teleworking

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Abstract

This paper examines Mobile Computing Technology with a particular focus on the effect Mobile Computing is having on teleworking. Mobile computing as it is defined for this paper is described. The enablers of this technology as well as the inhibitors to this technology are discussed. Future possible trends in the area of mobile computing are also explored. Teleworking is reviewed in terms of the advantages and disadvantages it offers to the organization. Also outlined is the use Information Technology (IT) in teleworking. This examination of teleworking leads the paper into the next step up from teleworking i.e. The virtual organization. The issues around this type of structure are outlined including, Strategic Change Issues, Virtual teams, Integration of Virtual teams, Trust Issues and Cultural Issues. The paper then examines the implications involved in managing a virtual organization. Having explored the issues and possible complications surrounding a virtual organization it is important to highlight any strategic advantage that a move to this type of organizational set up would give and organization.

1. Introduction

The aim of this paper is to give the reader an overview of mobile computing technology and to highlight the effect this technology is having on teleworking. The research for this paper was conducted by referencing a number of acknowledged text books, academic journal articles and web publications. This paper is aimed at those interested in the evolutionary changes that are becoming apparent in organizations today. Mobile computing technology is providing the basis for this revolutionary fundamental change in the way organizations are structured. However even though the technological infrastructure is in place there are a number of issues facing an organization that wants to use these technological advancements to their full potential. If these issues are not addressed by the organization the realization of a purely virtual organization may not be possible.

The paper is divided into four main sections. Section 2 considers the technological side to mobile computing, including the enablers and the inhibitors of this technology. There is also

an overview of possible future trends in this area. Second 3 discusses the effects of mobile computing on the organization. Teleworking issues, the virtual organization, management of a virtual organization and possible strategic advantages of the virtual organization are considered here. Section 4 is the conclusion of the paper.

2. Mobile computing

Mobile computing also known as Wireless Computing has begun moving out of its gestation period (Gartner Group, 1998). Today's workforce is becoming increasingly mobile and companies are keeping remote users up to date and in touch by providing notebook computers and remote access capabilities to their employees. Mobile computing seems to be the latest 'Buzz Word' in the technology industry. It can have different meanings for different people. The next section explains the term mobile computing, as it is understood for this paper.

2.1 What is mobile computing

There are many diverse definitions of what exactly mobile computing is, some example include:
"Mobile Wireless – the use of wireless devices or systems on board motorized moving vechicles, e.g. Mobile phone and Personal *Communications devices (PCD's)" (www.whatis.com)"*

This limits the term mobile to use only in relation to moving vehicles, today mobile computing has a much broader meaning. Another definition refers to mobile computing as telecommunication in which electromagnetic waves, rather than some form of wire, carry the signal over part or all of the communications path (www.whatis.com). Therefore mobile computing would be the ability to connect computers or computing devices using electronic waves rather then wires. However for the purposes of this paper mobile computing will be defined as *"Any computing device which facilitates work outside the organization."*Today the term mobile is used to refer to the many wireless technologies available, these include:

- Cellular Phones and Pagers
- Global Positioning Systems
- Cordless PC Peripherals e.g. cordless mouse
- Home entertainment-systems controls e.g. television remote control.
- Wireless Applications Protocol (WAP)
- General Packet Radio Service (GPRS)
- Universal Mobile Telecommunications System (UMTS)
- Video Conferencing

- E-mail
- Voice-mail.

These are but a few of the systems to arise out of the mobile revolution. Some of which are not particularly applicable to this paper. Mobile technologies can be divided into several forms including direct-dial and virtual private networks (VPN). Direct-dial allows users to dial in or out from a corporate LAN, or to establish LAN-to-LAN connections using traditional analogue or high speed ISDN lines (Saab, 1999). A secure VPN is a network tunnel created for encrypted data transmission between two or more authenticated parties over a shared data network. Through a VPN employees can simply dial into a corporate network or into any ISP and have direct access to the corporations data and decision-making tools regardless of their location (Saab, 1999). Using VPN technology, intranets can be created to keep off-site sales forces informed of new products, product enhancements and new price structures. Extranets implemented using VPN technology can also establish secure communication channels between corporations and their business partners, permitting proprietary information to be shared in confidential secure environments. These two complimentary technologies, direct-dial and VPN, can help maximize mobile computing while minimizing underlying costs (Saab, 1999).

2.2 Enablers of Mobile Computing

"Major driving and enabling technologies are now in place to ensure that mobile data becomes pervasive over the next five years: Internet, intranets, successful Personal Digital Assistants (PDA's), browser enabled phones and finally higher speed mobile WAN services" (WAN Wireless, Gartner Group, 1998).

Mobile computing is one of the fastest growing segments of the communications industry (Krichevsky, I., 1999). The international data corporation expects there will be one billion wireless phones by 2003. Applications for mobile computing are also growing at rapid speeds. In August and November 1999 there were 14 significant news announcements related to mobile computing (Krichevsky, I., 1999). These announcements ranged from wireless access to the Internet to the recently announced "Wireless MD", which claims to be the first two-way wireless communications product for physicians. In terms of the organization some of the key motivators for investment in mobile computing, and particularly remote access, are increased productivity, increased accuracy and improved customer service and satisfaction (Gartner Group, 1998).

According to the Gartner Group, major developments in networking, including the advent of universal wireless LAN and WAN access as well as further evolution in mobile, home-based and wearable devices are triggering the evolutionary change into the mobile era.

