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Racing for Virtual Mobility

--virtual meetings as substitute of business travel in Chinese organizations

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Abstract

This thesis investigates the virtual meetings characteristics and policy intervention options in Chinese organizations. Virtual meetings can enable the communication of two or more parities in different locations with assistance of ICT technologies. It is thus possible for virtual meetings to substitute conventional physical face-to-face meetings without business travel and the associated environmental impacts. Virtual meetings present opportunities for China to provide accessibility to its people and better manage the challenges from mass-transportation.

By investigating four cases including a telephone survey in China, some characteristics of virtual meetings are presented as compared to the experience in Europe. Barriers for more use of virtual meetings in Chinese organizations are also identified, analyzed and categorized into four groups. A brief summary of success factors to implement virtual meetings in Chinese organizations drawn from the experiences of the case organizations are provided. It is argued by the author that system level changes require a whole set of actors in the society including some new players. Therefore the author also suggested proactive approaches for various actors in the society including policy makers, virtual meetings services providers, investors and NGOs to encourage more use of virtual meetings in China. The roles of new actors and new players are highlighted.

Executive Summary

Transport sector development is a driver for economic development and personal welfare, but transport sector has great environmental impacts which are externalities and not accounted for. There are various ways to reduce environmental impacts from the transport sector but reduction of transport activity has been less touched. This is because the concern of hurting economic development or personal freedom if the transport activity is controlled.

What people need from transport activity is the accessibility, not transport *per se*. ICT technologies such as virtual meetings can enable people at remote locations to communicate without traveling. This presents opportunities to reduce transport activities without sacrificing people's accessibility.

ICT technologies also have their own environmental impacts. But comparing the environmental impacts of virtual meetings and business travel meetings, all of the life cycle analysis studies show that virtual meetings are more environmentally favorable. However, the relationship between virtual meetings and business travel more complicated. Virtual meetings can substitute, supplement or generate business travels. Existing empirical evidence based on studies at the organizational level virtual meeting applications shows that the dominant effects are the substitution effects with some exceptions.

Organizations' decisions to conduct virtual meetings or business travel meetings are based on the costs and benefits of the two options. Individuals also play important roles in making decisions about traveling or not. Therefore the decision will depend on the balance of perceived costs and benefits of virtual meetings and business travels by organizations and individuals. Society level costs and benefits can only indirectly influence the decision making by influencing the organizations or the individuals.

Since virtual meetings are more environmentally favorable and can substitute business travels, can it provide a solution for China to deal with the increased accessibility needs from people and the fast development of mass-motorization process?

To understand the characteristics of virtual meetings in Chinese organizations, four case studies were conducted to gain better understanding of virtual meetings use in Chinese organizations. These four cases are:

- SPDB: a banking firm with various branch banks in different locations in China;
- SEPA and Shandong EPB: a central government agency and one of its provincial level subordinates
- Regus and Whygo: a network of commercial office buildings with video conferencing studios for rent;
- Shaoshan, Hunan Province: a rural area application.

Cases are selected based on publicly available information or drawn from snowball methodology. Interviews are conducted for the case studies and these cases are described in the thesis with a short analysis and discussions for each case. In addition, a telephone survey was conducted for the video conferencing studio renting services in office buildings. These research activities have generated both qualitative and quantitative information on virtual meetings applications in China.

Some characteristics of virtual meetings in China were identified based on four case studies and the comparisons with previous experience in Europe. It was found that similar to European experience, virtual meetings can provide a viable alternative to accessibility for

Chinese organizations. The substitution effects are also dominant in the case studies. It is believed that there are more opportunities for virtual meetings to be used to achieve accessibility in China than in Europe because of the low level of development of transport sector in China. However, virtual meetings applications in Chinese society still lag behind Europe. Their applications still heavily rely on economic development and a mature cmmercial culture. Within Chinese organizations, including those companies considered best practices in China, there are still big gaps for more use of virtual meetings compared with European best practice companies. Compared with European organizations, organizations in China seem to have more control than the individuals in decision making on business travel, especially in the government institutions. Major drivers for adopting virtual meetings in both European and Chinese organizations are financial benefits, increased efficiency, time savings and social inclusion. While reducing corruption is more relevant in China and environmental concern is more apparent in European organizations.

Barriers for more use of virtual meetings in Chinese organizations are also identified. The main barriers for more use of virtual meetings in China are grouped into four categories, the organizational barriers, the personal barriers, the institutional barriers and practical barriers. The organizational barriers include the corporate business travel culture, corporate business meeting culture, lack of resources allocation and responsibilities definition, and non-rational factors of decision making processes. The personal barriers mainly include the fact that business travels especially international business travels are still perceived as a great opportunity by employees in China. Loss of economic benefits, cultural experience and even corruption chances is also a barrier. Lack of knowledge and skills on virtual meetings as well as low level of environmental awareness also hinder more use of virtual meetings. Practical barriers center on the limited availability, insufficient telepresense, poor reliability and meeting environment. Institutional barriers are mainly the facts that virtual meetings are not addressed enough either by environmental policies or voluntary initiatives.

Of these four categories of barriers the organizational barriers and institutional barriers are more important as policy interventions can be designed towards them. The organizational barriers are addressed by presenting some success factors that could contribute to overcoming the barriers. The major success factors summarized in this research are top management support, clear targets and control, accumulation of experience about virtual meetings and toleration of some possible difficulties. To be a successful organization on virtual meetings, it should also allocate resources and define responsibilities, organize promotion and training activities. CSR and environmental initiatives may also help since they can improve the employee morale and gain their support.

The institutional barriers should be addressed by policy makers or other actors in the society. To bring system level changes around transport and virtual meetings, more actors including the new players are needed. A number of suggestions are developed for various actors in the society to proactively promote the use of virtual meetings.

To encourage more use of virtual meetings, policy makers should

- Consider including virtual meetings in the "soft measures" of transport policy.
- Make efforts to internalize the external costs of transport sector.
- Improve broadband infrastructure and develop common standards
- Promote government use of virtual meetings by e-government strategy, green public procurement, and new urbanization policy.
- Promote ICT services in rural areas and increase social inclusion

Institutional investors in China should exert more pressure on companies to demand reporting on environmental management, and venture capitalists should consider more about environmental when investing in ICT, or consider more about ICT when investing in cleantech.

Various business actors along the value chain of virtual meetings should all innovate with better technology solutions, qualities and business models to increase the attractiveness of virtual meetings. Product and service systems (PSS) would be a useful idea for innovative business models. They should also provide consumer education about the various benefits of virtual meetings, including the environmental benefits. Corporations should lead the way by using their own products and services and promote the policy change towards better environment for virtual meetings use.

As the change agents of the society, NGOs should also actively advocate for virtual meetings by awareness raising campaigns and policy lobbying. Finally joint efforts on research and development of virtual meetings should be promoted.

Future research suggestions such as the testing of some specific characteristics of virtual meetings in China, or more detailed studies on the roles of a specific actor in the society are also provided at the end of this thesis.

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1 Introduction

1.1 Background

1.1.1 ICT and sustainable development

Information and communication technologies (ICT) have been changing the world profoundly. ICT itself is a new industry, but it also changes the traditional industries and the way of doing business in general. This has offered a potential for human society significantly increase productivity similar to industrial revolution in 19th century. There are various terms such as "information revolution", "information society", and "knowledge economy" to describe the profound transformation brought by ICT. In addition, ICT has also been changing the way that people live by creating new lifestyles. With the help of ICT, one can communicate with friends at the other end of the earth very easily, can go shopping on-line without actually "go" to the shops, for example.

Facing the challenges of sustainable development, many have hoped that ICT can help to tackle the challenges of climate change and environmental deterioration by providing new solutions such as virtual goods to replace material goods (e.g. online news vs. newspaper) and virtual mobility (e-mails, audio, video and web conference, telework, tele-shopping etc.) to replace passenger and freight transport, and other more complex ICT applications to solve different environmental problems. Through these new solutions, people hope that ICT could promote sustainable consumption and production patterns, and sustainable lifestyles. Many believe that as ICT becomes more sophisticated and more embedded in our organizational structures and everyday life, human beings are in a better position than ever before to make sustainable development work. (Alakeson *et al.* 2003) However, despite the great potentials that ICT might have to reduce environmental burdens, ICT also have significant negative environmental impacts by consuming a lot of energy, producing electronic wastes, and increasing total material consumption due to rebound effects. It is now generally believed that ICTs will not automatically bring positive impacts on sustainable development. A simulation study (Erdmann et al., 2004) using system dynamics approach in combination of scenario techniques and expert consultations revealed that ICT can have roughly -20% to +30% impact on environment in European Union until year 2020 compared with year 2000 levels. There are both great opportunities and threats in ways that ICT can affect future environmental sustainability, therefore relevant ICT measures should be studied carefully and managed appropriately to achieve positive impacts and suppress negative impacts.

Some studies on environmental potentials of ICT applications have been conducted, but most of them are in the context of developed countries. Little research has been done in a developing country context. Unlike many other industrial sectors, ICT sector in developing countries started almost at the same time as developed countries. In some cases, ICT development in developing countries, for example the software industry in India, is even more advanced than many developed countries. Since environmental management measures are more effective in the early stages of industrial development, one can assume that utilization of ICT in developing countries to achieve environmental potentials in their early stages of industrial development would mean greater environmental gains and avoid repeating the mistakes that industrialized countries have made. In this sense, research on ICT applications for environmental sustainability in developing countries is highly desirable.

1.1.2 Transport sector and sustainable development

Transport sector is an important driver to economic development and personal welfare. Goods mobility provides the basis for modern trade and economic globalization. Personal mobility can provide accessibility to people and increase their welfare. However, the transport sector has significant environmental impacts ranging from air pollution, land uptake to waste generation and climate change. Mobility, together with housing and food, accounts for 70-80% of the total environmental burdens of human society. (*Tukker et al.* 2006)

There are various ways to reduce the environmental impacts brought by transport sector including emission filtering, energy efficiency and clean fuel. But the effects of these measures could be offset by the increase in total transport activity.

Virtual mobility concept presents an attractive way to reduce transport activity without sacrificing people's accessibility. Virtual meetings are said to be able to substitute business travel and thus reduce the environmental impacts associated with it. Studies on these ICT applications and their impacts on transport activity are very interesting for the sustainable development in the transport sector.

1.1.3 Sustainable development in China

China is the world's largest developing countries with the world's largest population. The rapid economic growth in the past three decades has lifted a large part of its population out of poverty. However, the economic growth has also brought negative impacts particularly on the environment.

The transport sector in China is growing very fast and is projected to grow rapidly for a long time in the future. Several decades lagging behind developed countries, the mass-motorization process in China is gaining its momentum. Its impacts on China's already vulnerable environment and people's health can not be neglected.

ICT sector development in China is also very fast, and in general maintains the same level of development as developed countries. In certain areas, China is even ahead of some developed countries. Virtual meetings technology is such an area that its development in China is much faster than the world's average.

When two alternatives, mobility and virtual mobility are presented, what will be the choices of organizations in China and how will this influence its sustainable development are interesting questions to be explored.

1.2 Purpose and research questions

Use of virtual meetings to substitute unnecessary business travel is frequently mentioned as a way to reduce transport related negative environmental and social impacts, but there is very limited research on this. So in reality, more use of virtual meetings has become a kind of slogan such as "please turn off the lights": everybody thinks it is interesting and important, but most of them also think it is too simple and would not bother to do further detailed research on it. However, to really make it happen and reach its promised potentials, it is crucially important to understand people's perceptions and behaviours around it and what factors can influence them. Arnfalk (2002) and other researchers have done pioneered research on the behaviours change within organizations around virtual meetings applications in European countries such as Sweden and UK, but there is no such research conducted in a developing

country context. Since the behaviours change is highly dependent on the social and cultural context, the author is convinced about the need to do such research in a developing country context and fill the gap.

This research project has selected China as the country context, and virtual meetings as a specific ICT application area to be studied and hope this could be a starting point to explore a wider spectrum of environmental sustainability issues of ICT services in developing countries. Virtual meetings application was selected because of its potential effectiveness to reduce environmental impacts of passenger transport identified by relevant studies (Arnfalk, 2002; Erdmann et al., 2004) and its existing applications in China.

The objectives of this research are to understand the use of virtual meetings in Chinese organizations, and its environmental, social and economic impacts as compared to European experience. Since system level changes require a whole set of actors and players, it is also important to understand different actors around the virtual meetings applications in addition to organizations adopting virtual meetings. To fulfil these objectives, the following research questions are formulated for this research:

1. What are the characteristics of virtual meetings in Chinese organizations compared with European experience?

2. What are the barriers for virtual meetings use in Chinese organizations and what are the success factors?

3. What approaches should be taken by different actors, particularly policy makers, virtual meetings businesses, investors and NGOs to encourage more use of virtual meetings in China?

It is intended that this research could cumulate some empirical studies on the research of virtual meetings in developing countries, and provide some suggestions for further virtual meeting development.

1.3 Methodology

This thesis mainly uses qualitative methodology (case studies) to understand and describe a phenomenon. Some quantitative methods are also used to gain a more general picture of a phenomenon.

1.3.1 Literature review

General literature review are conducted on sustainability of ICT and transport sector, virtual mobility concept and virtual meetings, the theories and empirical evidence around virtual meetings and business travel, development of transport sector and virtual meetings industry in China, etc.

1.3.2 Case studies

Four cases in China about virtual meetings use were selected:

- SPDB: a banking firm with various branch banks in different locations in China;
- SEPA and Shandong EPB: a central government agency and one of its provincial level subordinates
- Regus and Whygo: a network of commercial office buildings with video conferencing

studios for rent;
- Shaoshan, Hunan Province: a rural area application.

All of the four cases have the potential to be replicated in similar organizations. Selection of the cases is based on snow ball methodology and public information on these organizations. For example, SEPA was selected because there is news about its video conferencing applications; Shaoshan in Hunan rural area case was selected because it was recommended by a web conferencing supplier; and SPDB was selected because it mentioned its video conferencing use in its CSR (corporate social responsibility) report.

These cases are presented in this thesis as descriptions with some analysis and discussions.

1.3.3 Telephone survey

In the Regus and Whygo case, a telephone survey of all the office buildings in Regus and Whygo online list was conducted. A total of 23 office buildings were contacted by telephone, and 16 of them participated. Seven simple questions were asked during the survey and some quantitative data were generated. Even though the data generated are based on only 16 office buildings which do not have statistic significance, the total number of office buildings is 23 and thus can reflect the actual situation.

1.3.4 Interviews

Interviews were conducted for the four case studies. Some interviews with virtual meetings service suppliers were also conducted to gain the knowledge of the market. Some interviews were conducted concerning the policy suggestions. A list of interviewees can be found in Annex II of this thesis.

1.4 Scope and limitations

Two sectors, namely transport sector and ICT sector are studied in this thesis. For transport sector, the research focuses on business travel, a structurally enforced form of personal mobility. For ICT sector, the focus is on the application effects of the sector (as compared to lifecycle effects and system effects). China is the country context for this study and the four cases are the focuses of this research.

There are several limitations to this research.

- Firstly, conclusions drawn from the four cases are sometimes generalized which should be viewed carefully.
- Secondly, case studies are all based on interviews and information provided by the case organization. Verification of the data provided was not possible.
- Thirdly, each case represents a sector with no similar cases in the same sector studied and compared, thus the representativeness of the case to the sector is limited.
- Last but not the least, due to the limited literature in this area, this study has relied heavily on limited sources.

1.5 Outline of the thesis

Chapter two presents the environmental impacts of transport sector and the concept of virtual mobility. It introduces different ways to reduce transport impacts and their limitations and virtual mobility could be a new solution. Concept and examples of virtual mobility are also discussed.

Chapter three reviews the theories and empirical evidence of virtual meetings and its relationships with business travel. The central questions which are answered in this chapter are: virtual meetings and business travel, which is environmentally more favourable? Can virtual meetings substitute business travel? What are the costs and benefits of business travel and virtual meetings and how organizations make decisions between the two? Some examples of virtual meeting applications in organizations are introduced in the end of the chapter.

Chapter four presents the general context in China and the detailed four case studies. Each case study is described and a brief analysis and discussions following each case are also presented. Some characteristics of the virtual meetings in China are drawn from the case studies.

Chapter five analyzes the barriers for more use of virtual meetings in China. Organizational barriers, personal barriers, institutional barriers and practical barriers are presented. A brief summary of success factors for a Chinese organization to implement virtual meetings is given.

Chapter six provides some suggested approaches that should be taken by various actors in the society including policy makers, businesses, investors and NGOs.

Chapter seven concludes the thesis with future research suggestions.

1.6 Definitions used in this paper

ICT is a general term to describe the tools and the processes to access, retrieve, store, organize, manipulate, produce, present and exchange data and information by electronic and other automated means (UNESCO 2007).

ICT products here in this paper refer to the hardware and equipment of ICT encompassing computers, printers, copy machines, telephones, cell phones, etc.

ICT services or applications here in this paper refer to the use of ICT products to perform a specific function for a specific purpose. For example, the use of computers to conduct online meetings is a type of ICT applications, and also a service or function provided by ICT.

Virtual communication is defined as ICT facilitated communication, which means people could communicate with each other without physical presence through using the services provided by ICT products.

Virtual mobility refers to the process of accessing activities that traditionally require physical mobility, but which can now be undertaken via ICT without recourse to physical travel by the individual undertaking the activity.

Virtual meetings here in this paper are interchangeable with virtual conferencing, which means "synchronous communication mediated by ICT, making it possible for two or more geographically remote people to interact". (Arnfalk 2002) Virtual meetings/virtual conferencing include audio-conferencing, video-conferencing and web-conferencing. Audio-conferencing refers to voice communications between two or more people in geographically separate locations via ICT. Compared with audio-conferencing, video-conferencing also transmits picture and image in addition to sound. Sometimes people use the term tele-conferencing to describe audio-conferencing and video-conferencing. Web-conferencing refers to audio and video conferencing conducted via internet, which sometimes also involves data transmission and exchange. Web-conferencing is also called web-meetings, on-line meetings/conferencing, etc.

2 Environmental impacts of the transport sector and the concept of virtual mobility

Transport especially road transport and aviation has great environmental impacts. Transport sector is a major contributor to global greenhouse gas (GHG) emissions, and it has a number of other environmental impacts such as air pollution, land degradation and biodiversity loss. A recent European research project consisting of various studies on environmental impacts of products found that 70-80% of the environmental burden is due to the human consumption of food, mobility and housing. (*Tukker et al.* 2006)

2.1 Road transport

Road transport including cars and other private vehicles is considered to be the biggest contributor to the environmental burden of transportation sector (Tucker *et al.* 2006, EEA 2005). They account for about four fifths of all the environmental impacts associated with transportation consumption (Tukker *et al.* 2006). Road transport is a major user of materials, land and energy. According to EEA (2001), the transport infrastructure accounted for 1.2% of the total land area in Europe, of which 93% is road networks including motor ways, highways and state, provincial and municipal roads. Road network construction and the land uptake have significant impacts on the biodiversity. Car manufacturing industry is one of the largest industries in human society which use a lot of raw materials and energy to produce cars. Once produced, the cars become one of the world's biggest consumers of fossil fuels and create various air pollutants such as NOx, VOC, CO and PM as well as CO_2 emissions which contribute to global climate change. Air pollution and noise in town and cities are mainly due to the traffic and both of them have significant impacts on human health.