Trends in mobile computing e.g. Web-enabled GSM phones with larger screens, integrated web browsers, e-mail agents and personal information management applications and the growth of GSM-enabled PDA and portable PC's, has resulted in individuals and groups within the enterprise, seeking to implement mobile data connectivity initiatives in the absence of any corporate program. This means that the corporation will be obliged to support multiple applications and gateways, so even if the corporate decision to move into mobile computing is not taken it seems that the push from individuals and groups within the organization will be so strong the corporation is going to have to move in this direction (Gartner Group, 1998). Another enabler of mobile computing has been in introduction of broadband wireless services called local multipoint services (LMDS). These give new competitors an opportunity to enable infrastructure flexibility and time to provision of services. Organizations can also use LMDS to eliminate common single point of network access failures by incorporating this technology into a diverse access route strategy.

As can been seen from this section there are a number of technologies driving the growth in mobile computing, however there are some areas that would be considered inhibitors to the successful continued growth of mobile computing. The next section considers these.

2.3. Inhibitors to Mobile Computing

The inhibitors to this technology that are considered in this section are:

- Cost
- Networks
- Standards
- Complexity
- Lack of Talent

2.3.1 Cost

"Through 2003, organizations that fail to proactively manage mobile cost reduction will overpay as much as 40%" *(Gartner Group, 1998).*

With an new and emerging technology one of the major inhibitors tends to be the cost and mobile computing is no exception. Most ongoing costs for mobile projects dwarf any initial investments, making many endeavors more costly then expected (Gartner Group, 1998). According to the Gartner Group, (1998), as European organizations add up the costs of

mobile services many are surprised to see that it represents as much as 50% of their overall communications costs. The reason cited for this is a lack of competitive bidding, devolved procurement and a dearth of pan-European suppliers. However the Gartner Group does give some hope to the organizations suggesting the use of other WAN networking solutions in an attempt to control the spiraling costs of mobile communications. The other possibility is to bypass the middleman. Few organizations are aware of how much the fixed line operators charge for delivering a call to a mobile. Organizations can eliminate terrestrial network surcharges by simply linking office PBX systems with the nearest mobile network point of presence (Gartner Group, 1998).

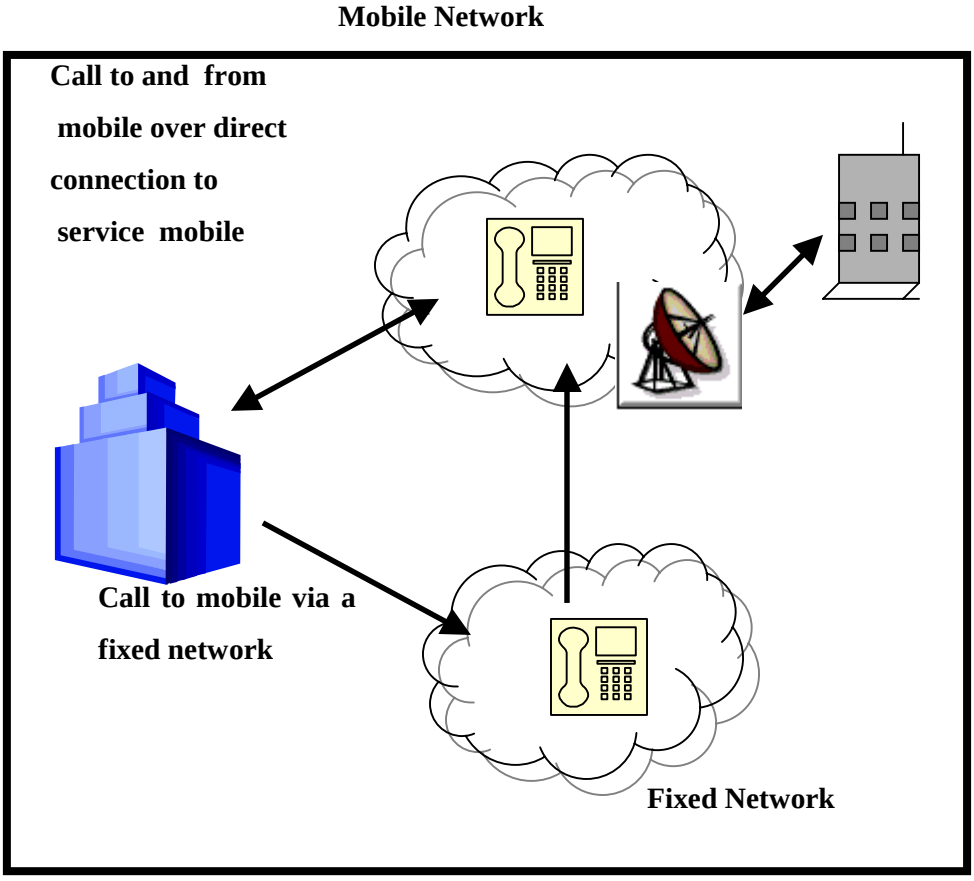

Figure 1: Gartner Group, WAN Wireless, 1998.

Few organisations are aware of how much the fixed line operators change for delivering a call to a mobile phone. This figure 1 represents the calls from an office to a mobile phone. In the upper bubble organizations could save money by connecting to mobile over a service mobile switch. This eliminates the middleman thus saving money. The lower bubble represents the fixed line call to a mobile, incurring the costs of the fixed line operators.

In order to have a complete perspective on cost it is important to include setup and maintenance costs, for organizations wishing to implement mobile computing, which can be

very high. According to Cascio (2000), for individual employees the cost to equip a mobile office varies from $3,000 to $5,000 plus another $1,00 every year in upgrades. In addition to this a virtual office requires online materials and database products. Also needed are well-indexed, automated, central files that are accessible from remote locations and a way of tracking any other mobile workers.The final cost consideration with relation to mobile computing and virtual organizations is the effect of the loss of efficiencies. When expensive equipment is concentrated in one location, multiple users can access it. However if the same equipment needs to be distributed across locations cost efficiencies may be lost (Cascio, 2000).

2.3.2 Networks

At present there is a lack of a fast reliable and affordable network infrastructure to support mobile computing (Dhawan, C., 1997). On the road, most wireless networks do not yet have the ubiquitous coverage that many mobile applications require. As for reliability the wireless networks are more prone to errors then fixed networks, with temporary disconnects still quiet common (Dhawan, C., 1997).

2.3.3 Standards

There is a distinct absence of standards in the mobile computing industry. As a result most solutions are proprietary based and therefore not interoperable. While some standards such as the IEEE 802.11 for wireless LANS, TCP/IP for transport and CDPD for the network are emerging, here is still a lack of more pervasive standards (Dhawan, C., 1997).

2.3.4 Complexity

The move to a mobile computing environment is very complex. Systems integration of a large mobile computing project for enterprise-wide deployment is a non-trivial task. The number of component involved, application modifications required, end-to-end integration and the emerging nature of the technology all contribute to its complexity (Dhawan, C., Computer Dealer News,1997).

2.3.5 Lack of Talent

According to the Gartner Group, organizations are facing a similar challenge to that which was seen in the mid- 1990's around web development. Just as with web-enabled applications, organizations that fail to proactively grow the requisite programming talent will be forced to delay or outsource projects. Today, most organizations are turning to outside resources, such as application service providers, for their wireless applications development talents. While this strategy is sufficient for the present organizations need to realize that mobile

technologies will become so embedded in their computing infrastructure that wireless access will become a common feature needed to be supported. The long term need to build customized business applications, as well as a need to link mobile applications to existing systems will force many organizations to assemble their own wireless application teams.

The next section considers the trends in the area of mobile computing. Will the inhibitors to this technology stunt its growth? Or are the enablers such that continued growth will be sustained?

2.4 Trends

Not since the Mainframe era has technology reached a level of relative stability before other discontinuous architectures entered the IT environment (Gartner Group, 1998).

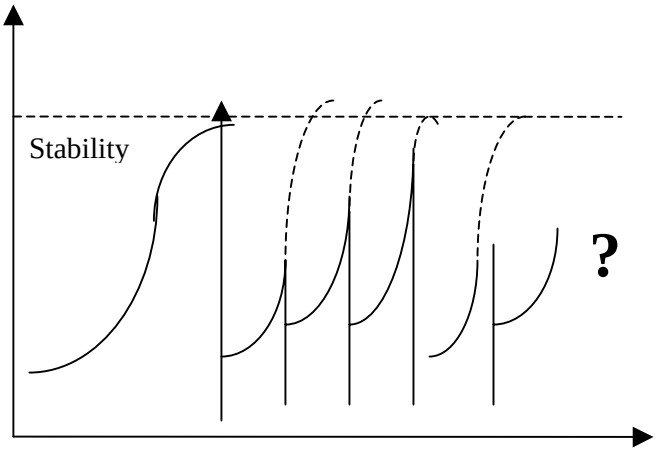

Figure 2: Gartner Group , 1998.

As can be seen from figure 2 above, very early in the life cycle of each new emerging technology over the past 10-15 years, a newer technology has superceded the previous one. With PC's, LAN's , Client/Server and now network computing, IT planners have barely had time to come to terms with new management, security support and total cost of ownership before the new paradigm arrives.

According to the Gartner Group a key element in predicting future trends in the IT industry, is to identify the driving forces of the present that will influence the future. Some of these driving forces are predetermined e.g. the number of computer science graduates entering the market in 2000 will depend largely on the number of students enrolled on these courses. Global Business Network, one of the pioneer organizations involved in planning, characterizes a subset of the forces as "Critical uncertainties", that are the key to the focal

issue. This organization represents these critical uncertainties as axes on a matrix, e.g. determining the future of the office environment in 2008 (figure 3) the two axes would be :

1. Whether the dominant equipment will still be general purpose PC's with massive memories and storage V's targeted, task specific computers,
2. Whether the devices will be wireless on dependant on a wired network solution.

Looking at the four corners created by combining these two axes leads to radically different scenarios each posing a different possible future trend.

a) **Deskbound**: If the trend stays with general purpose PC's on the wired side, then employees will be deskbound.
b) **Device Proliferation**: If the trend was towards task-specific devices on the wired side, then there would have to be rapid growth or change in the devices being used.
c) **Wearables**: If the trend were to be general purpose PC's on the wireless side, devices could be reduced in size a carried around i.e. they would be mobile, thus employees could work from anywhere, home, office, traveling.
d) **Ubiquitous Computing**: If the trend was to move both towards task-specific devices and a wireless world we would certainly be looking at computing everywhere and at once. Devices would be mobile and specific to the task required, e.g. a salespersons device would differ from a H.R. managers device, the only similarity being that all are mobile.