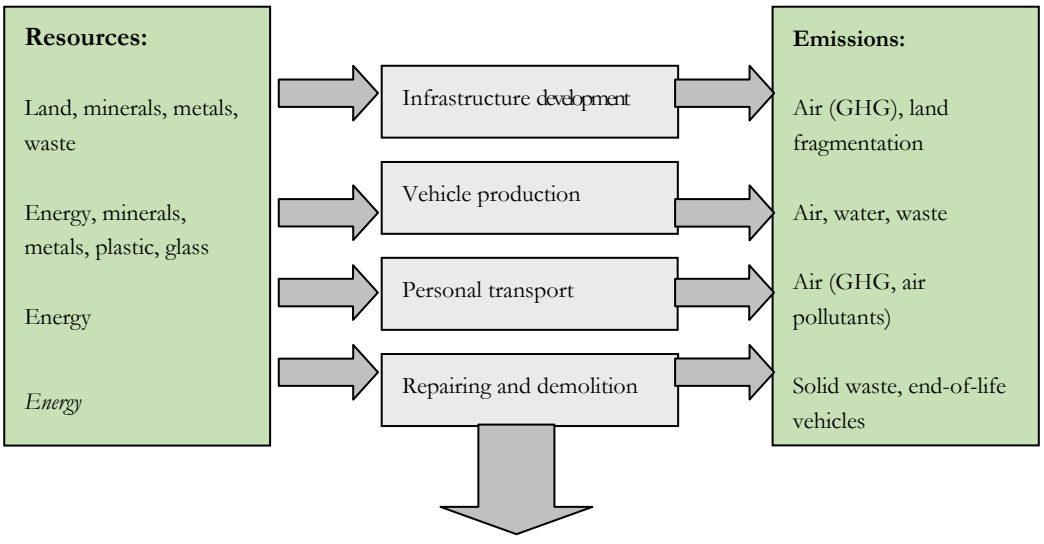

Figure 2-1 Environmental Impacts of Personal Travel and Mobility

Source: Adapted from EEA 2005

2.2 Aviation

Although road transport has significant environmental impacts, air transport is believed to be the worst offender to the environment, particularly climate change, per kilometer traveled. Air crafts not only emit GHGs such as carbon dioxide and water vapor, but also emit significant amount of nitrogen oxides which promote the formation of another important GHG: Ozone. In addition, air crafts also emit black carbon. These air crafts emitted gases are believed to have larger environmental impacts because they are emitted at higher latitudes. (WBCSD 2004) Air crafts also create a lot of noise pollution, and in addition, the building of airports also creates a number of environmental impacts particularly the land degradation and bio-diversity loss.

To illustrate environmental impacts from air travel, Lonely Planet gave an example on its website (Lonely Planet 2007): one return trip between US and Europe for two people could contribute to climate change as much as an average household's gas and electricity consumption over the whole year.

Not only the impact is significant, but the total volume of air transport is also growing very fast. According to WBCSD (2004) projections, air transport is the fastest growing mode of personal transport over the 2000 to 2050 period, with average annual growth of 3.5%. Factors from both demand side and supply side contribute to this trend. From the demand side, consumers tend to visit more remote destinations, and prefer traveling faster. From the supply side, the aviation industry is continuously growing and has provided highly competitive prices. Cheap flights have made traveling by air more accessible and more frequent. As a result, the environmental burdens associated with air traffic will continue to grow, especially the burdens on climate change.

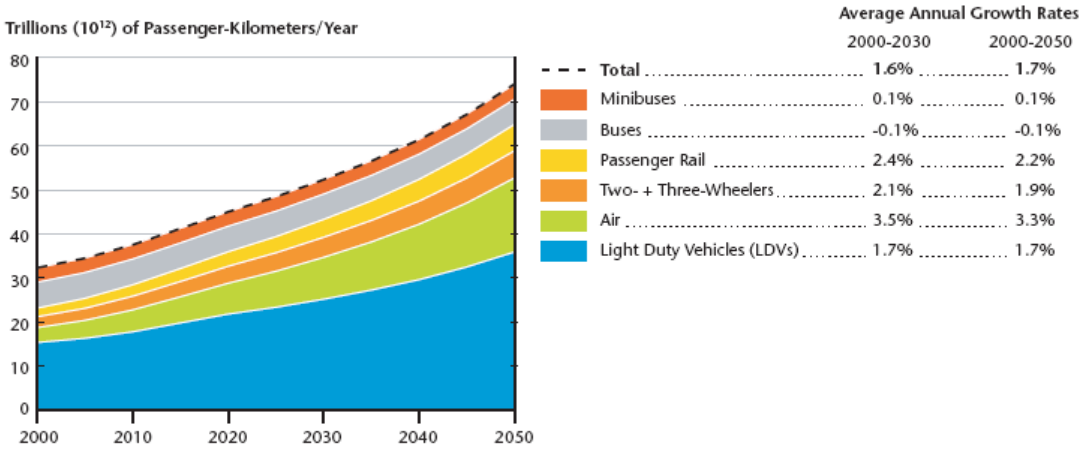

Figure 2-2 World's trend of personal transport activity by mode (2000-2050)

Source: WBCSD 2004

According to the IPCC (1999), aviation represents 3.5% of total human-induced radiative forcing (this is as much as the current contribution of the UK to global warming) and could represent as much as 15% by 2050 if no measures are taken to reduce these emissions, even after accounting for expected technological and operational improvements.

Other transport means such as rail and water transport also have negative environmental impacts, but compared to road transport and aviation, impacts from these transport modes are minor.

2.3 Ways to reduce environmental impacts of transport sector

There are a number of ways to reduce the environmental impacts of the transport sector. Technology improvements on emission filtering could significantly reduce the air pollutants emissions per vehicle, but the increase in numbers of vehicles could offset the improvements.

Improving fuel efficiency is also an important means to reduce environmental impacts, particularly GHG emissions from transport sector. However, the projected fuel efficiency improvements are not likely to offset the increase of transport activity. Light duty vehicles, heavy duty trucks and air crafts are the modes of transport mainly responsible for transport sector GHG emissions. The average energy consumption per unit of transport activity for light duty vehicles, heavy duty trucks and aircrafts is projected to decline by 18%, 29% and 29% respectively over 2000—2050 period, but over the same time period, the transport activity of the same modes of transport is projected to increase 123%, 241% and 400% respectively. (WBCSD 2004)

Switching to more environmentally friendly energy sources such as bio-fuels, fuel cells and hydrogen could also significantly reduce the environmental impacts particularly air pollution and climate change. However, the renewable energy sources are still expensive and are not developed as fast as expected.

A better transport modes mix encouraging more use of public transport and rail instead of cars and aircrafts can reduce the overall environmental impacts while not sacrifice the total personal transport activity.

Car sharing schemes can also improve the efficiency of allocating resources in the society and reduce the consumption. If such schemes could be scaled up, the environmental gains would be significant. But currently such car sharing schemes remain a niche market.

2.4 Why we need transport?

With limitations of the existing measures to reduce the environmental impacts of the transport activity, it becomes attractive from an environmental perspective to think of reducing transport activity at the first place. If the transport activity is reduced, all the environmental impacts associated with it will also be reduced. However, this is not an easy fix either. This is because environment is only a part of sustainable development, and transport sector is very important for economic and social development.

In the EU, for example, transport sector is estimated to represent 4% of the total GDP and the sector employs 9% of the work force. (Arnfalk 2002) Transport sector has also stimulated other sector development by providing logistics for production and distribution. Today's globalization is to a large extent enabled by modern transport. Personal transport is seen as a basic freedom for human beings. All these have made the idea of reducing transport activity illusive. However, for personal transport or personal mobility, why people need it at the first place? What is the basic human need behind personal mobility? What people need is not transport or mobility *per se*, it is accessibility. Accessibility is a basic human need and can be obtained through personal mobility.

It is generally agreed that accessibility is "fundamentally concerned with the opportunity that an individual at a given location possesses to participate in a particular activity or set of activities." (Thakuriah 2001) Accessibility is normally measured by indicators of personal mobility such as the percentage of households having access to motorized personal vehicles, or the percentage of households located within a certain distance of public transport of a given minimum quality. (WBCSD 2004)

Since accessibility is what people really need, it is interesting to investigate if there are other ways than transport to obtain accessibility.

2.5 Accessibility through virtual mobility

Virtual mobility is one way to increase accessibility without recourse to physical travel/transport. As defined by Kenyon et al. (2002), virtual mobility is:

"*a shorthand term for the process of accessing activities that traditionally require physical mobility, but which can now be undertaken without recourse to physical travel by the individual undertaking the activity. Thus, virtual mobility creates accessibility opportunities, both substituting for physical mobility and enabling access where previously there was an accessibility deficit.*"

This definition focuses on the role of virtual mobility to enable access in the situation of lacking accessibility. Arnfalk (2002), focusing on the effects of substituting physical travel and transport, defined virtual mobility as: "Providing access to activities by means of ICT and thereby substituting the need for travel." Since this thesis also focuses on the virtual mobility's effects on substitution of physical travel, the second definition is used in this research.

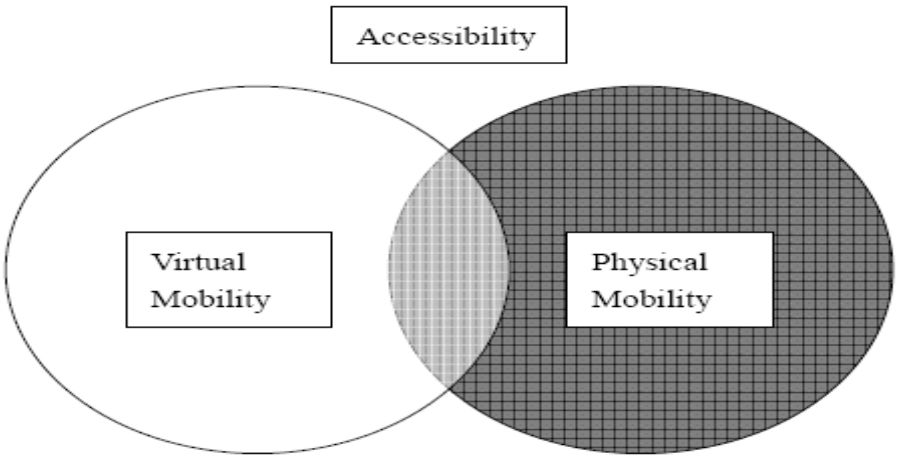

Figure 2-3 Accessibility through physical mobility and virtual mobility

Source: adapted from Arnfalk 2002.

As shown by the Venn diagram, some accessibility can only be obtained from physical mobility and some accessibility can only be obtained from virtual mobility. But there is also an overlap between the two ways, which means some accessibility can either be obtained by

physical mobility or virtual mobility. In this sense, some physical mobility could potentially be substituted by virtual mobility[1].

Virtual mobility has a lot of social and environmental implications, for the environment, as discussed earlier, if it can substitute some transport activity the environmental impacts associated with transport will be reduced at the first place. This is achieved without sacrificing people's accessibility and welfare, thus presents attractive solutions.

2.6 Virtual mobility applications

There are various forms of virtual mobility, while the most common ones are virtual meetings/virtual conferencing, telework/telecommute, telemedicine and teleshopping/e-commerce.

Virtual meetings or virtual conferencing means "synchronous communication mediated by ICT, making it possible for two or more geographically remote people to interact". (Arnfalk 2002) Virtual meetings/virtual conferencing include audio-conferencing, video-conferencing and web-conferencing. Virtual meetings have potential to substitute business travels and reduce the associated environmental impacts.

Telework is interchangeable with telecommuting, referring to working at home or other locations without going to the normal work stations at office, thereby substituting the need for commuting.

Telemedicine is a type of practice with the help of ICT, people can get health care remotely without physically meeting the doctors.

Teleshopping/e-commerce refers to the practices that people shop on-line without physically going to the shops.

Telework, telemedicine and teleshopping all have implications to the environment, but due to the scope of this thesis, they are not included in the study. Compared with telework, telemedicine and teleshopping, environmental implications of virtual meetings are less obscure which is also a reason why this study mainly focuses on virtual meetings. Nevertheless, there are some overlaps for these virtual mobility applications, eg. virtual meetings can be used for telework. Thus some analysis on other virtual mobility applications will also be made where relevant. What's more, some policy suggestions at the end of this thesis could also be valid for other virtual mobility applications and in a broader sense, ICT services.

2.7 Virtual mobility, pollution prevention and system innovation

The practices and approaches of environmental protection in industries and organizations have evolved significantly.

The industrial approach to environmental pollution started from a defensive response as end-of-pipe treatment, using filtering or diluting technologies to capture or dilute pollutants.

[1] The diagram aims to show the conceptual relationship between physical mobility, virtual mobility and accessibility. The sizes of the areas (physical mobility, virtual mobility, overlap area) may not reflect the actual situation.

However, while such approach is effective in confining the pollution it does not eliminate the pollution and it is often very expensive.

The concept of pollution prevention was later introduced alongside with some other similar concepts such as cleaner production and eco-efficiency. Such concepts focus on finding the sources of pollution in the production processes and find ways to prevent pollution at source.

Even if the pollution in the factory was well controlled or prevented, the environmental impacts of the products after production could be more significant. The concept of eco-design was then developed to make product improvements and reduce environmental impacts from products.

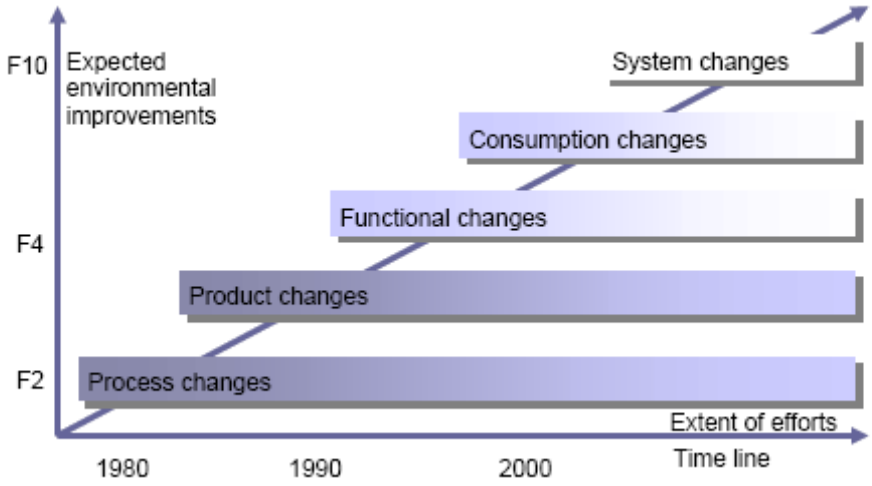

Figure 2-4 Changes needed for environmental improvements

Source: Mont 2004.

In often times, what people need is not the products *per se*, it is the function or services of the products people need to fulfil their needs and increase their welfare. Functional thinking or functional economy and the concept of product service system (PSS)[2] were developed to further reduce environmental impacts from products. Under such concepts, efficient leasing and sharing schemes could significantly reduce the resources consumption while maintaining the welfare level of human beings.

Virtual mobility concept is compatible with pollution prevention and functional thinking concepts. Virtual mobility has the same function to reach accessibility as physical travel, thus it could potentially substitute some of the physical travel and avoid pollution caused by transport activity. This is to prevent pollution from being generated.

[2] Defined by Mont (2004) as "a system of products, services, networks of actors and supporting infrastructure that continuously strives to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models."

In addition, virtual mobility applications is a complex system which brings in a total new set of actors such as ICT equipment producers, software designers, service providers etc. To make virtual mobility work, one needs to move beyond the transport sector and create system level changes.

2.8 Environmental impacts of ICT sector

Virtual mobility applications are enabled by information and communication technologies which also have their own environmental impacts. These environmental impacts should also be considered when we talk about the environmental improvements potentials of virtual mobility.

There are three levels of effects from ICT on the environment: the life cycle effects, the applications effects and system effects. (Arnfalk 2002)

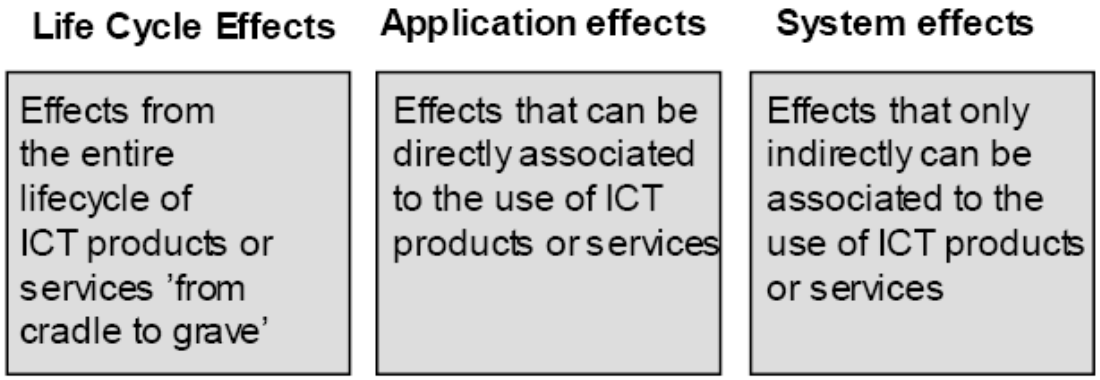

Figure 2-5 Three levels of effects from ICT

Source: Arnfalk 2002.

Environmental impacts at different life cycle stages of ICT products include raw materials extraction, manufacturing, transport of components and products, use of ICT equipment, and disposal of ICT equipment. Raw materials extraction typically through mining can cause creation of waste and loss of habitat; manufacturing process of ICT products and components has important environmental impacts, for example the manufacturing of semiconductors can cause significant amount of air emissions (acid fumes, VOC and doping gases), waste water discharges (solvents, cleaning solutions, acids, metals) and solid wastes (silicon, solvents); (EPA 1995) transport of ICT products and components also creates significant environmental impacts, due to the fact that ICT products are produced through a global supply chain, for example a typical personal computer (PC) has 1500 to 2000 components sourced around the world and transported normally by air; (Berkhout *et al.* 2001) the major environmental impact during use of ICT products is energy consumption; environmental impacts associated with disposal of ICT products after use has become more and more evident with the fast increasing stream of electrical and electronic wastes (WEEE).

The application effects mainly refer to the direct effects generated from using ICT products and services. The direct changes that virtual mobility applications could bring are application effects, for example a trip is avoided due to virtual meetings. It could have negative environmental impacts or positive environmental impacts. Research on virtual meetings in this

thesis mainly focuses on this type of effects, which will be discussed in more detail later in the thesis.