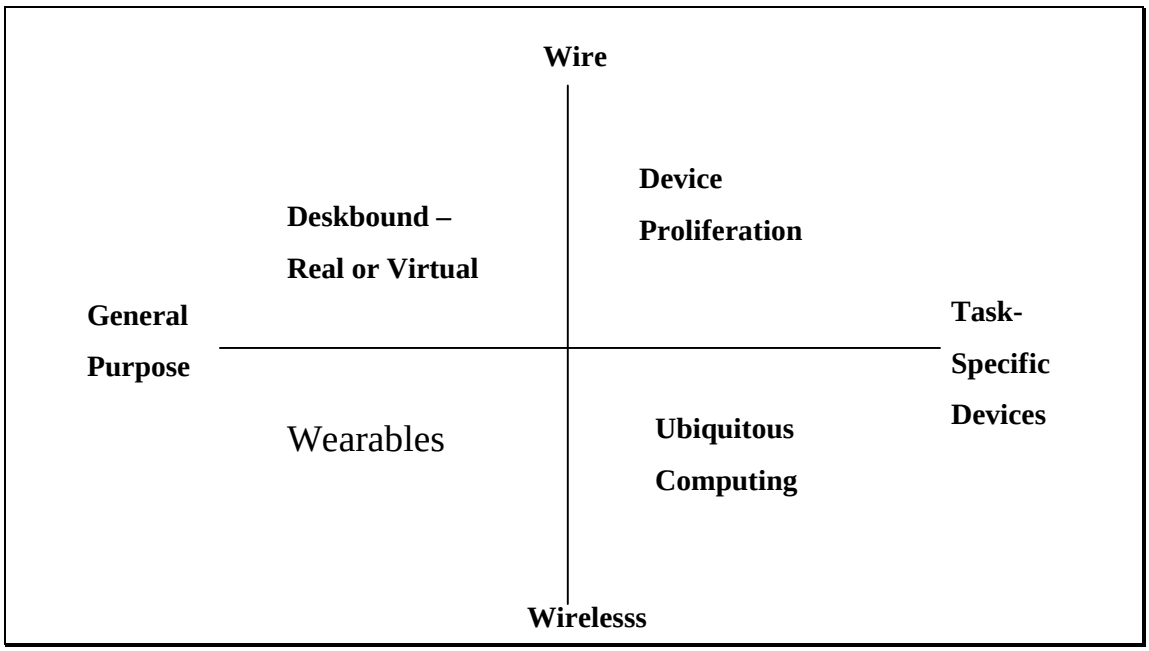

Figure 3: Gartner Group, 1998.

With regard to mobile computing the indicators seem to sow a distinct move in this direction, the decision facing organization seems to be more a question of when is best to invest? If an

organization launches into a new technology too soon, it runs the risk of suffering the painful and expensive lessons associates with new technologies. It also runs the risk of a newer technology superceding it as in Figure 3. On the other hand if the organization delays too long it runs an even greater risk, that of being left behind by its competitors.

The possible trends in this area are impossible to predict conclusively at this stage however the following have a 0.8 probability of happening according to the Gartner Group:

- The adoption of wireless data services will be driven by individual and organizational messaging and personal information management through 2002.
- Third generation wireless systems will offer higher data rates and increased functionality by 2002 in Europe.
- Through 2003, satellite systems will play a niche role in providing access in regions where terrestrial alternatives are limited or where rapid provisioning is higher priority then cost.
- Through 2003, the cost of rapid growth in enterprise use of mobile communications will not be offset by tariff reductions alone.
- Organizations that do not put in place strong procedures, policies and guidelines will loose control of mobile costs before 2003.

Having discussed what mobile computing is and the future trends in this area, the paper will now move on to look at the effects that this technology is having on the organization.

3. Effects of mobile computing on teleworking.

Study after Study asserts that mobile computing and telecommuting are going to be key factors in the next phase of the information revolution (Bartlett, J., 1997). While Mobile computing is becoming more and more widespread it is necessary to understand the effect this revolution is going to have on organizations. Will Mobile computing leave us with purely virtual organizations? The effects this new technology is having on organizations can already be seen by the increase in teleworking. Teleworking is an evolutionary step in the integration of mobile computing into the organization. The next section deals with teleworking within organizations.

3.1 Teleworking

Teleworking is an evolutionary step in the move towards the virtual organization (Huws *et al.*, 1993). Mobile computing has enabled teleworking (Huws *et al.*, 1993). Teleworking is when an employee carries out their work in a location remote form the central offices or

production facilities. The worker would have little or no personal contact with other employees, but is able to communicate with them via electronic means. Many of the issues faced with teleworking are also those faced by the virtual organization. There was a 60 percent increase in telecommuting between 1996 and 1998, to almost 16 million workers spending at least one day per week outside the traditional office environment, according to the International Telework Association and Council. The Gartner Group has estimated that this will grow to over 30 million by the year 2000.

Teleworking will now be considered under the following headings:

- Why teleworking was introduced
- Advantages of teleworking
- Disadvantages of teleworking
- Use of IT in teleworking

3.1.1 Why teleworking was introduced

In order for teleworking to be successfully introduced to an organization there needed to be an involvement from two groups of people:

- The Employer
- The Employee

Teleworking can only take place if there is sufficient convergence of interest for both parties to agree to it (Huws *et al.*, 1993).

The Employer – There is a wide range of reasons organizations might have for considering the introduction of teleworking, many of which are outlined in section 3.1.2. Advantages of Teleworking. Gil Gordon, a telework consultant who has done research on this area in the United States, outlines eight common reasons for the introduction of teleworking:

- Improved Recruitment.
- Improved retention of Staff.
- Curiosity to experiment.
- Space Savings.
- Hiring a disabled employee.
- Increased productivity.
- Response to employee demand.
- Need to improve customer services.

However the reasons for adoption of teleworking can be better analyzed based on different work sectors. For example, the software industry adopted it mainly as a way of retaining staff, whereas some companies decentralized typing and word processing task in order to minimize cost including expense of office space. And lastly consultancies companies introduced teleworking as a way to meet customers and business needs in the organization.

Having looked at management reasons for adopting teleworking, it is necessary now to look at the reasons why teleworkers themselves have chosen to work in this way. The main reasons cited by employees for wanting to telework are:

- Autonomy of work
- Balance between work and home life
- Flexibility of working hours
- Reduction in commuting

The benefits of these reasons given by employees are further outlined in section 3.1.2 Advantages of Teleworking. Teleworking must be agreed between employer and employee, in most cases the type of job being undertaken as well as the person involved are considered. The job needs to be one that can be conducted without major face-to-face communication. The individual involved needs to be self-motivated and disciplined in order to meet the work requirements from home. Having discussed how teleworking came about it is necessary to discuss the advantages teleworking offers to both the employers and the employees.

3.1.2 Advantages of Teleworking

Some of the reasons why firms might want to shift some of their workload to a virtual office environment include:

- For those in a rapid-growth mode, physical office space may be a problem, and remote working could provide an inexpensive alternative to leasing additional real estate (Faulkner & Gray, Inc., Accounting Today, 1999).
- The dwindling and ever more expensive pool of skilled professionals makes competition for the best talent tougher than ever. Offering creative alternatives to traditional work environments may help to recruit or retain those who would like to work part-time, on flexible schedules, or those with special physical or family needs.
- Finally, several studies have shown that workers can be both happier and more productive when freed from long commutes, parking expenses and formal office routines. (See Kavanagh (2000), example below).

The technologies that make this possible are available today, and are evolving and improving rapidly. These improvements in technology mean that teleworking is a very viable solution. The example cited by Kavanagh (2000) is based on BT, they have 3500 people teleworking. So far the policy has lead to a 20% growth in productivity and can increase morale for those employees finding a new balance between work and home life. BT say that peoples communication skills have also increased.

Even though teleworking offers many viable advantages to the organization it also has some disadvantages that need to be considered.

3.1.3 Disadvantages of Teleworking

As increased numbers of employees work from home or at distant peripheral offices, they can quickly and easily become disconnected from the central office (Cascio, 2000). They may begin to feel demotivated and loose self-discipline. A good tool for making teleworking more effective is the Internet. It can provide the forum for a chat, a means of communication and the technology to manage projects (Gurton, 2000).

Despite all the proposed benefits and advantages of teleworking there is now some literature to support the fact that teleworking may not be working! Despite these and other trends, the telework initiative isn't taking hold (Dvorak, Computer Shopper, 2001). This situation was recently outlined in a Wall Street Journal report, offering example after example of people specifically looking for telework and finding nothing, even at companies literally begging for employees. Those who did find telework ended up being isolated from the rest of the company, excluded from meetings, and viewed as expendable (Dvorak, Computer Shopper, 2001). Ironically, it's the newer, younger executives who are killing the telework movement. This trend will continue until they realize the old model won't work in the new century. It's too inefficient and old- fashioned (Dvorak, 2001). Two young entrepreneurs flat out said they will hire no telecommuters. Their rationale was simple-and shallow: People need to be in the office so they can be part of a team (Dvorak, 2001). The Internet Age is moving so fast that the need for teamwork on the spur of the moment is critical, they say. With cell phones, virtual private networking, e-mail, pagers, and desktop teleconferencing, you'd think virtual gatherings would be easy (Dvorak, 2001).

Teleworking relies on IT in order to be successful therefore the next section looks at the usage of IT in teleworking.

3.1.4 Use of I.T in Teleworking

The best way to outline the usage of I.T for teleworking is to use a table. The following is a tables are taken from Huws *et al.* (1993).

TABLE 1 – Teleworker's use of electronic hard and software

Proportion of working time spent using the equipment					
EQUIPMENT	**NONE**	**VERY LOW**	**<= One Third**	**Half**	**>= One Third**
Terminal	63.0	6.7	8.4	3.4	18.4
PC	45.4	19.3	15.1	6.7	13.4
Elec. Typewriter	95.0	4.2		0.8	
Modem	52.9	21.0	7.6	2.5	15.9
Wp S/W	54.6	23.5	8.4	8.4	5.0
Vidoetex	95.8	3.4	0.8		
Other	74.8	6.7	5.0	5.0	8.4

From this table it can be seen that IT equipment is used by teleworkers both for the performance of their work and for communication with other workers, managers and clients. Terminals are used by under a third of the teleworkers in the sample taken by Huws *et al.* (1993), for the majority in conjunction with a modem for connection to an external mainframe. Despite widespread availability of electronic typewriters reported by management, these were only being used by 5% of teleworkers in the sample. Word Processors were being used extensively by under 15% of the sample.

Communication is particularly important to teleworkers therefore Huws *et al.* (1993), asked not only about IT based methods but also more traditional communication methods:

As can be seen form the table Teleworkers still rely a lot on traditional form of communication e.g. the phone, and postal services, however e-mail and modems are also a well used means of communication for Teleworkers.

With the continued improvements in technology teleworking can now be taken a step further to the virtual organization. The next section looks at the possibility of a virtual organization and the issues involved in setting up a virtual organization.

TABLE 2 – Teleworkers use of Communications media

Equipment	No Use	Usage per Week <1 (Usage per Week)	1,2 (Usage per Week)	3-6 (Usage per Week)
Modem	61.3	5.9	5.9	9.2
Teletex	98.3	1.7		
Videotex	99.2	0.8		
E-mail	84.0	2.5	4.2	5.0
Disk	70.6	11.8	7.6	2.5
Texts	19.3	10.9	31.9	5.9
Tapes	88.2	2.5	1.7	1.7
Post	29.4	6.7	26.1	10.9
Courier	68.9	21.0	4.2	1.7
Meetings	25.2	45.4	19.3	2.5
Other(phone)	46.2	2.5	10.1	7.6

3.2 The Virtual Organization

The definition of a virtual organization is *"A group of skilled people who form a company but are geographically separated and communicate mostly electronically."* (Chutchian-Ferranti, J., 1999).

The diagram following in figure 3 is a representation of the virtual organization as the author sees it. The traditional organization is represented inside the office structure with each department having it's own area within the building. The virtual organization is different to this in that there is no fixed central location for the organization. Each department can be geographically dispersed around anywhere in the world. The virtual organization does not need to have all it's sales, H.R, Marketing or other functions in one area, the sales department can be made up of different people from anywhere in the world. The key difference between a virtual organsiation and a global organsiation is that it is possible for the virtual organization to have no central offices at all, whereas a global organization, while being distributed around the world, would have central offices in each location.