System effects refer to the effects that indirectly related to ICT applications. For example, a direct effect of virtual meetings could be time and money savings, while an indirect effect of virtual meetings is what people will do with the saved time and money. In many cases, people could use the saved time and money for other travels and other activities and create rebound effects[3]. System effects are highly uncertain and difficult to quantify. In addition, it is argued by the author that what people choose to do with the saved time or money for example, is based on their needs and wants, and could increase their total welfare. Therefore if the increases of resource consumption due to rebound effects are at the society average level that is required to increase that level of welfare, then the rebound effects are not as bad as described. System effects are not the focus of this research, but will be considered where relevant in this thesis.

[3] Defined by Radenmacher (1999) as "the subsequent erosion of the positive potential of technological innovation by increases in overall activities, and the concomitant increase in consumption of material and energy"

3 Virtual meetings vs. business travels: theories and empirical evidence

One of virtual mobility applications, virtual meetings, is the main focus of this thesis. This chapter discusses the theoretical framework around virtual meetings and business travels and how organizations make choices between the two. Empirical evidences of virtual meetings applications in some organizations in the world are also presented.

3.1 What are virtual meetings?

Virtual meetings here in this paper are interchangeable with virtual conferencing, which means "synchronous communication mediated by ICT, making it possible for two or more geographically remote people to interact". (Arnfalk 2002)

Virtual meetings/virtual conferencing include audio-conferencing, video-conferencing and web-conferencing. Audio-conferencing refers to voice communications between two or more people in geographically separate locations via ICT. Compared with audio-conferencing, video-conferencing also transmits picture and image in addition to sound. Sometimes people use the term tele-conferencing to describe audio-conferencing and video-conferencing. Web-conferencing refers to audio and video conferencing conducted via internet, which sometimes also involves data transmission and exchange. Web-conferencing is also called web-meetings, on-line meetings/conferencing, etc.

Audio conferencing is cheap and readily available. To participate in an audio conferencing, one only needs to have a fixed line telephone or a mobile phone, and call the bridge services. Therefore it is widely used by many organizations. The drawbacks of audio conferencing are also apparent mainly due to the lack of image.

Video conferencing can enable both sound and image transmission and can increase the effectiveness of communications. However the use of video conferencing is still very limited due to the need for infrastructure and the high costs. Video conferencing technology was introduced in 1960s, but the application of video conferencing in Europe and North America in the past four decades was not as fast as people expected. There are numerous social and cultural issues that hampered its development. Some experts believe that mass video conferencing is still several years out[4].

With internet becoming more and more used in the society, web-meetings are growing very fast. Web-meetings can be designed innovatively and incorporate various meeting tools, thus has great potential to evolve in the future.

Virtual conferencing has been grown rapidly in recent years. A report in USA Today quoted Wainhouse Research figures that there were 27 trillion minutes spent on tele-conferencing world wide in 2005, more than doubled the figure in 2002. (GeSI 2006)

Like other virtual mobility applications, virtual meetings have the potential to provide accessibility without recourse to physical travel and thus could reduce environmental impacts associated with travel. While virtual meetings could also substitute personal travel, this thesis mainly focus on the substitutions of business travels as it presents significant potentials. As

[4] Chris Tuppen, British Telecom, Email correspondence, April 5, 2007

WWF (2007) reported, if 5-30% of business travels in Europe was substituted by videoconferencing, more than 6-34 million tonnes of CO_2 emissions would be saved. If one physical meeting per year was replaced for 50% of today's employees in the EU-25 countries. This would result in savings of approximately 2.1 million tonnes CO_2 per year.

Even high level officials at United Nations have recognized the role that virtual meetings can play in reducing carbon emissions. During an interview, Dr. Klaus Toepfer, former Executive Director of UNEP said: "Technology can replace some transport functions—investing in video conferencing technology instead of flying long distances is one way companies can start lightening their carbon footprint." (Swiss Re, 2003)

3.2 Why business travels?

3.2.1 Business travel in the society

There are various reasons for people to travel, including commuting, shopping, leisure, business, personal business, and even taking children to school, etc. Worldwide data on detailed reasons for travel are not available, but data can be obtained normally through National Travel Surveys (NTS) in many developed countries.

Travel for leisure purposes seems to be the largest part of the passenger transport. For example, according to UK 2005 NTS, 31% of all the trips in the U.K. in 2005 were for leisure purposes, including visiting friends, eating out, sport and entertainment, holiday and day trips. The broad category of leisure accounted for 40% of the distance travelled in 2005 (DfT 2005)[5]. In a survey of long-distance travel (exceeding 100 km) in seven European countries Danmark, Spain, France, Italy, Austria, Portugal and Sweden, Weckström-Eno (1999) found that 50-60% of all the long-distance travels were for leisure purposes.

The share of business travels in total passenger transport varies from country to country, but it is a significant part of passenger transport in all countries. Business travel is 16% of all US long distance trips. (BTS 2003) In Sweden, 10% of the total distance travelled is business travel.

In the Weckström-Eno (1999) survey, 25-40% of all the long-distance travels were found to be business travels. Another survey conducted in Danmark in 2001 found that 40% of all the air travels from Danish airports had a business purpose. (Transportraadet 2001)

At the micro-level, some business travel behaviour patterns were revealed during recent surveys. During January 2006, Interwise interviewed 230 managers for European Business Travel Survey in France, Germany and UK. (Interwise 2006) The survey results show that 25% of the respondents said that they attended more than two meetings out of office each week, and 30.2% of them said they attended more than four meetings each month out of office. 18.9% of the respondents stated that they made more than 100 car journeys every year (or two per week) for business purposes; 12.1% reported taking flights more than once per week, which means at least 50 air journeys every year.

As an important part of passenger transport, business travel creates significant environmental impacts. But compared to leisure purpose travels, business travels are in many cases structurally enforced, which means travels that are not desired but enforced by certain norms

[5] Holiday trips outside UK are not included in the NTS.

in the society. It is thus very relevant to discuss the opportunity of virtual meetings to substitute business travels.

3.2.2 Business travel from organizational perspectives

Traditionally organizations only view business travel as a cost issue since it is the second largest variable expenses for most organizations. The major considerations to manage business travel at organizational level have been cost, security and convenience. (Godeke 2003) More recently, the environmental impacts of business travel have gradually been recognized as organizations start measuring and calculating their environmental footprints. After measuring their GHG emissions, many companies, especially those in the service sector found that business travel constitutes a large part, in many cases the largest part of their total GHG emissions. Transport activities were found to be responsible for the majority of CO_2 emissions in Swedish companies Ericsson and Telia. (Arnfalk 2002) In Swiss Re, business travel have accounted for 70.8% of the company's total CO_2 emissions. (See Figure 3-1)

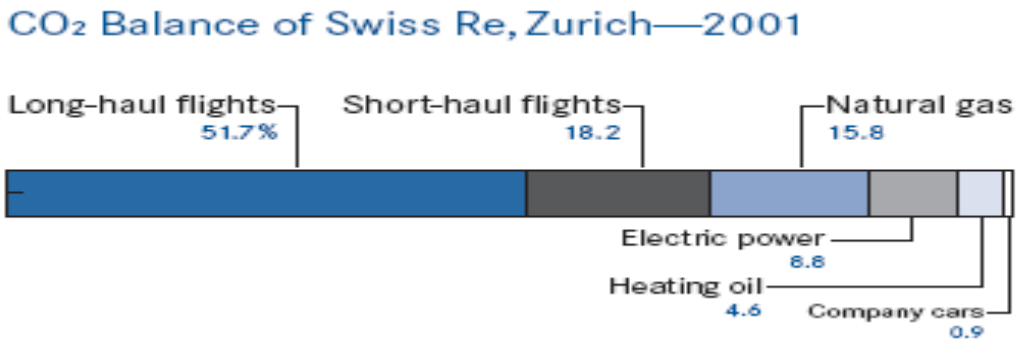

Figure 3-1 CO_2 emissions at Swiss Re in 2001

Source: Swiss Re 2002

Unilever once compared the CO_2 emissions of two adjoining sites with similar size in Port Sunlight, UK. One is manufacturing site which uses a lot of steam and electricity for production, and the other site is a R&D centre hosting Unilever's scientists. The researchers assumed that compared to the manufacturing sites, CO_2 emissions from the R&D center would be negligible. However, the final results showed that the CO_2 emissions in the R&D center account for one third of the manufacturing site which consumes a lot of energy. The major contributor to CO_2 emissions in the R&D center was found to be business travels. (Godeke 2003)

3.3 Comparing environmental impacts of business travel meetings and virtual meetings

Business travel presents significant environmental impacts both from a societal perspective and from an organizational perspective. It is thus very interesting to know if business travel was substituted by virtual meetings, how many environmental gains will be achieved, or if there is any environmental gain? Life cycle analysis (LCA) of the two options to hold a meeting is the only way known to scientifically compare the two alternatives from environmental perspective.

There have been some LCA studies on virtual meetings and business travels conducted by various parties. A study carried out by Deutsche Telecom found that comparing video-conferencing with two groups of participants located 100 km away from each other and a physical face-to-face meeting involving one party drive a car to meet the other group, video conferencing consumes less than 5% of primary energy than that of face-to-face meeting. (GeSI 2006)

Toffel *et al.* (2004) compared different environmental impacts between travelling to attend a meeting and attending a meeting by a cell phone. Travelling to meeting has bigger environmental impacts than wireless communication in all the categories of the environmental indicators including emissions of CO_2, CH_4, NOx and SO_2.

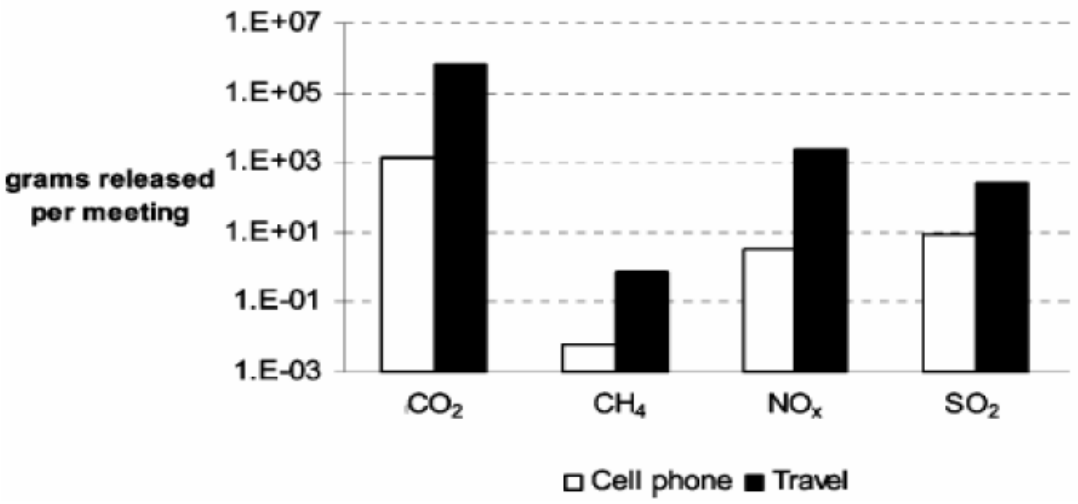

Figure 3-2 Environmental effects of travel versus wireless communication

Source: Toffel et al. 2004.

Arnfalk (2002) noted that virtual meetings not only require equipment, but also meeting rooms and furniture. For conventional face-to-face meetings, the hotel stay and the meeting venues as well as travel transfers (eg. Taxi) should also be factored in. Meeting activities in two factious companies were compared in terms of their CO_2 emissions. The result shows that the company which has more use of virtual meetings ("collabication"[6]) could reduce far more CO_2 emissions compared with the company only with limited use of virtual meetings (business as usual).

[6] Collabication means collaboration and communication, a word created to describe a company with extended use of virtual meetings.

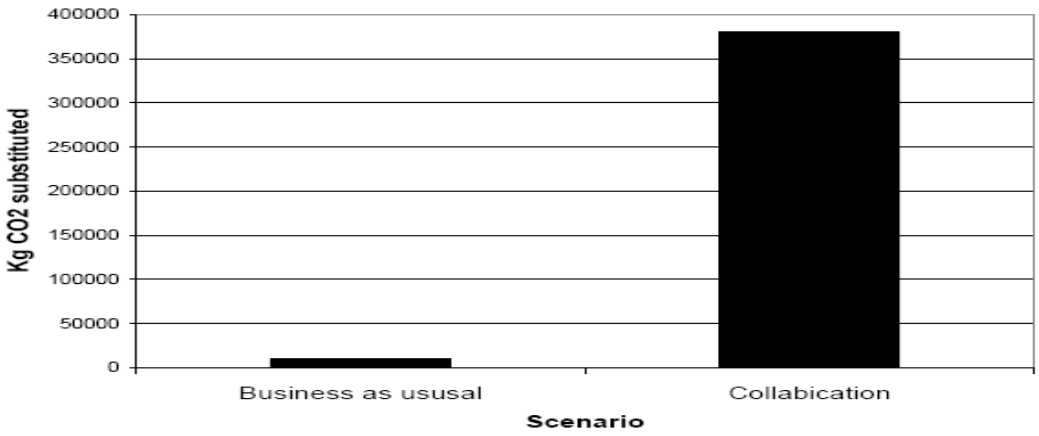

Figure 3-3 The reduction of CO_2 from teleconferencing in the two scenarios 'Business as usual' and 'Collabication'

Source: Arnfalk 2002

An attempt to also include "ripple effects"[7] into the comparison was made by Takahashi et al. (2006).

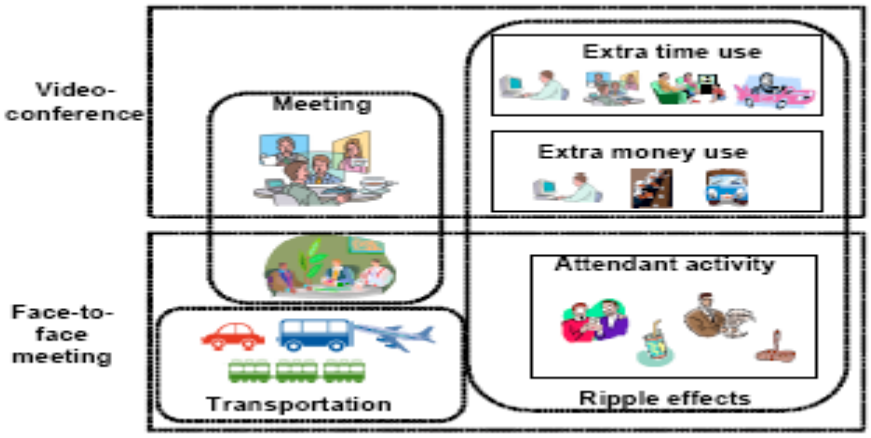

Figure 3-4 Boundary of the assessment

Source: Takahashi et al. 2006

Assuming the extra money and time were used for normal company activities, Takahashi et al. (2006) found that even the "ripple effects" were factored in, the CO_2 emissions of a video

[7] Ripple effects are defined as indirect effects resulting from the changes in behavior brought about by videoconferences. They are similar to "rebound effects" but ripple effects include both negative and positive effects on the environment. Some examples are illustrated in Figure 3-4

conference are still much less than that of a business trip, accounting for 20% of CO_2 emissions of a business trip.

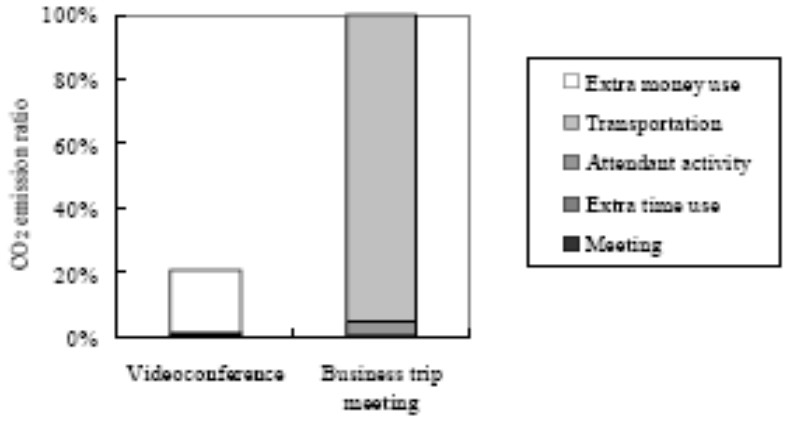

Figure 3-5 Results of the assessment

Source: Takahashi et al. 2006

Various studies have been made so far confirming that in general a virtual meeting is more environmentally favourable than a meeting with business travel, especially if the business travel is by air.

3.4 Can virtual meetings substitute business travels?

3.4.1 Theoretical relationship between telecommunication and travel

It is clear that virtual meetings in general have less environmental impacts than business travel meetings, but the question remains about if virtual meetings can substitute business travel meetings. If virtual meetings can not substitute business travel meetings, then virtual meetings would only be able to create additional environmental burdens no matter how few resources or emissions they consume or emit.

For around 20 years, audio and video conferencing companies have marketed the benefits of virtual meetings on replacing business travels and saving cost and time. Yet, business travel continues to accelerate. The transport activity in the society has increased significantly despite the development and advanced use of telecommunication systems. It can be argued that the total economic value has increased more significantly, but it is interesting to understand some basic relationships between telecommunication and travel. Various researchers have done different studies on their relationships, and Arnfalk (2002) has summarized these relationships.

- Substitution: travel is substituted or replaced by virtual communications. The travel will happen otherwise if without virtual communications.
- Supplementation: virtual communication does not change the travel behaviours, it neither increases nor decreases travel.
- Generation (stimulation or complimentarity): virtual communication created new travels, the travels will not happen without the virtual communication.

All of these relationships are true and backed by empirical evidence. However it is still debated in the macro level, which relationship is more dominant. These relationships, together with other theories, will constitute the analytical framework for this research.

3.4.2 Purposes of business travels

It is important to understand the needs and purposes for business travel and then to investigate if the needs can be fulfilled by virtual meetings. Theoretically the purpose of business travels is to get accessibility. However, in practice, there are different detailed purposes, and they vary significantly from organization to organization.

Arnfalk (2002) found that the on average, the most common reason for business travel in Swedish organizations is to attend a business meeting. For large organizations with distributed offices in various locations, the majority of the business trips are for intra-organizational collaboration.

Through web-based questionnaires to 1800 employees and face-to-face interviews with 11 selected employees in two Danish knowledge organizations: HP Danmark (HP) and Aalborg University (AAU), Lassen et al. (2006) found that the majority of the employees in HP (75%) and AAU (69%) travel internationally for business purposes every year. The major purposes for business travel in the two organizations are summarized in Table 3-1.

Table 3-1 Purposes of work-related travel in HP and AAU

Purpose	HP	AAU
Conference/congress	13%	49%
foreign departments	21%	0%
Sales, purchase, negotiations	25%	2%
Research & development	0%	12%
Consultancy	16%	4%
Course	15%	4%
Teaching/supervision	6%	12%
Meeting	2%	10%
Other purpose	2%	7%
Total	100%	100%

Source: Lassen et al. 2006.

Though the purposes of business travels are grouped in many categories, but most of these purposes share the common element that is to meet other people. Therefore at least the meeting function of the purposes can theoretically be fulfilled by virtual meetings.

In the European Business Travel Survey done by Interwise (Interwise 2006), the managers stated that in average only less than 22.7% of the meetings needed to be held face-to-face, which means that less than 3 in 10 meetings are necessary for business travels. In another survey commissioned by video-conferencing provider Tandberg, Ipsos MORI interviewed 1,403 business travelers in seven European countries[8] in May 2006. They found that 55% of the business travellers admitted that some of their business trips were unnecessary. (Tandberg 2006) These figures show there are a lot of spaces for business travel to be reduced or substituted by other means of activity.

In two surveys conducted in 2004 and 2006 about the conference use in BT, around two thirds (68% for 2004 and 63% for 2006) of conferencing users believed their last conference call met all its objectives. Most of the remainder (62% for 2004 and 63% for 2006) did not think that the lack of success was related to the "virtual" nature of the meeting. (James et al. 2004 & 2006)

The results indicated that virtual meetings can not only fulfil the purposes of conventional meetings in theory, but also in reality. For the BT case, under the majority of circumstances virtual meetings can fulfill the functions of physical face-to-face meetings, though there are circumstances that virtual meetings fail to fulfill the functions of conventional meetings.

3.4.3 Empirical evidences of virtual meetings effects

Literature about teleconferencing dates back to the 1970s, but the amount of empirical work remains spark, particularly compared to the large literature on teleworking. Nevertheless, some empirical studies do exist and are presented as follows.

In October 2004 and May 2006, two independent surveys were conducted by researchers at University of Bradford and SustainIT to assess the status of use of conferencing at BT (James et al. 2004 & 2006). The 2004 survey contacted 4957 people working at BT and got 18% (911) response rate. The 2006 survey contacted 4856 people working at BT and 10% provided useful responses. In the two surveys, 71% (2004) and 67% (2006) of the respondents thought their last conference call had definitely or probably replaced a meeting. These two studies presented compelling evidence that substitution is the predominant effect of virtual meetings on physical meetings in BT.

In the survey of 1403 European business travelers conducted by Ipsos MORI (Tandberg 2006), UK business travellers interested in or already enabled for video conferencing believed 28% of their meetings could be handled satisfactorily via video conferencing.

Studies conducted by Arnfalk (2002) on four Swedish organizations also showed the substitution effects. Among the respondents of the four surveyed organizations (Telia, SVUG, Skånska Lantmännen, and Tetra Pak), 45-61% said video conferencing had reduced their own travel, 15-25% said it had reduced other people's travel. Only 1-3% said it had increased their travel.

[8] France, Germany, Italy, Netherlands, Spain, Sweden and the United Kingdom

Table 3-2 Respondents impressions of effects of video conferencing on travel in four Swedish organizations

	Telia	SVUG	Skånska Lantmännen	Tetra Pak *
Replaced my own travel	47%	45%	58%	61%
Replaced other people's travel	15%	22%	25%	19%
Some reduction but only minor effect on my travel	20%	14%	17%	39%
Participated in meetings that I would not have travelled to otherwise	16%	15%	n.a.	19%
Increased my travel	1%	4%	0%	3%
Number of persons answering this question	158	73	12	31

** In the survey at Tetra Pak, the respondents had the possibility to check more than one alternative.*

Source: Arnfalk 2002

In addition to the perceptions of the employees, some facts on travel changes were also identified during the research by Arnfalk (2002). One of the studied organizations Tetra Pak estimated its business travels reduced by 10% due to use of video conferencing. At another studied organization Telia, business travels by air reduced by over one third between 1997 and 2000 partly due to the use of virtual meetings.

In a survey of Canadian business travellers (Roy & Filistrault 1998), 24.2% respondents said they were travelling less often as a result of company policy to increase utilisation of teleconferencing. 45% of video conferencing users also stated that it had been a substitute for an air trip in the previous year.

In a study about SCAG (Southern California Association of Governments) meeting, Mokhtarian (1988) found the total vehicle miles increased by 29% by replacing a regional meeting for a teleconference, as shorter distances to teleconference facilities were outweighed by increased attendance.

To summarize the empirical evidences collected for this study, most of the cases showed that substitution is a dominant effect of virtual meetings. Between 45% and 90% of people involved in virtual meetings feel that virtual meetings reduce their travels or other people's travels. The case study by Mokhtarian (1988) found the increase of travel, but it is predominantly due to the increase of the attendance. In terms to what extent can virtual meetings substitute face-to-face meetings, the evidences show a travel reduction level between 10% and 30%.

Based on the theories and empirical evidences, it is safe to conclude that conventional face-to-face meetings can be substituted and replaced by virtual meetings, and it had actually already happened in the organizations exemplified by the empirical studies. It should be noted,

though, the substitution effects vary from organization to organization, and in some cases substitution effects can be eroded by the generation effects.

3.5 Decision between business travels and virtual meetings: Costs and benefits

As virtual meetings can present significant potentials to substitute business travel and improve the environment, it becomes interesting to investigate how to promote the sustainable use of virtual meetings.

The decision to choose between business travels and virtual meeting depends on weighing of the perceived costs and benefits of the two alternatives. For business travels or virtual meetings, there are both costs and benefits for the society, for the organization and for the individuals. Organizations and individuals jointly make the decision for their meeting behaviours based on their perceived costs and benefits. The costs and benefits to the society may indirectly influence the decision making through influencing the organization or the individual. For example the society values may influence the organization to adopt policies encouraging virtual meetings due to the environmental benefits, or influence the environmental awareness of employees and change their behaviours.

Even though the business travel or virtual meetings are paid by organizations and organizations have important influence on business travel behaviors of their employees, individuals or the employees of the organization also play important roles for the final decision making. Lassen et al. (2006) found that only a small proportion of the employees in their surveyed organizations (23% for HP and 6% for AAU) have no or little influence on their business travel decisions. Individual employees' requests, choices and priorities are important factors for their business travel behaviors.

Table 3-3 The degree of individual freedom in making international business travel decisions

Individual freedom to choose business travel	HP	AAU
Completely their own decision	4%	24%
Predominantly their own decision	32%	48%
Partly own decision	41%	22%
Little influence	22%	6%
No influence	1%	0%

Source: Lassen et al. 2006.

The costs and benefits of virtual meetings at three levels (society, organization and individual) are presented briefly by Arnfalk (2002) as follows.

Table 3-4 Summarizing costs and benefits of business travels

	Benefits	Costs
Society	Stimulating growth and progress	Externalities of transport in form cost for infrastructure, and of environmental impact, causalities, accidents, noise, etc.
Organisation	Access to established and generating new contacts, exchange of ideas and information, supporting an expanding business	2-3rd largest controllable cost in organisations, loss of productive time for work, less availability of key personnel
Individual	Nice experience, developing personal and professional contacts, knowledge, skills, experiences, travel allowance and travel bonus	Frequent travelling often perceived as stressful, absence from home may impact social life, routine travel considered tedious and burdensome

Source: Arnfalk 2002

Similarly, some general costs and benefits of virtual meetings are summarized by the author and presented in the following table.

Table 3-5 Costs and benefits of virtual meetings

	Costs	Benefits
Society	● Environmental impacts from ICT equipments, the meeting rooms and infrastructure.	● Avoided environmental impacts of business travels; ● increase the economic development in the ICT sector
Organization	● Investment in virtual meetings equipments, rooms, infrastructure; ● risks of hurting business due to virtual meeting use, eg. Loss of clients.	● Avoided business travel costs including transport, accommodation and allowances; ● increase efficiency; ● time savings meaning more productive time; ● new business opportunities ● improve environmental performance
Individual	● Loss of personal and professional networking opportunity; ● Loss of personal financial benefits such as travel allowance and bonus points ● Loss of opportunity of experiencing new cultures	● Time savings which may improve work-life balance ● Relieved from stress of travel ● Reduced personal safety risks

	and conducting leisure activities	

Source: own compilation

In real life, the actual decisions will depend on the power balance between the organization and individuals which varies in different organizations. It should also be noted that the actual costs and benefits may be different from what organizations or individuals perceive, which will also influence the outcome of the actual decisions.

3.6 The virtual meetings technology trends

Although technology is changing very fast and technology issue is not the focus of this thesis research, some general technology development trends are worth to be mentioned. These trends can help us better understand how the technology in the future may look like.

3.6.1 Integrated conferencing/collaboration environment

Traditionally voice, video and data have different platforms of transmission, namely voice over PSTN, video over dedicated networks, and data over IP (internet protocol) networks. Today, voice, video and data are more and more converged to a single platform: IP network. (Wainhouse Research 2004) This has made transmission of integrated rich media much easier. As a result, the legacy networks will be gradually phased out and the converged network will dominate.

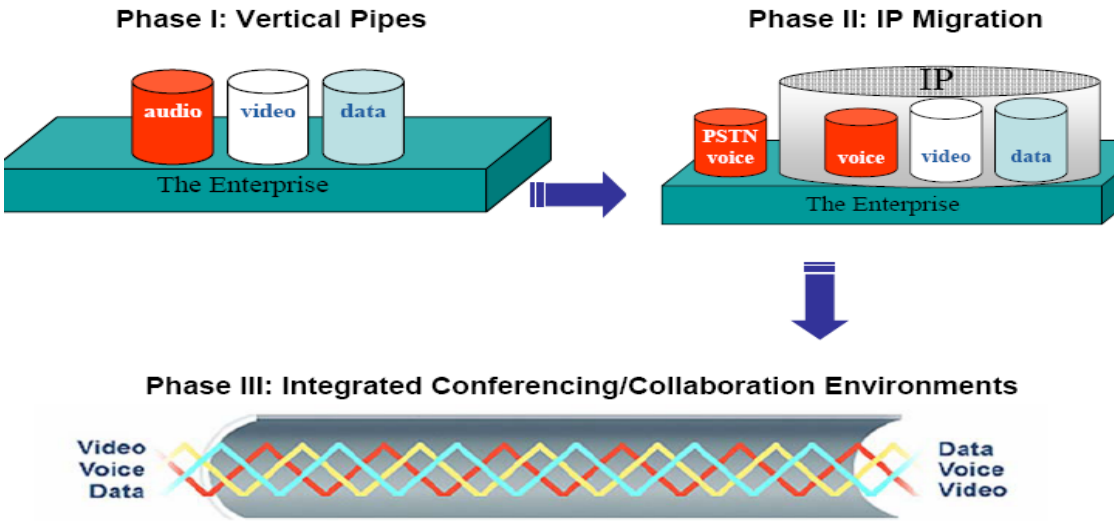

Figure 3-6 Conferencing technology integration trend

Source: Wainhouse Research 2004

Internet enabled web based virtual meetings are gaining competitive advantages over traditional audio conferencing and video conferencing due to its lower cost, scalability potential and more value added functions.

Table 3-6 Comparing different virtual meeting technologies

Technology	Cost per connection	Scalability	Usage trend
Audio conferencing (audio only)	Relatively low	Not much—each connection pays the same rate	Fairly flat
Video conferencing (audio and video)	High	Not much—each connection pays the same rate if using ISDN. Equipment required at each endpoint is quite costly	Declining
Web conferencing (audio, video and data)	Low	Very—the only equipment required is a standard PC and internet connection. If events use VOIP, the charge per connection is zero.	30 percent annual growth

Source: The Maxwell Group, adapted from (Lam 2005).

3.6.2 Interoperability

Another trend is interoperability, which means the users can connect other users over different networks and different protocols. For example users can get access to a video conference via a telephone, a mobile phone, a PC, a PDA, etc. Different software enabled web-conferencing can also connect with each other.

3.6.3 Ad hoc conferencing

The introduction of IM (Instant Messenger) and web conferencing made it much easier to launch a conference and to participate in it. Web conferencing can be launched via a buddy list or a URL, enabling more and more ad hoc conferencing. Streaming servers are normally included in most web conferencing, allowing users to participate in the conference without special equipment other than a web browser and internet connection. In addition, the centrally managed, scheduled and monitored audio/video bridging services are also shifting to automated self services. Management of the conferencing is also moving from dedicated staff and trained operators to the end users. (Wainhouse Research 2004) As a result, there will be more and more ad hoc conferencing n the future.

3.6.4 High definition and telepresence

High definition screens will enable users to have easier eye contacts, facial expressions, and body languages exchanges during the video conferencing, thus make the participants feel "realness" during the communication. A 3-D positional technology is also being developed

which can help the participants to distinguish between speakers, and give users more of a "live" experience. (Vittore, 2005)

3.6.5 Multi-functions

Technology can also play a role to increase the content of the communication. Adding a function of whiteboard to virtual meetings would be extremely helpful for engineers and knowledge workers, and make virtual meetings more of a real alternative. Multi-functions development is a trend for virtual meetings technologies especially the web-meetings.

3.7 Some examples of virtual meetings applications in organizations

Despite the significant impacts, business travel has rarely been considered by companies in their environmental management. In a survey carried out in Sweden for Swedish Road Administration in 2000, only 14% of companies out of 864 respondents had taken some action to reduce environmental impacts of business travel. (Arnfalk 2002) Considering that environmental awareness in Sweden is relevantly higher than many other countries, the interest of environmental impacts from business travel among companies is very low.

With more and more companies begin to realize the significance of environmental impacts associated with their business travel, this situation is also slowly changing. Some pioneering companies have developed measures to seriously address the environmental issues of business travel. Companies in telecommunications and financial services sector are leading the way, BT, HP, Telia, HSBC, Swiss Re all have undertaken measures to reduce their business travel by investing in virtual meetings. Some people believe that executive travel provides the next opportunity for organizations to demonstrate to their employees, suppliers, customers and communities that they "walk the talk" on corporate citizenship. (Godeke, 2003)

Financial service company Credit Suisse reported that business travel by its Switzerland-based employees was responsible for 140,000 tons of CO_2 emissions in 2004. The company has announced it will pay $2.4 for every hour of flying by its employees. It has also trying to use video and web conferencing to reduce travel and cut cost. The group stated that its virtual meetings increased 14% in 2005 while kept zero growth for the travel mileage of its employees. (Coggeshall 2006)

Hong Kong and Shanghai Banking Corporation (HSBC) made its commitment in 2004 to become the world's first major bank to achieve carbon neutrality. As carbon emissions from business travel makes up a significant part of its total emissions, it has invested in virtual meetings technologies to better manage its business travel. In support of the Group's commitment to achieve carbon neutrality, HSBC in Hong Kong has invested approximately HK$3.9 million in video conferencing facility to reduce the need for business travel. Together with other environmental efforts, this has won HSBC Environmental Performance Award in Hong Kong. (HSBC 2007)

In its 2006 global citizenship report, HP (2007) recognizes the climate change impact of its employee business air travel and reported data on the emissions. It encourages its employees to use teleconferencing whenever possible, to reduce CO_2 emissions from transportation and to cut costs. It reported that its employees frequently use web-based meetings and conference calls for training and collaboration. As an ICT company, HP itself also provides several solutions for virtual meetings including the HP Virtual Room and the HP Halo Virtual Collaboration System. In its global citizenship report, HP described a case on its Halo video conferencing technology which provides high definition video with no speech delay. It

provides studios to its employees at HP's major facilities which enable project teams to meet virtually and avoid flying to meetings. As employees become more confident with technology, they began to use it for increasingly complex assignments. One particular project was also mentioned as moving a manufacturing assembly line from US to Singapore. Typically, assembly line transfers at HP require 12 months and extensive team member travel. But since HP extensively used video conferencing for this project, the project saved six months and 44 international trips. HP currently has 29 halo rooms in nine countries, and has plans for further expansion.

A more detailed case, BT, with statistical information is presented as follows.

BT

BT has widely adopted virtual meetings in the company. BT conferencing, a business branch of BT that offers audio video and web conferencing facilities, provides conferencing services for BT's employees as well as its customers. Two independent surveys of BT's employees' behaviours of using conferencing were conducted (James et al. 2004 & 2006). The findings are summarized blow.

Both surveys found the use of conferencing in BT was widespread as over half of the respondents (66% for 2004, 55% for 2006) had used virtual conferencing in the past four working weeks.

Virtual meetings continue to grow in BT after years of extensive use. In both 2004 and 2006 surveys the majority of respondents (84% for 2004 and 75% for 2006) stated that they participated in more virtual meetings in the previous two years than before. As a result, 69% of the respondents in the 2006 survey stated that conferencing is an essential aspect of their job.

Conferencing at BT has substituted business travels and reduced environmental impacts. In the two surveys, 71% (2004) and 67% (2006) of the respondents thought their last conference call had definitely or probably replaced a meeting. Many (46% for 2004 and 42% for 2006) of the trips avoided would have been by car thus reducing the environmental impacts of automobiles. 78% (2004) and 79% (2006) of trips avoided would have been at peak travel times, helping to relieve congestion on roads.

Based on the survey results at BT, the researchers estimated that conferencing in BT at least replaced 296,000 face-to-face meetings in 2004, and 338,607 face-to-face meetings in 2006. They further estimated that every conference call saves at least 32 kg (2004) and 40 kg (2006) of travel related carbon dioxide emissions, and in total conferencing in BT saves minimum 47,400 (2004) and 54,000 (2006) tons of carbon dioxide emissions. (James et al. 2004 & 2006) There were no significant differences between the results in two different years, with all the results indicating significant savings of carbon dioxide emissions.

In the 2006 survey, the researchers also estimate that each replaced meeting avoids travel and subsistence costs of £271 per meeting, and frees up at least £160 of management time for more productive purposes. These figures equate to £81 million of avoided travel and subsistence costs, and £54 million of opportunity benefits for BT as a whole. These benefits are at least 10-15 times greater than the costs of providing the conferencing services.

Virtual meetings have also brought personal benefits for BT's employees. 73.5% of the respondents believed they had saved at least three hours of travel time because of the last

virtual meetings, while this figure was 53% in 2006. This resulted in greater control of time among the conferencing users which is a key personal benefit for them. In general, respondents reported improved work performance and better work-life balance. In the 2006 survey, 68% of the respondents believed conferencing had improved their work performance and 54% stated positive impacts of conferencing on their work-life balance. However, a small number of respondents reported some negative impacts, particularly the lack of time due to the over-use of conferencing.

4 Virtual meetings in Chinese organizations

4.1 Business travel and virtual meetings in China—the context

4.1.1 China's mass-motorization development

China's mass-motorization development did not start until 1980s when China began the economic reform. It is at least 20 years lag behind Europe and Japan where the mass-motorization took off in 1960s. Today, the personal mobility in China is still very low, with an average Chinese person travelling 1000 km per year, compared with 15,000 km per year for Europeans and over 24,000 km for Americans. (Ng and Schipper 2006) This indicates that the accessibility is also low for Chinese people.

However, this situation is changing rapidly with the acceleration of the motorization development in recent years in China. China has entered an age of mass car consumption, every day in Beijing, for instance, more than 1,000 new cars are rolled out on its already highly congested streets (Porritt 2006). National passenger car sales increased by 76% from 2002 to 2003, and during the same period the passenger car production increased by 86%. (CATARC 2004) China has become the world's second largest automobile market and the third largest automobile manufacturer.

Aviation sector is also booming in China right now. China's fleet is expected to double by 2010, and 48 airports are to be built over the next five years (Coggeshall 2006).