The key to making a virtual organization work is communication and effective technology, in a virtual organization the technology architecture is the organizational structure (Chutchian-Ferranti, J., 1999). The main advantage of a virtual organization is there are no geographical restraints. From a hiring perspective it's a major advantage. With today's difficulties in getting staff you have a wider range to choose from, not having to worry about relocation issues.

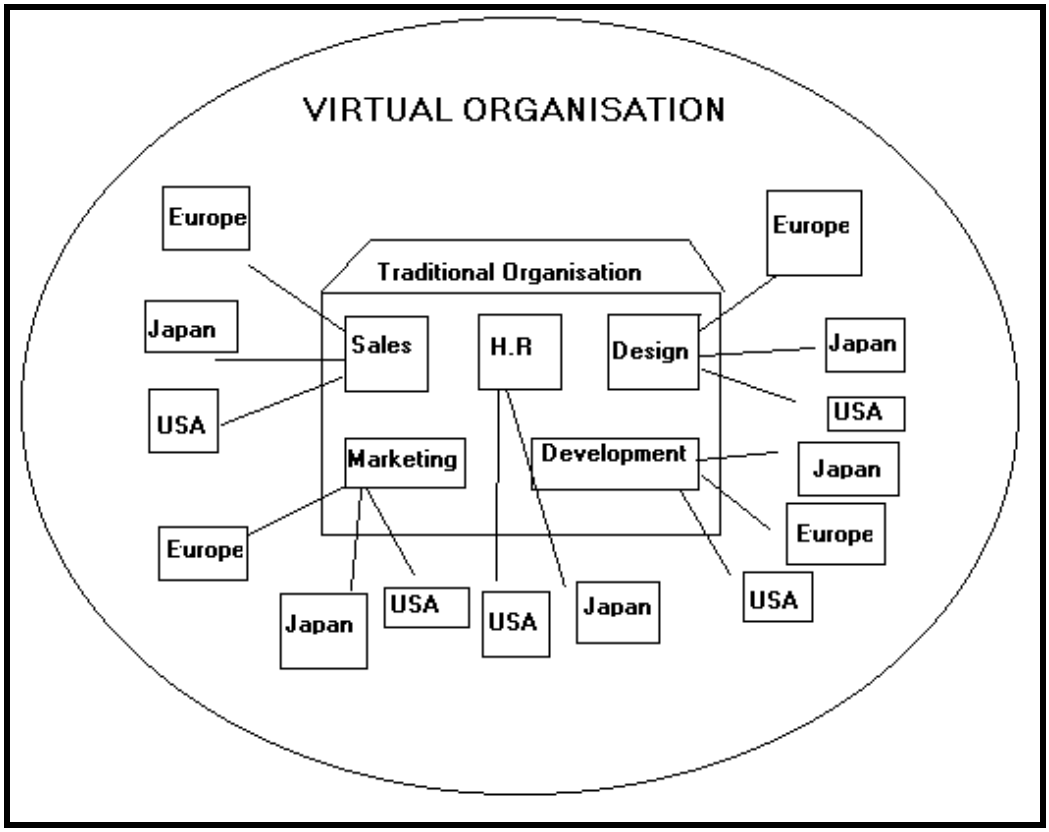

Figure 3 - Roisin Agnew January 2001

Having researched many publications, (Chutchian-Ferranti, J., 1999, Handy, C., 1995, Hsiao&Omerod, 1998, Jackson, P. J., 1999, Lipnack & Stamps, 1997, Warren, L., 2000), on the subject I have come up with the following five main issues surrounding the implementation of a purely virtual organization:

- Strategic Change Issues
- Virtual Teams
- Integration of Virtual Teams
- Trust Issues
- Cultural Issues

The following sub-sections examine these issues beginning with the strategic change issues.

3.1.1 Strategic Change Issues

A wealth of information can now be found dealing with "IT enabled" strategic change. Mobile computing is causing strategic change within organizations (Jackson, P., 1999). Hsiao and Omerod (1998) discuss different change archetypes related to IT-enabled strategic change, the one of interest to this paper is called "IT transformation". This describes the situation where IT is used to support innovation in processes, job roles and organizational culture, resulting in the overhaul of business structures. Mobile computing is effecting these

changes in organizations and these changes require understanding and analysis within a strategic business and IT context (Jackson, P, 1999). In order to ensure this, consideration needs to be given to the business model an enterprise must adopt in order to respond to the competitive conditions of its market place. In understanding and managing virtual teams, it is important to know what type of team we are concerned with and what role it plays alongside other elements of business structures and processes (Jackson, P., 1999).

Many strategic developments point towards the growth in virtual teams. These include the move towards a more horizontal organizational structure, a growth in teamwork generally and the increased use of mobile computing techniques to connect people dispersed in time and space. As Townsend *et al*. (1998) point out, changes in teams may have to transcend both organizational and national boundaries. This is because the expertise needed for many work processes is unlikely to be located in the same office or organization. For Townsend *et al*. (1998), flat structures, interorganisational co-operation and globalization make the move from face-to-face team to virtual teams an imperative.

Where virtual teams are concerned a central role is played by advanced technologies such as mobile computing, video conferencing and e-mail. This adds a layer of complexity to what is already a very dynamic situation. The redesign of the business processes in order to fit in with the changes brought about by mobile computing organizations will have to consider significant social redesign (Badham *et al*., 1997). Because these changes are likely to be highly complex with a high degree of uncertainty Badham *et al*. (1997) suggests that a lot of time be spent ensuring effective communication to encourage flexibility, address perceptions and generate involvement.

Having looked at the strategic change issues involved, the next stage is to consider virtual teams in the organization.