Over the long term, both personal transport activity and freight transport activity in China are projected to grow very fast over 2000-2050 period. Freight transport activity in China is projected to grow 3.3% annually over 2000-2050 period. Personal transport activity in China is projected to grow 3.0% annually over 2000-2050 period, the highest growth rate in the world, compared to the world average annual growth rate of 1.7%. (WBCSD 2004)

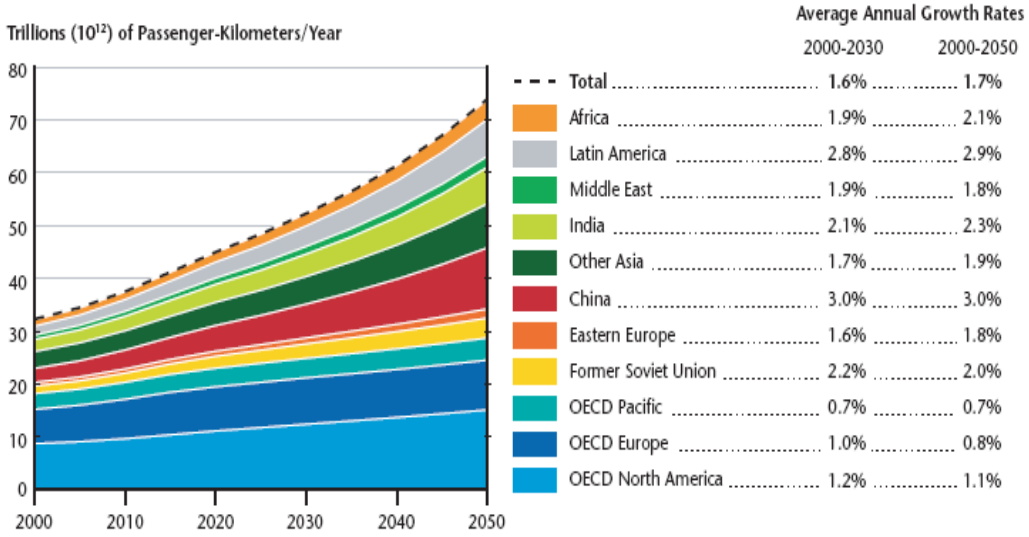

Figure 4-1 Personal transport activity by region

Source: WBCSD 2004

China's transport sector is projected to be responsible for over 12% of the world's total transport energy demand by 2050, reaching a level which equals 81% of the transport energy demand from OECD North America in 2000. (WBCSD 2004) Business travel constitutes a large part of passenger transport and could continue to grow with accelerated economic activities and globalization in China.

While increase of mobility could increase the accessibility, the benefits of personal mobility could easily be exceeded by high external costs. Congestion, air pollution, road accidents and greenhouse gases emissions, all of these could have very serious impacts on social welfare as well as the welfare of the individuals. In addition, mass-motorization development path similar to the western countries would mean China need significant amount of oil which will make the country more dependent on import of oil, creating risks for energy security.

It is laudable that China's 11th Five-Year Plan established ambitious targets to reduce energy consumption per unit of GDP by 20%, and reduce major pollutants per unit GDP by 10% by 2010. However, will China be able to achieve these targets with current trends is still questionable. It is safe to say that it would be very difficult to achieve the targets without new ways of thinking, such as ICT solutions which could enhance people's welfare and increase GDP with significantly less environmental impacts.

Again here it is argued by the author that virtual meetings technology could achieve accessibility for people and increase people's welfare without necessarily increase the personal mobility. Thus should be considered as an innovative approach and be included into the public policies.

4.1.2 Virtual meetings technology development in China

Until late 1990s, video conferencing was used very rarely in China. The first IP video network in China was implemented in 1998. It was implemented by Ministry of Post and Telecommunications and was believed to be the first largest implementation outside the lab. (Wainhouse Research, 2004) Video conferencing has developed very fast since then. In 2002, China Unicom launched a video conferencing network called UniVideo which can support over 3000 simultaneous video calls in 300 cities in China. At the time it was the world's largest IP video network. (Wainhouse Research, 2004) This implementation dramatically improved the network infrastructure, interoperability and connectivity.

According to Wainhouse Research (2004), China has become one of the world's largest markets for visual IP equipment. In 2003, the revenues for video conferencing infrastructure products including video MCUs (multipoint control units), gatekeepers, gateways and conferencing servers increased 27% in China compared to the world wide growth of 13%. More significantly, the endpoint revenue growth in China in 2003 was 83% compared to 5% world wide. The combination of the large market and the fast growth made China one of the world's largest markets. In 2003, China's video conferencing infrastructure products revenues account for 10% of the world total, and endpoint revenues account for over 15% of the world total.

Table 4-1 China vs world wide revenue on video conferencing

Revenues (M USD)	2002 Infra-	2003 Infra-	Growth	2002 Endpoints	2003 Endpoints	Growth

	Structure	Structure				
China	$32	$40	25%	$53	$97	83%
Worldwide	$287	$323	13%	$574	$601	5%

Source: Wainhouse Research 2004

However, a conclusion that video conferencing development is much faster than the world average based on above statistics must be treated with caution. This is because in 2003 the SARS outbreak in China had accelerated the growth of video conferencing which otherwise would not have grown so fast. Another research conducted by CCID Consulting (2006) concluded the total sales growth of video conferencing in 2003 was 35%, while the growth rates in later two years (2004 and 2005) were both around 20%. This confirms that the video conferencing growth in 2003 was unusually higher than that of the other years. Nevertheless, the video conferencing growth rate in China is still higher than the world wide growth rate. In 2006, the market revenues in China have reached $360 million (CCW Research 2007).

Voice and video over IP are key selling features in China for web conferencing services, while these features are still optional add-ons in other markets. Due to the fast growth and the market size of Chinese market, companies all over the world are taking Chinese market requirements, introducing products and services that are in tune with the market need in China. Wainhouse Research (2004) thus believes that China is starting to become a driver for new trends of visual IP communications.

At present, there are many companies providing virtual meetings services, from traditional audio-conference operators and video conferencing equipment suppliers, to various web-based conferencing service providers. Both international companies such as Polycom, Tandberg, Webex, and Chinese domestic companies such as Huawei, ZTE and V2 exist in the market. Chinese domestic companies have grown very fast due to the rapid growth of the market. Although lacking management experience, financial resources and most advanced technology, they are providing innovative products and services that meet the needs of the local market. The competition is fierce therefore for vendors and service providers, and it is not likely to have a monopolistic enterprise in the near future. (CCID Consulting, 2005)

Virtual meetings have been used in various sectors in the society in China. The major users include banks, education institutions, governments, enterprises, hospitals, and telecom operators. It is crucially important to understand the behaviours of organizations in order to develop public policies or organizational programs to better manage business travels and virtual meetings. However, there is no literature on how many organizations in the society are using virtual meetings and to what extent they are using virtual meetings.

In order to fill the gap, two case studies focusing on organizational level virtual meetings applications are studied and presented in this thesis. Recognizing the need of scale up and the limitations of focusing on one single organization level applications, two case studies focusing on the society wide use of virtual meetings are also studied. Each case study will present a brief analysis and discussion, and in the end of this chapter, some characteristics of virtual meetings in China are summarized. These case studies are meant to accumulate empirical evidences of virtual meetings applications in China, and serve as a basis for policy recommendations.

4.2 Case One: Shanghai Pudong Development Bank (SPDB)

4.2.1 Case introduction

This case examines the virtual meetings use in a Chinese commercial bank with various branches located across China. The aim is to understand the virtual meetings applications in a banking firm, which can shed some lights on virtual meetings use in the banking sector, or in a large business organization in China. Information and data on this case are primarily based on interviews of staff members at SPDB, and some secondary data from SPDB CSR report and information on its official web. The following people are interviewed for this case study:

Interviewee: Dafeng Wu, Information Office, SPDB.

Xia Gao, CSR officer, SPDB.

4.2.2 SPDB and the communication needs

Shanghai Pudong Development Bank (SPDB) is an incorporated commercial bank in China founded in 1993 and headquartered in Shanghai. It has been listed in Chinese stock exchange since 1999 and its total assets had reached RMB 573.1 billion by the end of 2005. SPDB has 28 directly subordinate branches and sub-branches and over 350 business units across China.

With various branch banks located in different places, the needs to communicate between the headquarters and the branch banks are enormous. Every year there are a lot of meetings held in the Shanghai headquarters with participants coming from the branch banks. Participants normally travel by air, automobile or train and accommodate in Shanghai. With expansion of its business and growth of business activities, SPDB has ever growing needs for meetings and communications.

In 2000, SPDB decided to make an investment in a video conferencing system with the hope to cope with the growing demand of meetings and communications. In 2001 it implemented the video conferencing system in its headquarters in Shanghai and most of its branch banks. Currently the video conferencing systems are in place for SPDB's headquarters in Shanghai and all of its 28 branch banks in various locations across China. SPDB is one of the earliest banks in China that adopted video conferencing system and it has accumulated over 6 years of experience using video conferencing for various purposes.

4.2.3 Video conferencing applications at SPDB

SPDB has frequently used video conferencing for various purposes. The major functions of video conferencing at SPDB include meetings, trainings, interviews and examination supervision.

Corporate-wide trainings are most frequently held via video conferencing. Video training programs account for around 50% of the total video conferencing applications at SPDB. These training programs normally involve trainers from the headquarters, and trainees from the branch banks. The scale of such training programs is normally large, with over 50 participants. Training programs are top-down type of communications with low interaction level.

Corporate wide meetings are the typical type of meetings held through video conferencing at SPDB. There are corporate-wide management meetings with participation of top management in the headquarters and managers from the branch banks. There are also corporate-wide staff meetings with participation of most of the employees. In any case, these meetings are large meetings with many participants. A typical corporate-wide management meeting has more than 50 participants in different locations. Corporate-wide staff meetings have more participants. The largest virtual meeting in SPDB was with over 2000 participants.

The contents of corporate-wide staff meetings and management meetings are mainly briefings from the top management with few interactions. While there are some interactions in corporate-wide management meetings, corporate-wide staff meetings are basically a one-way top-down communication.

Small scale meetings are less frequent. A manager in charge of different branch banks could initiate such meetings, but the practice is not wide spread yet. It is believed to be mainly due to the technical reasons. The effectiveness of communication is often undermined because sometimes there are still some time lags for image transmission, and it is still difficult to fully achieve the purposes if the meeting requires a high level of interaction. The situation is being improved, though. One important application of video conferencing started in late 2006 at SPDB is the loan committee meetings, which review the loan applications that were received in various branch banks. Project managers in the headquarters and the branch banks meet together once a week over video to discuss the loan applications and make loan decisions.

For internal training and promotion purposes, there are various paper-based examinations at SPDB every year. To ensure the process of examination is without cheating, supervision from the headquarters is deemed to be necessary. The supervisions of examinations are also conducted via video conferencing. The examinations are arranged in the video conferencing rooms so that people at the headquarters can monitor the examination process in real time via video.

Many job interviews at SPDB are also conducted via video conferencing. There are a large number of job applicants every year at SPDB, and they are from different places in the country. After the pre-selection, SPDB normally asks the applicant to go to one of their branch banks closest to where the applicants live and sit on interviews via video conferencing.

Table 4-2 Characteristics of virtual meetings at SPDB[9]

Virtual meetings	Type	Scale	Interaction level	Frequency
Training	Internal	Large	Low	High (50%)
Loan committee meetings	Internal	Small	Medium to high	Medium to high (once a week)
Tele-interviews	Semi-external	Small	High	Medium (10%)

[9] Some analysis of this table is presented later in this paper, in the section of Analysis and Discussions of SPDB case

Corporate-wide management meetings	Internal	Large to medium	Medium to low	Medium
Corporate-wide staff meetings	Internal	Large	Low	Medium to low
Examination supervision	Internal	Large	Low	Medium to low
Other collaboration meetings	Internal	Small	High	Low

Source: own compilation

190 video conferences were held in 2006 at SPDB with an average number of 16 video conferences per month. The use of video conferencing has been growing rather rapidly in SPDB. The growth in 2005 over 2004 was 44% and growth in 2006 over 2005 was 67%. The number of video conferences in 2007 is not known yet, but there were 25 video conferences held in SPDB in March 2007 alone, suggesting continued growth.

SPDB has designed an on-line booking system for video conferencing. Employees can book the video conferencing by submitting a request on line, and then the administrative staff will check the availability and confirm the bookings. In most circumstances the video conferencing can be held as requested, but recently there are some conflicting schedules and some meeting requests have to be turned down and rescheduled to another time. This is a sign that there are increased uses of video conferencing, and the current capacity is not enough to meet all the demands.

4.2.4 Costs and benefits of video conferencing at SPDB

As can be seen from the purposes of virtual meetings at SPDB, trainings, corporate wide meetings, top-down briefings, loan committee meetings, interviews and examination supervision can be conducted via video conferencing. Many of these meetings were traditionally held face to face which requires employee travels. For example, loan committee meetings were traditionally held face-to-face once a week, now all of these meetings are conducted via video conferencing at SPDB, which has reduced the business travels of the employees. A survey among SPDB employees about their perceptions if video conferencing had substituted their business travels was not conducted due to the limited time assigned to this research. However, the information officer at SPDB believes that over 50% of SPDB meetings can be substituted by video conferencing, and SPDB is doing well in reaching that level of application[10]. It can be confirmed that some of the meetings traditionally requiring employee travel now are substituted by video conferencing at SPDB. Therefore the substitution effects of video conferencing are real for SPDB case.

At the society level, since some of the business travels are substituted by video conferencing, the negative environmental and social impacts from transport and hotel accommodations are reduced. SPDB does not have statistics on the business travels, but the information officer at SPDB feels that their overall business travels have been reduced, despite the growth of their

[10] Interview with Dafeng Wu, information officer at SPDB. April 28, 2007.

businesses. In addition, the investment in video conferencing has contributed to the economy by benefiting the video conferencing industry. Hence the video conferencing applications at SPDB are beneficial to the society.

At the organization level, the major costs of video conferencing at SPDB include financial investments, human resources take up, and the risks of poor performance of video conferencing compared to face-to-face meetings. Financially, it is estimated that SPDB has invested over 4 million RMB in video conferencing systems. In terms of human resources, there are two employees designated to assist the video conferencing at headquarter of SPDB. SPDB also suggests that each branch bank should allocate one employee on video conferencing, but in practice this has not been done. The risks of poor performance of video conferencing are difficult to quantify, but in early days of using video conferencing, SPDB did experience failure of meetings due to the low quality of video conferencing. It is a cost to SPDB at least in terms of wasting employee time.

Video conferencing has also brought a lot of benefits to SPDB. SPDB was asked to give the three most important reasons for using video conferencing and rank them according to their importance. Cost reduction from business travel and accommodation came first on the list, followed by improving management efficiency due to the short time needed for communications, and time savings for employees.

A major benefit is the reduction of costs of traditional meetings. By substituting face-to-face meetings requiring employee travel, video conferencing can achieve cost savings from the avoided transport, hotel accommodations, and in some cases the renting of conference venues. SPDB made calculations of the cost savings of video conferencing and the results suggested significant savings. In 2006, for example, SPDB held 190 video conferences and it is estimated that by doing so it saved around 4.72 million RMB in total. According to this estimate, the financial pay back period is around one to two years.

Table 4-3 Cost savings of video conferencing at SPDB

Year	2004	2005	2006
No. video conferences	79	114	190
Money saved (RMB)	3,123,000	3,819,000	4,720,500

Source: Wu 2007[11]

Video conferencing has also improved the management efficiency in SPDB, with quick and clear communication between headquarters and the branch banks. Compared to physical face-to-face meetings, video conferencing allows more participants to participate in the meeting without additional cost. Traditionally, only a number of people in the management team of branch banks had the chance to travel to Shanghai to attend meetings. After the meetings, they have to go back to their branch bank and communicate the messages in the meeting to the other staff members in their branch bank. There are concerns that such communications

[11] Dafeng Wu, interview, April 28, 2007.

are time consuming and not totally effective. Some important messages might be lost during such communications, and sometimes it might create misunderstandings and confusions. Video conferencing has eliminated such drawbacks, saved time and improved the management efficiency.

Time savings are also apparent, especially the time spent on travelling to and from the meeting places. Such time can be spent on work if travel is not needed for the meetings. It can also be converted to monetary values by multiplying the wages, but it was not calculated at SPDB.

To conclude, financially the benefits of video conferencing are clear and straightforward. Time cost (human resources allocation) and time savings can also be compared quantitatively directly or can be converted to monetary terms, but this is not done in SPDB. If calculated, the time savings are most likely surpass the employee time allocated for operating video conferencing. The management efficiency improvements and the risks brought by video conferencing can not be easily compared, but the management efficiency improvements are wide spread and the risks of poor performance of video conferencing are limited and decreasing. Overall it can be concluded the benefits of video conferencing applications at SPDB overweigh the costs, at least financially.

At personal level, there is no travel allowance at SPDB and the costs of business travel are reimbursed for real expenses. So financially there is not much difference between business travel and video conferencing for individual employees. Nevertheless, frequent flyer programs and nice food and hotel stays are seen as benefits for the employees on business travels, and these will be lost if meetings are held virtually. Lost of personal networking opportunities is also an important cost for individual employees. On the benefits side, an important benefit for the employees at SPDB is the increased opportunity to get information and improve their knowledge very quickly. Time savings due to video conferencing can not only be spent on work but also help with work-life balance for the employees. Since a detailed survey of the employees in SPDB was not conducted, the personal opinions towards video conferencing by the employees are not obtained. Therefore, the personal costs and benefits of video conferencing in this section are mainly based on speculations. While the individual employees still play important roles in making decisions between business travels and video conferencing, more accurate information on costs and benefits for individual employees is needed in order to make a sounder judgement.

Overall, SPDB considers video conferencing has more benefits than costs and thinks it should be promoted in the society. The information officer at SPDB believes that "virtual meetings are neither difficult nor expensive".

4.2.5 Analysis and Discussions

The context: virtual meetings at banking firms

SPDB is a relatively small bank in China. The four biggest banks in China have over 95,000 branch banks distributed across the country. How to communicate effectively among the branch banks is a daunting challenge for them as the banks expand their businesses and face rising expectations from customers. According to David Luff (2007), Bank and Finance Practice Leader at Tandberg, there are four levels of video conferencing application in bank firms. The first level application is to provide an alternative way to face-to-face communications. The second level application is to strengthen collaboration among employees, facilitate the information and resources sharing, and improve employee knowledge and skills. The third level of application is wider applications to support various business

operations in the firm. For example, a manager in charge of 14 branch banks would not be able to stay at his own office if he has to drive between the 14 branch banks and perform the management role. But with video conferencing, he can hold meetings with a specific branch bank or all the 14 branch banks at his own office while still have time for a coffee break. The fourth level of application is to go beyond the internal applications and use video conferencing as a tool for customer service. It allows customers to communicate with their financial advisors without going to the banks. It is a type of value added service and a good way to increase customer loyalty. It is also a way to expand existing services and provide more convenience for customers. For example, Sovereign Bancorp Inc. of Philadelphia installed two video-teller stations at its Harvard Square branch in Cambridge, Mass. USA. The two-way screens in the branch's automated teller machine vestibule enable customers to do transactions with live tellers. (Bills 2006) Currently, most of the applications are concentrated on the first level applications and to some extent the second level applications. The third level and in particular the fourth level applications are still very rare. The SPDB case has confirmed this general conclusion, but there are certain characteristics of SPDB's experience with virtual meetings.

Headquarters vs. local branch banks

Video conferencing at SPDB is used in all departments irrespective of their functions. However, an interesting fact is that most of the video conferences are initiated by the headquarters, not by the branch banks. The reason could be attributed to the fact of hierarchical management in China's enterprises, but another important reason is the lack of technical support and facilitation in the branch banks. In most of the video conferences held at SPDB, two dedicated staff are allocated to support the video conference, while there is often no technical support or facilitation at branch banks. Another example is that in the early stages of video conferencing applications at SPDB, some branch banks did not want to install video conferencing because they need to bear the costs. They offered to participate in the virtual meetings in a nearby branch bank with video conferencing facility. However, all of them later changed their minds and installed video conferencing in their own branch bank due to the fuss of going to other places to attend meetings. Lack of initiatives from branch banks is certainly a barrier to make full use of video conferencing and enhance interactive and efficient communications.

Large scale meetings versus small scale meetings

Most of the virtual meetings at SPDB are corporate wide large meetings. This is firstly because there are strong needs for efficient corporate wide communications with so many branch banks. It is also because the smaller meetings normally require high level interaction, but the video conferencing at SPDB still could not fully fulfil the functions of high level of interaction. Lack of video conferencing application for small scale meetings shows that there is still a big gap for video conferencing to be fully integrated to SPDB's core business operations. The loan committee meetings recently started to be held via video conferencing is a sign of improvement.

Internal applications vs. external applications

Most of the virtual meetings at SPDB are internal meetings. External meetings are rarely held via video conferencing, partly because the video conferencing is not yet wide spread and in many cases their clients do not have access to such facilities. Another reason is that face-to-face meetings are considered important to show respects to their clients, and no one is willing to risk losing their clients because of the use of video conferencing. Job interviews at SPDB

are held via video conferencing, which is a kind of semi-external use. This might also be due to the reason that for job interviews, SPDB is in the position that can require job applicants using video conferencing. To extend the use of video conferencing to external parties is very important for an organization to fully utilize the benefits of video conferencing and for the society to scale up the use of virtual meetings. However, the results suggest that an organization should first start with non-important external parties, or parties that the organization can exert important influences, for example the suppliers or contractors.

Video conferencing vs. audio conferencing

There is not a good platform for audio conferencing at SPDB, therefore the audio conferencing, especially those involving many parties, are very rare. According to the information officer at SPDB, when many people are involved in audio conferencing, it is very difficult to recognize who is talking and the participants can easily get lost. What is more, if there is not a good facilitator, it could also create a mess when everybody is trying to speak at the same time.

Technology and price

SPDB stated that a major barrier for more use of video conferencing, especially for smaller meetings, is the fact that the virtual communications is still less effective than face-to-face meetings. Improvements of technology might help solving the problems, but the price is another concern. However, over the long term, the prices of technology will get lower and lower. In fact, falling prices have been mentioned as an important factor that has stimulated more use of virtual meetings at SPDB. The dynamics of technology improvements and price changes will continue to influence the decisions of meeting forms at SPDB.

Direct vs. indirect impacts

For banking firms, attentions have been focusing on the indirect environmental and social impacts of their investment decisions. SPDB has also been trying to improve the environmental and social performance of the projects it is financing. The author admits in most cases the indirect impacts are larger than the direct impacts for banking firms; however, it is not an excuse to overlook the direct impacts brought by their own operations of the banks. Direct and indirect impacts shall both be addressed. This thesis focuses on the direct impacts of the operations of the banking firms.

4.2.6 Success factors

The application of video conferencing has been spreading very fast within SPDB, and SPDB has rather successfully utilized video conferences to achieve various goals. There are some factors that have contributed to this success.

Top management support is a very important factor for successful application of video conferencing in SPDB. It was the top management who made the decision to invest in video conferencing system. It demonstrated the vision of the top management, because at that time video conferencing was still a very new phenomenon. Top management has also been championing the use of video conferencing, by converting many meetings into their virtual forms.

Perseverance is another important factor. SPDB experienced some failures in using video conferencing in the beginning, but this did not stop SPDB to continue using video

conferencing. Experience of poor quality of video conferencing could have very negative impacts on the users' impressions of video conferencing, and could possibly prevent them from using video conferencing again for years. SPDB, however, analyzed the reasons for the failures and found ways to fix them. Allowing mistakes for new things, learning from mistakes and continuously trying to better use the technology are all important factors that helped SPDB through the difficulties.

Designated staff to manage the video conferencing facilities and venues at SPDB's headquarters is a cost for SPDB, but on the other hand, this practice has showed the commitment from the management, and ensured the technical readiness to solve potential problems. Therefore it is also an important factor that has contributed to the smooth application of video conferencing at SPDB.

Easiness of the procedure has also improved the attractiveness of video conferencing at SPDB. Online booking system made the booking and scheduling only some mouse clicks away. In SPDB, business travel plans have to be approved before travelling. Although it can be approved by project manager level of management and is not very difficult either, the procedure of holding a video conferencing is still easier.

Corporate social responsibility (CSR) In 2006, SPDB published its CSR report. It is the first time a banking firm publish such a report in China. According to the report, SPDB had conducted various activities to contribute to social and environmental improvements. Use of video conferencing is considered a type of CSR activity at SPDB to reduce environmental burdens of its own operations. This awareness has contributed to the successful implementation of video conferencing system as well.

Other ICT applications At SPDB, in addition to video conferencing, various other ICT technologies have been applied. Electronic documentation and digital signature system at SPDB have eliminated a large part of need for paper and saved around 200 tons of paper. SPDB have also actively promoted e-banking by encouraging its customers to use internet banking and the call center functions. These activities have increased SPDB's knowledge and experience of using ICT technologies in general, and contributed to the success of video conferencing application.

Some ICT applications experience may also help SPDB advance the use of video conferencing and make further improvements. For example, SPDB's practice on e-banking has not only saved time for customers but also avoided their trips to the banks and thus reduced the related environmental impacts. The practice has improved the customer satisfaction and increased sales and profits. Similar to e-banking, video conferencing applications could also potentially not only reduce the internal costs and increase the efficiency, but also increase sales and profits. However, this potential has not been explored by SPDB.

4.3 Case Two: SEPA and Shandong EPB

4.3.1 Case introduction

This case aims to examine the use of virtual meetings in Chinese government agencies through a specific government system: the governmental environmental protection system. The case investigates the use of virtual meetings at State Environmental Protection Administration (SEPA), and one of its provincial level subordinates: Environmental Protection Bureau of Shandong Province. Information and data on this case are primarily based on interviews of

staff members at SEPA and Shandong EPB, and some secondary data from SPEA documents. The following people are interviewed for this case study:

Zilong Li, the information office at SEPA, April 5, 2007.

Anonymous, the meetings management office, April 15, 2007

Mr. Liu, section chief, information center of Shandong EPB, April 9, 2007.

4.3.2 SEPA and the communication needs

SEPA is the highest (national) level of government agency in charge of environmental protection affairs in China. There are around 300 staff members in SEPA. Under SEPA, there are provincial level, municipal level and county level of Environmental Protection Bureaus (EPBs). Currently, in China, there are 31 provincial level governments (excluding Hong Kong, Macau and Taiwan), including 23 provinces, four municipalities directly administered by central government, 5 ethnic minority autonomous regions. All of them have their provincial level EPBs. Under each provincial level government, there are also numerous municipality level governments, and county level governments, with each level of governments have their own EPBs. Therefore, like any other government system in China, the environmental protection system in China, even though a relatively small one, is a large network distributed across the country. There are various needs for communications between SEPA and the local level of EPBs to coordinate the management of environmental protection issues.

Every year, SEPA needs to hold large conferences within the government environmental protection system to brief about the policy issues and assign tasks that need to be undertaken by local EPBs. Different departments of SEPA also organize conferences on various topics and often times with participants from all over the country. These conferences and meetings normally incur a lot of expenditures including renting the venue and facilities, travel and accommodation costs of the participants, etc. Such meetings and conferences have created a lot of burdens to the government budget and are deemed to be excessive. People often describe this phenomenon as "mountains of documents and oceans of meetings", to criticize the low efficiency of the government and wasting of tax payers' money, because these meetings and conferences normally generate very limited results but take up a lot of resources.

4.3.3 Virtual meetings applications in SEPA

It is in this context, SEPA decided to invest in video conferencing to increase the government efficiency and cut costs. Since SEPA is also in charge of environmental protection, this effort also aims to champion the use of virtual meetings in the society to advance resources conservation.

In late 2005, SEPA invested in a video conferencing system with 37 endpoints covering all the provincial level EPBs and it started using video conferencing from 2006. The information office at SEPA is in charge of the implementation of video conferencing and the provision of technical support. According to Zilong Li from the information office at SEPA, the video conferencing technology is mature and the quality of both sound and image transmission is good enough to hold high quality video conferencing.

Until 2007, over 10 large conferences had been conducted through video conferencing in SEPA, most of which are top down briefings which do not require a lot of interactions. As SEPA or various departments under SEPA hold around 70 to 80 large scale conferences every

year with participants from across the country, this indicated that around 15% of the large meetings and conferences were substituted by video conferencing in 2006. Based on SEPA's experience of using video conferencing in 2006, the Minister of SEPA announced an ambitious target in 2007 to replace 40% conventional meetings with virtual meetings.

There is a Conference & Meetings Management Office within SEPA which is in charge of all the large conferences and meetings organized by various departments of SEPA. When a department needs to organize a conference, it will need to send an application to the Conference & Meetings Management Office to get approval on the budget. With new target announced by the Minister of SEPA, the policy in the Conference & Meetings Management Office now is to first reduce the number of conferences by refusing applications for unnecessary or non-important conferences. Then the office will investigate which conferences left can be substituted by video conferencing and suggest video conferencing as the alternative.

The major criteria to determine the substitutability of the conventional meetings is the interaction level and the importance level, as well as the timing considerations. In general, video conferencing can substitute the conventional meetings with low interaction level, for example the policy briefings. Less important meetings and conferences are also frequently asked to be substituted by video conferencing. In addition, if a meeting is urgent, and it is not realistic to organize traditional meetings which require preparations in advance and allow travel time for the participants, the meeting can ideally be substituted by video conferencing.

The small scale meetings are rare, even though the procedure to hold such meetings is not complicated. It is not yet an on-line booking system, but it is not hard to book a video conferencing. If it is a virtual meeting with participants from two locations, the meeting participants can directly use the equipment only need to inform the information office. If the virtual meeting involve participants from more than two locations, it is necessary for the technician to configure the MCU. Besides the need for technical assistance, there are no other restrictions for using the video conferencing services.

According to Chinese government policies, business travels from employees at central government agencies have to be approved by a higher level of government officials. If the business travel is by air, the approval must come from director or deputy director of a department within a ministry. This has made business travels by air a little difficult.

4.3.4 Virtual meetings applications in Shandong EPB

SEPA provided financial resources for provincial level EPBs to purchase video conferencing equipment. Provincial EPBs also made their efforts to match the investment by investing in venue and some basic infrastructure.

Some provincial level EPBs followed the practice of SEPA to install video conferencing system within their jurisdiction area. In late 2006, Environmental Protection Bureau (EPB) in Shandong Province installed a video conferencing system connecting 17 municipal level EPBs across Shandong Province.

Shandong EPB is the provincial level government agency in charge of environmental protection affairs in Shandong Province. It needs to communicate with SEPA on various policies, but more frequently, it also needs to communicate with the 17 municipal level EPBs in different places under its jurisdiction to coordinate the environmental protection affairs in the province.

Compared with SEPA, an interesting feature of video conferencing use in Shandong EPB is that there are more small scale discussion meetings. Over 60% of the video conferencing is used for small meetings involving 2-3 locations with 3-5 participants in each location. These meetings serve for the purpose of internal discussion of various issues of their work. Larger scale meetings with participants from all the 17 locations are less frequent. They are held once per month in average while small meetings are held at least once per week. A typical virtual meeting lasts around one hour at Shandong EPB. Besides meeting functions, another major function is data transfer within the system and this has increased the efficiency of information exchange and data collection in Shandong EPB.

Shandong EPB has a policy for business travel and video conferencing. Business travel plans have to be approved by their supervisors in the government, but for video conferencing, the process is much easier. Staff members just need to simply book the system and use it.

4.3.5 Costs and benefits of virtual meetings at SEPA and Shandong EPB

The substitution effects of video conferencing over conventional meetings are also evident in SEPA and Shandong EPB. Currently virtual meetings replace 15% of conventional conferences and meetings in SEPA and it aims to achieve 40% substitution. Information officer at Shandong EPB believes that up 75% of their meetings can be substituted by video conferencing and they have substituted a lot of conventional conferences and meetings since implementing the video conferencing system.

At society level, the benefits of virtual meetings applications in SEPA and Shandong EPB are apparent. Virtual meetings replace the conventional conferences and meetings which incur a lot of expenditures on transport, accommodation and venue. Since the expenditures are from the public funds, these savings can be used for other projects on public welfare and thus beneficial for the society. Relevant negative environmental and social impacts due to transport and accommodations are also reduced. It can further promote a transparent culture in government agencies and reduce the chances of corruption.

When governmental officials from central government visit provinces, or the provincial level governmental officials visit municipalities, a wide spread practice is that the lower level government would normally provide nice hotel, nice food and even some luxury tourism activities. This kind of practice wastes tax payers' money, increases the burden on local governments, and provides opportunities for corruption. By substituting conventional conferences and meetings by video conferencing, the chances for such activities are eliminated. Therefore video conferencing also plays a role to reduce corruption and the economic burden of the local governments.

At organizational level, the costs are financial investments and human resources allocations. Training for the technicians is also a cost. However, more benefits are brought by virtual meetings applications. The information centre at Shandong EPB which is in charge of video conferencing implementation is fully aware of the benefits of video conferencing. The major benefits mentioned during the interviews were cost savings, time savings, relieving the stress of lack of manpower due to employee business travel, increasing the efficiency of communication, avoiding message losses and misunderstandings during secondary communications, and reducing safety risks of business travels such as car accidents.

Costs and time savings are normal features of using virtual meetings. Better human resources use is a particular benefit for SEPA and Shandong EPB, because both are under-staffed while the environmental challenges in China are daunting and many issues need to be dealt with by the government. The related government businesses will not be able to be dealt with if the person in charge is on business travel.

The benefit of effective communications is similar to the SPDB case, while there is more need for top-down communications in the government agencies due to the political governance structure. Another benefit particularly mentioned by the information officer at Shandong EPB is the benefit of reducing safety risks. This is because the poor road safety records in China, and many business travels within Shandong Province done by employees of Shandong EPB are via automobiles.

At personal levels, loss of opportunities to build personal and professional networks seems to be a major cost. There is still a strong need to meet people in person to build personal relationships, since the *Guanxi* (meaning relationship or connection in English) phenomenon is still very important in Chinese society, especially the government system. For some officials at higher level of the government, the loss of opportunities to be nicely treated in the lower level government agencies is also a personal cost. On the benefit side, relieving the stress of business travellers, reducing safety risks and saving time are major benefits for virtual meetings users as compared to business travellers.

4.3.6 Analysis and Discussions

Excessive meetings/business travels in government agencies

China is a large country and the government system is a huge network. The central government including different ministries and the local governments need to communicate about the policies and coordinate the actions with each other. There are also needs for local governments to communicate with lower level of government agencies within their own jurisdiction.

It is recognized both by the government and the public that the conferences and meetings organized by government agencies are excessive. It is not only the case for SEPA and Shandong EPB, but also for other government agencies in China. Therefore to substitute conventional conferences and meetings with virtual meetings is a way for the government to show the public that they are improving their efficiency. Virtual meetings are also very effective to improve the transparent operations of government agencies and reduce chances of corruption.

Internal vs. external applications

Like the case of SPDB, most virtual meetings are also confined to internal use at SEPA and Shandong EPB. Virtual meetings with other government agencies have not been conducted because the lack of virtual meetings facilities in other government agencies. This is a sign that the video conferencing in government agencies is not yet widely used. Virtual meetings with businesses or other sectors do not exist either. Officials from SEPA and Shandong EPB do not perceive any needs of holding virtual meetings with businesses or other sectors in the society. However, a possible way of using video conferencing with businesses mentioned during the interview was policy introduction meetings to foreign investors. Attracting foreign investments is an important function for most local governments. An offer of virtual meeting introducing their local policies could be a good way to attract foreign investment. This type of

meetings could be organized by local government with participation of various departments including EPB, or could be organized by EPB specifically introducing the environmental policies. By doing so, the government can also stimulate the use of virtual meetings in other parties of the society.

Large scale vs. small scale meetings

Small scale meetings with high level interactions are still very rare at SEPA. The information officer at SEPA thinks this is because that video conferencing is still a new thing. Many staff members still do not know about it and its benefits. Therefore it is thus not well received among them. With more knowledge and experience accumulated, it is expected that they will use more video conferencing. There is some information on the web encouraging employees at SEPA to use video conferencing, but no other activities beyond that.

A striking difference at Shandong EPB is that small scale meetings account for over 60% of their virtual meetings. There are several reasons for this. Firstly, the SEPA policy on use of video conferencing has been focused on large conferences and meetings which are most evident and easier to be substituted by virtual meetings. Thus the targets and management controls are focusing on large scale meetings. Small scale meetings have not been in the scope of the policy control measures. While for Shandong EPB, the main reason to install video conferencing is to meet the needs of collaboration which naturally involve a lot of small meetings. Secondly, compared to SEPA, the budget and human resources at local EPBs are more constrained. Using video conferencing instead of business travels is a practical solution to such constraints. Thirdly, local government officials have taken a more pragmatic approach towards video conferencing technology. Their expectations of video conferencing are not so high and they are more tolerating to the quality of video conferencing.

Success factors

Factors that are believed to contribute to the success use of video conferencing include the support from the top management, functional technology, and good management of the system.

Top management support is crucial for the implementation of virtual meetings systems, and it is more so in government than in business sector. The Minister of SEPA and the director of Shandong EPB actively promoted video conferencing within their jurisdictions. The Minister of SEPA also set up clear targets on how many conventional conferences and meetings should be substituted by video conferencing, which is another success factor.

It is also important to have a control mechanism to ensure the targets being met. There is a conferences and meetings office at SEPA performing such roles.

Lack of training and promotion

While the technology staff believes that the quality of video conferencing is good enough, the video conferencing users still think the effectiveness is below expectations. This is exemplified by infrequent use of video conferencing for small scale discussion meetings. Some information on video conferencing is provided in SEPA, but the promotion is far from enough to stimulate the interests of employees.

Shandong EPB organized a training workshop on the use of video conferencing. However, the purpose is only to train the technicians to run the video conferencing facilities from a

technological perspective. Trainings to the video conferencing users/virtual meeting participants are perceived to be unnecessary. However, the effectiveness of virtual meetings is highly dependent on the skills of the meeting participants and this is not negligible.