3.2.2 Virtual Teams

"Virtual Team developments certainly suggest a host of new opportunities for individuals and businesses alike. They point to new applications of the latest communications technologies. But they also bring with them a host of new questions and challenges" *(Jackson, P., 1999).*

It is these new questions and challenges facing the organization that this section will be considering. Organizations are having to deal with whole sets of challenges and transformation. Not only are technologies changing rapidly so too are the business environments. It is due to these changes that organizations need to look at redesigning their

structure. There needs to be a shift from hierarchies based on management control, to a horizontal form built around teamwork and employee empowerment (Jackson, P., 1999). Organizations need to encompass moves towards strategic alliances and virtual organizations (Jackson, P., 1999). These changes cannot happen overnight, it is very important that attention is paid to the management of change (Jackson, P., 1999). An organizational change into the running of virtual teams is likely to produce social, cultural and political ripples across the organization. For an organization the important thing is to understand the nature of these ripples in order to see how they can be dealt with and managed.Setting up of virtual teams can be difficult and time consuming but the greatest challenge is the integration of these teams into the organization as a whole.

3.2.3 Integration of Virtual Teams

When dealing with the integration of virtual teams into the work place there is a tendency to focus on the degree to which IT can substitute for face-to-face communications (Townsend *et al*. 1998). The general consensus is that the richer the medium the less need for face-to-face encounters. The problem with this is that verbal communication is not explicit, it often involves voice intonation and body gestures, which even the richest of media cannot convey. In order to be able to fully decide on whether IT can be a good substitute for face-to-face communications it is important to look at the boundaries of the teams involved.

Given the fact that mobile computing is eroding temporal and spatial boundaries, it would be tempting to presume boundaries no longer mattered (Jackson, P., 1999). In virtual organizations and teams, boundaries are seen as barriers, restrictions that frustrate the free flow of ideas, information and expertise. But Yan and Louis (1999) show boundaries remain an important aspect of organizational life, virtual or otherwise. They note that the absence of structures and well-defined sets of roles and responsibilities has increasing left the individual to deal with demands on time and energy. So even if teams are virtual it is important to lay out well defined structures for them to be able to work to, otherwise there could be a lot of unnecessary time wasted by individuals trying to sort this out themselves (Cascio, 2000).

In addition to considering the social and political integration of virtual teams it is important to focus on the process of knowledge creation (Jackson, P., 1999). This is particularly important in cross-functional and product development teams, where new ideas that come are intended to secure competitive success (Nonaka and Takeuchi, 1995). Team members are generally viewed as bringing their skills, knowledge and strategies to bear on the team processes. The challenge in creating teams is to combine these in order to ensure effective

and efficient creation of knowledge. Here the challenge for virtual teams becomes apparent, much of what is known is not held or communicated explicitly, it is acquired and passed on in the realm of action. It is knowledge learned by doing. When setting up virtual teams, the organization cannot presume that the members will share common metal models, figurative or symbolic language or particular routines and practices. Given the strong reliance on learning by doing for these to develop, the lack of face-to-face interaction in virtual working could prove problematic.

Once virtual teams have been set up and integrated, the organization can begin to function. Howeve other issues that need to be considered iteratively throughout the life of the virtual organization these include trust and cultural issues.

3.2.4 Trust Issues

Another common issue around virtual organizations is the idea of trust. Some organizations just presume that trust will develop simply because it is so important. There is little discussion about how trust might be achieved and what form it might take. There are some different schools of though on this matter, Lipnack and Stamps (1997) state that:

"As important as positive relationships and high trust are in all teams, they are even more important in virtual ones. The lack of face-to-face time, offering opportunities to quickly clear things up, can heighten misunderstandings. For many virtual teams trust has to substitute for hierarchical and bureaucratic controls"

In contrast, Handy (1995) says that trust cannot be presumed but must be managed. However he continues to tell us little about how trust can be enforced or the ways in which the organization can intervene in order to shapetrusting relationships. According to Cascio (August, 2000), a key ingredient in the success of a virtual organization is trust that one's coworkers will fulfill their obligations and behave predictably. A lack of trust in a virtual organization can undermine every other precaution taken to ensure success. Just as trust needs to be managed and revisited regularly throughout the life of the organization so too do the cultural issues that arise from the geographical dispersement of employees.

3.2.5 Cultural Issues

With the increased use and somewhat dependence of organizations on mobile computing, virtual teams can be seen as somewhat of a panacea for resourcing dispersed and global organizations. It is important to remember that in certain circumstances more effective human resource solutions may be possible (Jackson, P., I.S.J.,1999). Where Organizations use mobile computing to operate globally, a broad cultural perspective, as well as particular cross

cultural expertise, may be needed. In some circumstances the nature of the cultural knowledge may mean that learning it demands sustained presence in the culture in question. Having to transfer business policies and cultures to work with dispersed business teams across collaborating organizations, geography and cultures can lead to potential clashes of business and national cultures. According to Cascio (August,2000), if the members of a virtual organization are notempowered to make decisions, the technology that enables their collaboration will add little value and the competitive advantage associated with rapid responses to demands in the market place will be lost.

A virtual organization is fundamentally different to the traditional organizational setup. Due to this the management of such an organization would need to be different. Managers need to have certain characteristics and need to learn new skill. The issues around management of a virtual organization are considered next.

3.3 Managing The Virtual Organization

There are sound business reasons for establishing Virtual Organizations, but theiradvantages may be offset by setup and maintenance costs, loss of cost efficiencies, cultural clashes, isolation and lack of trust (Cascio, August 2000). According to Cascio (2000), in order to successfully set up a virtual organization managers need to ensure two things :

- Shift from a focus on time to a focus on results
- Recognize that virtual organizations, instead of needed fewer managers, require even better supervisory skills among the existing managers.