4.4 Case Three: Video Conferencing Renting Services in Commercial Office Buildings

4.4.1 The context

Virtual meetings have been used predominantly in large organizations. And almost all the existing case studies focus on the applications in large organizations such as BT and Tellia. There are several reasons for this. Firstly, the virtual meetings especially the video conferencing equipments and systems require a lot of initial investment which small companies normally cannot afford. Secondly based on case studies in developed countries and this research about China, virtual meetings have been predominantly used for internal meetings. Large organizations with offices in different locations apparently have more needs for internal communications than small organizations.

However, the virtual meetings use in small and medium sized enterprises (SMEs) is also very important because the majority enterprises in the society are SMEs. Without participation of SMEs, the virtual meetings will not be able to really scale up in the society and achieve its potentials for sustainable development.

There are also ways allowing more use of virtual meetings in smaller organizations. Firstly, new VOIP software technology development such as Skype allows smaller organizations to use virtual meetings at very low cost or even free. But the quality of such services can not be guaranteed. Secondly, some virtual meetings equipment and system suppliers have developed leasing services in addition to selling their equipments or software. Smaller organizations can use the virtual meetings on a pay-per-use basis without investing in the equipments or the software. This is more cost effective for infrequent users such as SMEs. There are also some service providers offering video conferencing meeting rooms renting services in commercial office buildings or business centres in hotels. Businesses in or close to the office buildings can book the services and conduct virtual meetings there.

Regus Group and Whygo are two companies that provide virtual meetings renting services in office buildings. In this section, these two examples are presented as case studies. A telephone survey was conducted about the current situations of this type of virtual meetings services use in China. All the commercial office buildings with video conferencing services in mainland China[12] listed in Regus and Whygo online systems were surveyed by telephone call in this study. In addition to the telephone survey, an interview with Regus Shanghai sales manager was also conducted. Compared to case studies in a specific company or government institution, this study could provide some hints on the situations of society wide commercial use of video conferencing.

[12] There are a number of commercial office buildings in Hong Kong providing video conferencing services, but due to the different economic and political systems in Hong Kong compared with mainland China, it is not included in the scope of this research.

4.4.2 Introduction of Regus and Whygo

Regus Group is the world's largest provider of outsourced workplaces. It provides its business clients rented workplaces services including fully furnished offices, virtual offices, meeting rooms, video conferencing facilities and other business services. The Regus Group Network has 950 business centres in 70 countries and includes four brands: Regus Business centres, HQ Global Workplaces, Stratis and Business Meeting Places. Each location includes a mix of offices, meeting rooms and common areas. An advanced communications system, Internet access and IT and administrative support are also standard features. Additionally, Regus also provides value added services, including meeting rooms, videoconferencing, business support services, and catering -- on a pay-per-use basis. Regus facilities are located in many cities in the world, often at premier addresses, central business districts or business parks with convenient access to major airports or public transportation. Today, more than half of the Fortune 500, along with thousands of small- and medium-sized companies, are outsourcing some part of their office requirements to Regus. Video conferencing is a typical service that Regus Group offers in many of its locations. Anyone can pay a fee to book and use the video conferencing services and connect with other places in the world.

Unlike Regus, Whygo is a company specifically focusing on video conferencing facilities. It is a broker of public video conferencing facilities by providing easy-to-use online booking and scheduling system. Most of the video conferencing facilities are located in commercial office buildings worldwide. Video conferencing can be booked at Whygo through an online real time automated scheduling system, or can be booked via traditional means such as phone, fax and email. Whygo also provides maps of the locations of the video conferencing rooms through Google maps to help customers find the venues easily. If the customers need assistance, they can also chat or meet with customer services at Whygo through video conferencing in real time. Whygo started in Australia and recently merged with a UK firm Face2face Meetings with similar businesses. The objective of Whygo is to have on-line video conferencing facilities in every major city worldwide which can be easily booked and scheduled through Whygo system.

Regus owns most of the video conferencing rooms and facilities it provides, whereas Whygo normally does not own the video conferencing facilities, and only provide easy booking and scheduling services to accelerate the use of video conferencing.

4.4.3 Distribution of office buildings with virtual meetings services

According to Regus online search system, there are (as of May 2007) 16 commercial office buildings in China that can provide video conferencing services. In Whygo system, there are (as of May 2007) 17 commercial office buildings in China that can provide video conferencing services. Combined together and discounting the overlapping ones, there are in total 23 commercial office building (and hotels) providing video conferencing renting services in China listed in Regus and Whygo systems.

Table 4-4 No. of office buildings with video conferencing services in some countries (Whygo list)

Country	US	Australia	UK	India	China
No. of office buildings with VC	794	661	249	25	17

There are significantly less commercial office buildings with video conferencing services in mainland China than in developed countries such as UK, Australia and US. If the size of the country is also factored in, the density of such video conferencing services in China is more significantly less than that in developed countries. Another developing country India also has very few video conferencing services provided in office buildings but it has more than China.

Table 4-5 Distribution of commercial office buildings with video conferencing services in Chinese cities

City	Beijing	Shanghai	Guangzhou	Shenzhen	Tianjin	Dalian
Number of office buildings with video conference services	7	10	2	2	1	1

The distribution of commercial office buildings with video conferencing services within China is also very unbalanced. As shown in Table 4-5, the commercial office buildings with video conferencing services in mainland China are predominantly located in big cities such as Shanghai and Beijing, with Shanghai being China's commercial and business center and Beijing being the country's capital and cultural center. None of these cities is from economically less developed areas such as interior and western regions in China. Even though this list is drawn from the Whygo systems and they do not necessarily include all the commercial office buildings with video conferencing services in China, it does indicate that the use of video conferencing is strongly connected with economic development. There are more video conferencing uses in places where the economy is more developed and the business culture is more mature.

4.4.4 Survey findings

A telephone survey was conducted by the author in March and April 2007 about the patterns of using video conferencing services in office buildings in China. All of the 23 office buildings were called and surveyed with a brief list of questions. Among the 23 office buildings, 4 of them declined to participate in the research and 3 of them were listed by the online system but actually not providing such services at the moment. Some of the findings are presented as follows.

Table 4-6 How long have video conferencing renting services been provided?

Years of operation	0~1 year	2~3 years	4~5 years	6~10 years
No.	3	9	2	2
Percentage	19%	56%	12.5%	12.5%

Video conferencing renting services in office buildings are still very new in China. Most (75%) of them started providing such services within the last three years.

Table 4-7 How many days ago did you make the last conference call for your clients? (When was the last conference call?)

Last call	0~1 day	2~5 days	6~10 days	11~20 days	Over 20 days
No.	3	1	5	3	4
Percentage	19%	6%	31%	19%	25%

The frequency of using such video conferencing services is in general very low. There are some office buildings where the video conferencing services are frequently used, but overall the frequency is low. Only 25% of them had their last conference call within the past 5 days. 25% of them had their last conference call over 20 days ago, indicating very low use rate. Office buildings that have high frequency of video conferencing use tend to be those that have a longer history of such service provision operations.

(3) What is the price of the video conferencing renting service?

The prices vary in different venues and according to different choices of services. Choices of connection speed, calling in or out all have influences on the price. The lowest price the author got during the telephone survey was RMB 1000 per hour for calling in.

(4) What are the destinations of the conference calls?

The majority of the conference calls are international calls with primary destinations being US, Europe and Australia. Only one office building out of the 16 (6%) indicated their last conference call was a domestic call.

(5) Who are the users?

Quantification of the results for this question is not possible because most interviewees did not know or could not supply the information of the users. However, some general statements were made by the interviewees. Most of the users of video conferencing are multinational corporations or SME businesses with some foreign investment background. There are also some Chinese business users. Some users already have video conferencing systems within their own companies, but the venue or the facilities are occupied when they choose to use the renting services.

(6) What was the purpose of the last video conference call?

Again, for this question, quantification is not possible because most interviewees did not know exactly about the content of the conference call. However they did provide some information about the purposes. As expected, there is a variety of purposes for using video conferencing renting services ranging from presentations, interviews, negotiations, etc. Some of them are meeting colleagues in the same company, but there are also a significant percentage of users meeting external parties.

(7) How many participants were there during the last conference call and how long did it last?

Most of the video conference calls last 1 to 2 hours with 2 to 3 participants.

4.4.5 Analysis and discussions

Accessibility of smaller organizations

Video conferencing renting services in commercial office buildings are on pay-per-use basis. It is not necessary anymore to make initial investment and buy expensive equipments which in often times smaller organizations cannot afford. With the renting service, video conferencing can be accessed by more organizations including SMEs. Based on the telephone survey, SMEs are evidently one type of users. Therefore this type of services can increase the accessibility of smaller organizations and all the parties in the society to video conferencing technology.

External applications

The previous cases have confirmed that most virtual meetings applications are confined within the organizations' internal use, but in order to scale up the virtual meetings in the society, it is important to have external uses. Video conferencing services in office buildings are also more suitable for external meetings because of its high reliability and professional environment. The survey results suggest that a significant percentage of users meet external parties through this service. As more organizations use this type of services for external meetings, the knowledge and experience for external virtual meetings will gradually be accumulated and the acceptance will also increase.

Potential for scaling up

Such video conferencing services are often provided through a network of commercial office buildings in many cities and countries in the world, which make it very easy for participants in different places to find such a location close to where they are. As the network expands, it will be easier and easier to find such a location and thus increase the convenience and attractiveness of conducting video conferencing in the society.

Product and service systems (PSS)

Renting video conferencing facilities and rooms is selling the function and services that video conferencing equipment provides. By using such services, smaller organizations avoided to buy such equipments and large organizations avoided to invest in additional equipment or meeting rooms. This could help to reduce the environmental impacts brought by video conferencing equipment and the venues hosting virtual meetings. Therefore this type of services also qualifies as product and service systems (PSS).

Gaps for further development

The video conferencing services in office buildings are still constrained in economically developed regions. China has fewer such services than developed countries and the existing services in China are only limited to big cities in wealthy regions.

Based on the survey results, such services in China are very new and people are still in the early stage of the learning curve. Since office buildings with longer history of providing video conferencing renting services tend to be more frequently used, this is a factor why in general the video conferencing services in office buildings in China are used infrequently.

High price could still be a reason why video conferencing services are not very frequently used. Since the typical price for a two-hour video conferencing involving two parties is at least RMB 4000, which is enough for a return air ticket from Beijing to Shanghai and two night stays in a four-star hotel. The price factor might also be the reason that most video conferences lasts no more than two hours.

Another reason for infrequent use of video conferencing renting services mentioned by the interviewees is that many customers still do not know about such services and the benefits. Businesses in China have not developed the habit of using video conferencing and a meeting culture focusing on efficiency is not yet wide spread.

4.5 Case Four: Hunan Rural Area Video Conferencing Applications

4.5.1 Case introduction

This case study is about web conferencing applications in rural areas in Hunan Province in China. Due to the limited time, direct contact and interviews with the farmers in Hunan was not conducted. This case study is mainly based on information provided by web conferencing supplier as well as secondary data from a TV news program[13].

Despite the fast economic growth and rapid urbanization experienced in China in the past three decades, China is still a developing country with the majority people living in the rural areas. Rural residents have been marginalized for a long time creating an apparent urban-rural divide. Basic infrastructure such as electrification and roads are provided in most rural areas, but the rural residents are lacking access to modern infrastructure, education and health care compared to their urban peers. What is more lacking is the information and technology which can help them to get out of poverty.

Hunan provincial government launched a program in 2003 aiming to bring technology to the remote rural areas and promote the rural development in the province. Unlike traditional programs which increase the agricultural extension services by simply increasing the number of technicians and their visits to the rural area, the new program was planned to apply ICT technologies such as telephone helpline, internet, and web conferencing to increase the accessibility of the rural farmers. The program started from some pilot projects including a project in Shaoshan County, which is examined in this case in more details.

4.5.2 Applications in Shaoshan County, Hunan Province

Hunan provincial and local governments made investments to set up public computer centers in townships and villages in Shaoshan. By the end of 2005, there were 72 public computer centers with broadband internet access being established and open for villagers to use for free or at very low cost. Of the 72 centers, 38 are based in village level administrative centers, and 34 are based in schools which are also accessible by the local residents.

There are three main functions of the computer centers. The first function is to provide online information and training programs to the rural residents about agricultural technologies and the market information of agricultural goods. The second function is to provide government services to the rural residents by responding to inquiries about government policies. And the third function is to bridge the virtual communication and online collaboration among the rural farmers and the agriculture experts. A web conferencing system was installed to fulfil this function, through which the farmers can meet the agriculture experts online and ask their advices.

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[13] The web conferencing supplier for this project is V2 Technologies. The TV program is the *Program of Focus* at China Central Television aired on December 30, 2005.

Some villagers from each village are trained to use the computers and the systems. Then they will become designated technicians in the computer centers to help and train the other local residents.

There are currently 35 famous experts and a bunch of local experts in the online expert database. They are specializing in different areas of agriculture ranging from rice growing to poultry breeding. With the help of the computer technician or by themselves, local farmers can call the experts through the web conferencing and meet them online to get advices on various issues directly. The experts are not always online, the farmers can also leave a message and the experts will later respond to it.

There are some apparent positive impacts on the life of the local farmers. It has improved the knowledge and skills of the local farmers and increased their income. A farmer was reported to increase the rice yield by over 60% through planting a new "super hybrid rice" with advice and technical support from the experts. Another farmer significantly increased the scale of duck husbandry with new technology, and sells his products based on the market information obtained online.

4.5.3 Costs and benefits of virtual meetings in Hunan rural areas

At society level, the major costs are public financial investments in the computer centres, the broadband connection and the virtual meetings systems. The benefits are predominantly the social and economic development in the rural area, which increase the welfare of the poor people and improve the social inclusion. Environmentally, the virtual meetings applications are not significantly substituting the business travels from experts or the farmers. Most of the farmers normally do not have the chances to meet the experts by traditional means anyway, so the virtual meetings are completely new channels for the farmers, and are not substituting existing transport. However, the rural agriculture extension technicians might slightly reduce their visits to rural areas.

The environmental impacts of transport by the rural farmers are very low due to their low level of mobility activities. However, as their incomes increase, the farmers will develop higher level of mobility activities. It is difficult to change people's behaviours if they already developed the habit of excessive business travels. But by learning to use virtual meetings at the early stage of the development, the rural residents would be able to get used to virtual means of accessibility and avoid potential excessive transport activities.

At personal level, the costs are minimal but the benefits are huge for the rural residents. This has significantly improved their knowledge and skills, increased their accessibility. The chances of generating more incomes and getting out of poverty are more than otherwise without the technology.

4.5.4 Analysis and discussions

Potentials to scale up

As shown in this case, ICT applications including virtual meetings have great potential to provide solutions for sustainable development. The technology can help to improve social and economic development in rural areas and bring benefits for rural residents and the society at large. It can also provide an early alternative for potential excessive transport in the future without sacrificing the welfare of the people. Since the majority of Chinese population is still living in the rural area, this practice also has great potential to scale up.

Role of public and private sectors

The public sector should make investments in such projects since they provide public goods to the society. Private sectors should also take a more proactive approach to this because the underserved rural poor are also untapped market for them. C.K Prahalad and Stuart Hart (2002) described the Bottom of the Pyramid (BoP) theories and examples about providing products and services to the world's majority of population, the poor people at the base of the Pyramid. They argued that it could be a large opportunity for private enterprises to make profits and also bring radical system changes towards sustainable development by selling to the poor. Many private actors including the virtual meetings products and services suppliers in China have not fully realized the strategic opportunity in the rural areas.

Various ICT applications

In this case, virtual meetings technology is only one type of ICT applications that have been utilized for rural development. Other ICT applications including the most basic online information search, emails and telephone helpline have also played important roles. Nevertheless, for many illiterate rural residents, the virtual meetings are more straightforward and more welcomed by them.

More training and education

Many rural residents still do not know how to operate computers and rely on the technicians to operate. The efficiency will be greatly improved if they can acquire the skills and knowledge for basic operations.

4.6 Characteristics of virtual meetings use in China compared with European experience

The four case studies in China have shown some certain characteristics of virtual meetings applications in Chinese organizations. These characteristics are compared with previous experiences in European organizations and the results are presented in this section. It should be noted that these characteristics are drown from only a few case studies and the generalization may not be accurate. Nevertheless, it could provide some useful materials for future research and debate.

Similar to European experience, virtual meetings can also provide a viable alternative to accessibility for Chinese organizations, and they can substitute business travels. Virtual meetings have enabled more effective communication within SPDB and SEPA without physical travel. For many customers of the virtual meetings renting services in office buildings, they could communicate with colleagues or business partners in foreign countries (in most cases) without flying to that country. Farmers in Hunan rural areas significantly improved their accessibility and social inclusion with the help of virtual meetings. The substitution effects of virtual meetings over business travel are evidently felt in SPDB and SEPA. Loan committee meetings at SPDB traditionally held physically now being held via video which avoided business travel. And the officer at SPDB believes 50% of the business travel can be substituted by video conferencing. SEPA substituted 15% of its meetings and conferences with video conferencing in 2006, and aims to reach 40% in 2007. Officer in Shandong EPB believes as much as 75% of the meetings can be held virtually.

Compared to Europe, the level of personal mobility is still very low in China, and transport sector development also lags behind for many years. A lot of needs for accessibility are unmet for Chinese organizations and individuals. On the other hand, ICT and virtual meetings technology development in China is not far behind Europe. Therefore, the opportunities for accessibility needs being met by virtual meetings are higher in China than in Europe.

However, virtual meetings application in China is still rare compared to European countries such as UK. This is examplified by the fact that there are far less office buildings that offer virtual meetings services in China than in UK for example. This is because virtual meetings development still heavily relies on economic development and a mature commercial culture. Even within China, the distribution of virtual meetings renting services in office buildings is heavily concentrated in economic developed regions in China such as Shanghai and Beijing, where a more mature commercial culture has been developed.

There are still big gaps for more use of virtual meetings within Chinese organizations compared with European best practices. Experience at BT shows a high level of use of virtual meetings which have become a central part of the work life of their employees. In Chinese organizations, the use rate at SEPA in 2006 was once per month. In public studios at office buildings, only 25% of them had their last conference call within the past 5 days. 25% of them had their last conference call over 20 days ago. Even in SPDB where video conferencing has been used for 6 years, the use rate is only 16 per month. The use of virtual meetings is predominantly for internal use and large meetings, indicating the gaps for more effective use patterns such as smaller interactive meetings.

Compared to European organizations, organizations in China seem to have more control than the individuals in decision making on business travel, especially in the government institutions. Business travel has to be approved by project manager in SPDB, but it is relatively easy. Air

business travel in SEPA has to be approved by Director or Deputy Director of a department, who are only under the Minister and vice Minister.

In both Europe and China, financial savings, increased efficiency, time savings, and social inclusion for marginalized groups are important drivers for virtual meetings development. In China the benefit of reducing corruption is also a driver, but environmental concern is not yet an important driver while in Europe it is environmental concern that are driving many organizations adopting virtual meetings.