Virtual organizations are multisite, multiorganisational and dynamic, it consists of a group of people that have joined in an alliance to exploit complementary skills in perusing common strategic objectives. This grouping represents a dramatic change in the way work is completed and this presents new challenges for managers. The challenges stem from the physical separation of workers and managers wrought by such information-age changes such as mobile computing and teleworking.

It is important to note that not all managers are suited to managing employees with virtual-work arrangements. Cascio (2000) has identified the following characteristics that the virtual manager requires:

- An open, positive attitude that focuses on solutions.
- A results-oriented management style. Those who need structure and control are not likely to be effective managers in a virtual situation.

- Effective communications skills, both formal and informal, using both mobile computing methods as well as more traditional methods e.g. the phone.
- An ability to delegate effectively and to follow up to ensure work is completed successfully.

Even if a manager seems suitable for the role of virtual manager it is important to ensure sufficient training is supplied in the following areas:

- How best to us the mobile computing software to enhance team performance. Guidelines on social protocol for virtual organizations
- How best to manage the virtual environment
- How to provide feedback, this is particularly important since the traditional cues of social interaction i.e. body language and gestures, may not be available.

Communication is a major challenge for managers implementing a virtual work environment. Many managers have to learn new communication skills in order to prevent team members from feeling isolated and not part of any larger group. It is important that managers do not rely solely on e-mail. Managers need to ensure they make the most of all that the mobile computing technology can offer them. Managers should conduct effective audio meetings, use voice-mail and video conferencing. Mangers should regularly schedule virtual meetings, communicate with all team members and produce regular updates and status reports for the whole team(Cascio,2000)

According to Cascio (2000), the biggest challenge in managing the virtual organization is the management of performance. It is vital that mangers define, facilitate and encourage performance.

- Define performance – In a virtual Organization it is important that everyoneunderstands their responsibilities. A manager trying to define performance may ask thefollowing questions to clarify responsibilities:

  What are the objectives?
  Which responsibilities are shared?
  Will the teams elect their own leaders?
  What are the responsibilities of the team leader?
  How will teams make decisions?
  What decisions can be make by which teams?

The next step is to develop specific, challenging goals. To be useful these measures should be linked to the organizations strategic direction. In defining performance regular assessment of progress towards goals focuses the attention and efforts of employees.

- Facilitate Performance – Managers that are committed to managing remote workerseffectively have two major responsibilities:
    1. To eliminate roadblocks to successful performance
    2. To provide adequate resources to get a job done right and on time.

Obstacles that can inhibit maximum performance include, outdated technology, delays in receiving critical information, and inefficient design of work processes. Adequate capital resources, material resourses and human resourses arenecessary if the remote workers are to reach the goals laid out by managers.

- Encourage performance – It is important to provide sufficient rewards that employees really value in a timely and fair manner.

For a organization to set up as a virtual organization or for an organization to move to being a virtual organization is a huge undertaking with several key issues to be considered. So this begs the question:

- What are the strategic advantages that an organization will gain from becoming a virtual organization?

3.4 Strategic Advantage

In a virtual organization the employees are dispersed and their primary interaction is through some combination of electronic communication systems. The employees may never even meet in the traditional sense. This type of organizational structureoffers several advantages:

- It can save time, travel expenses and can provide easier access to experts.
- Teams can be organized even if members are not in proximity to each other.
- Organizations could use outside consultants without incurring cost for travel, logging and downtime.
- Virtual teams allows organizations to expand their potential labour markets, enabling them to hire and retain the best people regardless of their physical location.
- Employees can easily accommodate both their personal and their professional lives.
- Dynamic team membership allows people to move from one project to another.
- Employees can be assigned to multiple, concurrent teams.
- Team communications and work reports are available online to facilitate swift responses to the demands of a global market.

According to Warren (2000), there are also the following benefits to having a virtual Organization:

- **Staff Retention** –In a case study done in Nortel after introducing teleworking for employees the job satisfaction survey conducted showed that staff retention was 16% better among teleworkers rather then office based staff, with job satisfaction level 11% higher and teleworkers being 17% more productive.
- **Reduced costs** – It is estimated that real estate is the second largest overhead of an organization after salaries, therefore moving people out of offices would realize a huge saving.
- **Staff mobility** – The increased mobility of staff means that staff can now work productively in any place at any time.

These are just some of the possible advantages of a virtual organization. This area is still in its infancy and therefore is relatively unexplored. It may be years before these benefits are actually realized by an organization, and it may also be years before any unforeseen benefits arise.

4. Conclusion

This paper has given a technological background to mobile computing before moving into the main body of the paper, discussing the effect mobile computing is having on the organization. As can be seen from this paper the effects of mobile computing are being seen in organizations already in the form of teleworking. The use of e-mail, voice-mail, video conferencing, and modems have enabled organist ions to allow certain people to work from home. These people rely on modern technological advancements as their main form of communications. Teleworking can be considered an evolutionary step towards the Virtual Organization.

A Virtual Organization is very different in every way from the traditional organization and therefore there are a number of issues involved in setting a virtual Organization up:

- Strategic change issues.
- Virtual Teams.
- Integration of Virtual Teams.
- Trust Issues.
- Cultural Issues.

As well as these issues the management of the virtual organization would be very different to that of managing a traditional organization. As indicated in the paper not everyone is suited

to managing a virtual organization and therefore managers must be carefully chosen and well trained.

In order to successfully set up a virtual organization all of the issues addressed in this paper must be considered fully, failure to identify with this issues and plan for them could mean the failure of the virtual organization. The issues addressed are difficult and time consuming so it is important that the organization is aware of the possible strategic advantage that this organization can offer including, staff retention, reduced costs, staff mobility, organizations can expand their potential labour markets, employees can easier accommodate home and work life, reduction in travel times and it can provide easier access to experts.

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