5 Barriers for more virtual meetings applications in Chinese organizations

Even though virtual meetings applications have a lot of advantages over conventional face-to-face meetings, the use of virtual meetings is still very limited in the society. The applications of virtual meetings in both affluent western societies and developing countries such as China are still far blow the desired level. Furthermore, the existing applications of virtual meetings are not as effective as expected to substitute physical travel and reduce environmental impacts from the transport sector. There are various barriers that impede more use of virtual meetings and effective use of virtual meetings.

Researchers have identified various barriers in the context of developed countries. From the perspective of virtual meetings applications within organizations, Arnfalk (2002) categorized the barriers into four groups: organizational barriers, personal barriers, institutional barriers, and practical barriers. In this section, based on the case studies in this research, these barriers will be tested and further analyzed in a developing country context. Comparisons with European experience are also provided where relevant.

5.1 Organizational barriers:

5.1.1 Corporate business travel culture

Corporations have developed the culture to meet people and solve the problems by travelling. Virtual meetings are still very new for corporations, especially for corporations in developing countries. Most organizations have not gained confidence that virtual meetings could perform the same tasks as business travels thus normally virtual meetings is not within their considerations when making decisions.

Business travel and meeting people in person are helpful building personal relationships. As *Guanxi* (meaning relationship or connection in English) phenomenon is still very important in Chinese society, personal relationships could mean business success, and therefore is strongly encouraged by Chinese organizations.

5.1.2 Corporate business meeting culture

Virtual meetings normally take shorter time and more formal than traditional physical meetings. A similar, mature and formalized meeting culture may help the participants to transfer to virtual meetings more quickly. While less formalized meeting behaviours, procedures and cultures in organizations may hinder the success of virtual meetings. Lack of a common communication platform is also a barrier for inter-organizational meetings (Kogg 2000). China's transform to a market economy have not been completely successful. Chinese enterprises are still in the learning process of establishing effective corporate cultures including the efficient meeting culture. Many enterprises in the less developed region do not have such awareness even. The fact that there are more public video conferencing studios in office buildings in Shanghai, a city with more formal commercial culture, is supporting evidence. Another supporting fact is the lack use of audio conferencing, which is cheaper and more accessible to small companies and companies in less developed regions. In addition, currently in China there are many types of corporations with different background and ownership structure such as MNCs, state owned enterprises (SOEs), joint ventures (JVs) and private

businesses. The heterogeneous meeting culture is certainly a big barrier for extended use of virtual meetings.

5.1.3 Resources and responsibilities allocation

Since virtual meetings are new to an organization, the resources and responsibilities around virtual meetings is often not clear. In the two cases in China about the organizational applications, both have designated technicians to support the virtual meetings. However, lack of designated human resources in branch banks is experienced by SPDB.

5.1.4 Decision making process

Even though in general the decisions to install or not to install virtual meetings facilities are based on the costs and benefits considerations, few Chinese organizations have a formal process of costs and benefits analysis which could compare the two alternatives rationally. In addition, what influence the decisions making is perceived costs and benefits, which might overlook the actual benefits of virtual meetings due to lack of knowledge. In the government institutions in China, decision to invest in virtual meetings facilities normally requires approval from higher level government who might not see the benefits of virtual meetings[14].

5.2 Individual barriers:

Based on a survey of employees in two organizations, Lassen et al. (2006) identified three major individual factors that drive business travel: the networking, the international identity and opportunities to carry out some leisure activity during business travel.

Arnfalk (2002) also identified a number of barriers. In addition to these three barriers, there are barriers including economic losses (travel allowances, duty free goods, frequent flyer points, etc.), the resistance to learn new things, lack of knowledge and skills to manage virtual meetings, and lack of environmental awareness or the knowledge of environmental impacts of business travel.

These barriers also apply to individuals in Chinese organizations to varying degrees. As the personal mobility level in China is still very low, business travels are often perceived by individuals as opportunities for personal development being paid by the employer. The international business travels are especially attractive to Chinese employees since many of them have never been abroad. Even though individuals in Chinese organizations normally has less freedom to make business travel decisions, their desire to business travels still have strong influence in decision making. For example, in some organizations in China, employers may provide international business travels to the employees as welfare. Many employees also seek job positions involving international travel.

Economic incentives for business travels present less a barrier since many business travel expenses are reimbursed in real costs without travel allowance. Nevertheless, benefits such as nice hotel stays, nice food and the frequent flyer points also have impacts on the feelings of the travellers.

[14] Jianping Chu, marketing manager of V2 Technologies. Personal communications.

For some officials at higher level of the government, the loss of opportunities to be nicely treated (and chances of corruption) in the lower level government agencies is also a personal barrier for using virtual meetings.

Lack of knowledge to manage a virtual meeting and resistance to new things are also personal barriers, but organizations also have a role to play here. Training programs can be organized not only for the technicians, but also for the virtual meeting participants.

The public environmental awareness in China is generally very low, therefore the employees do not see the environmental impacts of business travels or do not care.

5.3 Institutional Barriers

5.3.1 Environmental policies

Economic instruments

Market based instruments that introduce taxes and fees on vehicles and fuels can in general increase the cost of physical transport. Since decisions on whether to travel physically or to use virtual meetings are normally jointly made together by organizations and their employees. The economic costs of the two alternatives are still an important factor that influences the decisions. Even though in some cases individual employees make decisions while they do not need to pay for the costs, organizations always care about cutting costs. Therefore, efforts to internalize the external costs of transport sector could in general make virtual meetings a more attractive alternative.

There are various ways to internalize the external costs of transport sector from policy making perspectives, and some governments have been implementing some of them. Adding an environmental or carbon tax on fossil fuels, introduce a congestion charge, create a climate levy on aviation sector, or bring aviation into carbon trading schemes will all internalize some external costs of transport sector. Carbon tax has been implemented in Denmark; congestion charges have been introduced both in London and New York; and the inclusion of aviation sector into carbon trading schemes is in heated discussions in Europe.

In China, a tax on petrol fuels has been discussed for several years but the government still has not decided to impose such a tax because of the fear of slowing down the economy. China is a developing country without mandatory GHG emissions reductions targets, and it is not likely that China will develop a carbon cap and trade scheme very soon. The lack of policy measures, especially the economic instruments to increase the costs of transport sector in China is certainly a barrier for more virtual meetings applications, because if the cheap transport is always there, organizations lack the incentives to switch to virtual meetings from physical face-to-face meetings.

Permitting requirements and mandatory reporting

In many countries an environmental impact assessment (EIA) is required to start a project. There is also an EIA Law in China requiring companies to conduct EIA before starting activities, but focusing on manufacturing or construction projects. The EIA will sometimes assess the environmental impacts of the company owned vehicles for transporting goods and passengers (for example a public transport company), but normally does not assess the travel impacts of their employees. This is because it is highly unpredictable for most companies

(except public transport or logistics companies) and too difficult to make assessment on employee behaviours. Even though this is considered a barrier, it is not likely to be changed.

In some countries such as Sweden, companies are required to report on their environmental impacts regularly. In China, according to the Cleaner Production Promotion Law, the mandatory environmental reporting only apply to those top polluters which are violating national or local regulations and listed by local governments. For these companies, compared to their major pollutions, the environmental impacts resulted from employee travel are normally negligible.

5.3.2 Voluntary initiatives

Environmental Management Systems (EMS)

A lot of Chinese companies have ISO 14001 certified environmental management systems (EMS), which provides them a systematic approach to deal with their environmental impacts. However, ISO 14001 certified environmental management systems do not specify the environmental aspects that should be dealt with, but rely on organizations themselves to identify their own relevant environmental aspects. There are no laws and regulations on climate change in China, and the stakeholder requirements on this issue barely exist. The overall awareness of climate change issue within Chinese organizations is very low. Based on the author's experience of CSR auditing in electronics industry in China, few companies identify climate change as an environmental impact, even fewer companies identify business travel of their employees as an environmental aspect.

In addition, most of the ISO 14001 certified organizations in China are manufacturing companies. There are few service companies or public institutions certified by ISO 14001, whereas it is in such organizations employee business travels are more likely to be identified as an environmental aspect.

Corporate voluntary reporting

Many companies in the world have started corporate voluntary reporting on environmental issues. In recent years, environmental reporting has also evolved into sustainability reporting which not only address environmental issues, but also social issues around the company. Efforts have also been made to introduce a common guideline for all the corporate sustainability reporting, allowing more meaningful comparisons between different companies. The Global Reporting Initiative (GRI) is an example of such efforts. Up to now, GRI has developed three generation of guidelines with the most recent G3 guideline issued in October 2006, and many sector supplements.

In the GRI G3 guideline, two additional environmental indicators (there are core environmental indicators and additional environmental indicators) explicitly include business travel into the reporting scope. The two additional environmental indicators are EN8 (Initiatives to reduce indirect energy consumption) and EN 23 (other relevant indirect green house gas emissions). If companies follow the GRI guideline and report on these two additional environmental indicators, the environmental impacts of business travel will be noticed and considered by the organization.

In China, corporate voluntary reporting is still a new phenomenon. As of April 2007, only six companies in China (excluding Hong Kong) had published CSR reports adhering to GRI guidelines. These companies are predominantly state owned enterprises (SOEs), such as State

Grid Company, China Ocean Shipping Company (COSCO), China Mobile, China National Petroleum Corporation (CNPC), Bao Steel and Dongfeng Peugeot Citroen Automobile Co.Ltd. (DPCA). None of these six companies have reported the two additional environmental indicators in the GRI guidelines which include content on business travels.

Carbon reporting

Due to the rising concerns on climate change issues, some specific reporting schemes were developed focusing on carbon emissions of the corporations.

World Resource Institute (WRI) and WBCSD have developed a GHG protocol for businesses to calculate their GHG emissions. Business travels are explicitly included in the calculation of organizations' GHG emissions. When companies using GHG protocol to manage their climate change issues, they can realize the issue of business travel and start thinking ways of managing it. Whether or not will companies use the GHG protocol to manage their climate change impact depends on the evolution of society awareness on climate change, pressures to businesses from different stakeholders, and policy interventions. But right now, few Chinese companies use GHG protocol or have climate programs within their organizations. BLICC attempted promoting GHG protocol among Chinese corporations, and held a workshop in summer 2006, but the interests among Chinese businesses are low.

On an annual basis since 2003, the Carbon Disclosure Project (CDP) has on behalf of institutional investors requested the world's largest companies to disclose their carbon risks and management practices. The signatories of the CDP had increased to 225 investors representing $ 31 trillion assets in 2006. This is a significant pressure on the companies to consider the risks and opportunities around their carbon management. (ASrIA 2006) Together with various investor engagement activities and regulatory pressure to enhance environmental reporting in Europe and US, many companies in Europe and US have disclosed their information on carbon management by issuing their annual sustainability report including carbon management activities or by answering various questionnaires sent by programs such as the Carbon Disclosure Project.

The awareness of climate change issues and carbon emissions among Chinese firms is very low. In 2006, Association for Sustainable and Responsible Investment in Asia (ASrIA), in collaboration with CDP and Trucost, launched the CDP Asia ex-Japan program and for the first time obtained information on the carbon management of Asian companies, including Chinese companies. The results suggested that there are few Chinese companies that have a policy on climate change and carbon management measures. Out of 39 large companies in mainland China surveyed in this project, only one answered the questionnaire and one provided some information. Two companies declined to participate while there were no responses from the rest of the companies (31). No companies from China in the survey could quantify their carbon emissions. While around 10% of the Asian companies surveyed provided some form of quantification of their carbon emissions. (ASrIA 2006) The results indicated that Chinese companies' awareness on climate change and carbon emissions is not only lower than those in the developed countries, but also lower than the companies in other Asian countries.

Lack of awareness of climate change issues and carbon emissions among Chinese firms, lack of initiatives quantifying their carbon emissions and develop strategies or measures to manage the carbon emissions, impede Chinese firms to realize the significant environmental impacts brought by business travel activities of their employees, and to actively find solutions such as virtual meetings to reduce such impacts. As China is becoming the world's largest GHG

emitters and facing ever increasing international pressures, Chinese companies will also likely be facing more and more pressures. This will likely increase the awareness on climate change and carbon emissions among Chinese firms.

Carbon neutral initiatives

There are increasing numbers of corporations and organizations in the world that have launched carbon neutral programs.

In May 2006, Swiss bank Credit Suisse announced its initiative to make all its banking operations in Switzerland carbon neutral. In June 2006, the World Bank Group announced its commitment to going carbon neutral at its headquarter office in Washington D.C., including office operation, the Spring and Annual meetings, staff commuting, and all operational travel from headquarters. It is estimated that the direct and indirect carbon dioxide emissions every year from the headquarter office is approximately 148,000 metric tons. 60% of the emissions are from operations and 40% from airline travel. In 2006, The UK environmental secretary also announced that the UK government offices will go carbon neutral by 2012. (Anonymous 2006) Germany also announced that from 2007 it will make all trips on government business carbon neutral, which would cost the government 3 to 4 million euros each year. (Reuters 2007) And Costa Rica even aims to become the first carbon neutral country in the world (Herro 2007).

There are some common characteristics for the companies that have launched carbon neutral initiatives. Firstly, most of the companies or organizations are in the service sector or their main functions are to provide services (for example the governments). Secondly, carbon emissions from business travel especially air travel constitute a large part of their total carbon emissions. For these organizations, purchasing carbon emissions offset credits will increase cost for them, adding a price for their carbon emissions. This will create incentives for these organizations to reduce their carbon emissions to save costs. Business travel especially air travel will be easily sorted out as a target and virtual meetings will become a more attractive option. That is why many of the organizations with carbon neutral initiatives have invested in virtual meetings facilities and actively promoted virtual meetings within their organizations. Carbon neutral initiatives are important drivers for more use of virtual meetings.

Currently there is no organization in China with carbon neutral initiatives, thus lack of such initiatives presents a barrier for more virtual meetings use in China.

Frequent flyer programs and carbon offset programs

As Arnfalk (2002) discussed, the frequent flyer programs could be seen as an external institutional influence which may increase air business travels. Because the travel expenses are paid by employers of the business travellers but the bonus points/trips generated from that belong to the business travellers themselves, which can later be used for private purposes. This is certainly a stimulus for employees to travel more by air.

A countering trend is that some airline companies have begun to recognize the importance of climate change and introduced carbon offset programs for air trips. Sometimes airline companies allow the travellers to contribute certain amount of money to invest in carbon offsetting programs such as planting trees or renewable energy generation. Sometimes, the airline companies also cooperate with organizations to offset the carbon emissions generated by air business travels by their employees. Some activists even suggest that the airline companies should use labels in the airplanes to warn the passengers about the environmental

impacts of air travel. These activities can to some extents increase the cost of air travel and enhance the environmental awareness of passengers, but due to the voluntary nature, the take up of these programs are very low.

In China, all the major airline companies have frequent flyer programs to encourage people travel more by air. However, there is not any carbon offset programs or climate change awareness raising programs launched by airline companies. This is an important barrier to lower the attractiveness of air travel and promote its virtual alternatives.

5.4 Practical barriers:

The practical barriers for an organization to use more virtual meetings identified in earlier studies (Arnfalk 2002) on organizations in developed countries also apply to organizations in China to varying degrees.

The **limited availability** of virtual meetings equipments and meeting rooms are experienced in the case of SPDB, where the use of virtual meetings has been wide spread within the organization. However, in the case of governmental institutions, this is a less problematic due to the limited use of virtual meetings. As for the case of virtual meetings studios in office buildings, it is a mixed picture. On the one hand, there are very few office buildings in China that have such virtual meetings rooms to provide virtual meetings services, indicating a limited availability for organizations in the society to use such facilities. On the other hand, the existing virtual meetings renting services in the office buildings are rarely used and there is still space to allow a lot more use of virtual meetings.

Insufficient telepresence was also mentioned as a practical barrier (Arnfalk 2002) with participants of audio conferencing complaining about the feeling of alienation and insufficient telepresence. Based on the cases in China, users in China also share a general feeling that the audio conferencing can only generate limited telepresence. Even with video conferencing, the telepresence is not sufficient enough to allow very interactive communications.

Poor reliability is also a practical barrier and sometimes creates significant psychological barrier for the users to use more virtual meetings. In the cases from China, people are very careful when considering virtual meetings as an option for important meetings (for example meeting supervisors or bosses, or clients). Unless they are sure about the reliability they will not use virtual meetings for important meetings. Some failure experiences in using virtual meetings can create long lasting psychological effects. Even though the reliability of virtual meetings has improved significantly, people still tend to be sceptical about it.

The **virtual meeting environment** such as the lighting in meeting rooms and other practical matters including tables and chairs is not mentioned by the interviewees from case studies in China, probably because users in China have not expected virtual meetings to be a really high quality thing with every thing perfectly arranged. But this is a perception that hinders more use of virtual meetings in high level business meetings. If the details of the virtual meetings environment can be better arranged, it will change the perceptions of people and become to view virtual meetings a fashion of doing business. This will significantly increase the attractiveness and subsequently more use of virtual meetings. Video conferencing studios in office buildings in China present a solution but the use rate is still low partly due to high prices.

5.5 Success Factors for Chinese organizations to implement virtual meetings

The following is a brief summary of the factors for a Chinese organization to successfully implement virtual meetings.

1. **Top management support** is essential for successful application of virtual meetings implementation. It is the top management who will make the decision to invest in virtual meetings system. Top management's championship in using virtual meetings can change behaviours of other staff members.

2. **Clear targets and control** can help with implementation. The Minister of SEPA set up clear targets on how many conventional conferences and meetings should be substituted by video conferencing, which is important for successful implementation. It is also important to have a control mechanism to ensure the targets being met. There is a conferences and meetings office at SEPA performing such roles.

3. **Try it!** In the case studies conducted by Lassen et al. (2006), employees in HP who have more opportunities to participate in video-conferencing are more optimistic about the potential that virtual communications can reduce the physical business travel, even if they consider the video-conferencing equipment is old and the quality is not satisfactory. In both case companies that were surveyed in the study, respondents who have tried the virtual meetings are more likely to use it for communication. This indicates that the knowledge and experience with virtual-conferencing is important for people to accept it and use it to reduce business travel.

4. **Bare it!** Technology is not perfect. Compared to various difficulties with business travel, people tend to be less tolerating to difficulties of virtual meetings. SPDB experienced some failures in using video conferencing in the beginning, but this did not stop SPDB to continue using video conferencing. Allowing mistakes for new things, learning from mistakes and continuously trying to better use the technology are all important factors that helped SPDB through the difficulties.

5. **Allocate resources and define responsibilities** can ensure the practicalities of virtual meetings being addressed. Bothe SPDB and SEPA have designated staff in charge of maintaining virtual meetings facilities.

6. **Corporate social responsibility (CSR) or environmental initiatives** can contribute to the successful implementation of virtual meetings by creating employee morale to support the initiatives. If employees think that the motives for the employers to promote virtual meetings are only to cut cost and increase productivity, their willingness to actively participate in the program will be less than if there would be environmental arguments for the program. As discussed previously in this paper, employees also play important roles in making decisions about business travel and use of virtual meetings, the employee morale and endorsement to the program are important for the successful implementation.

7. **Training and promotion** activities should be organized. Training should not only be provided to the staff in charge of the facilities, but also the meeting participants.

6 The need for more actors to promote system changes

Based on the experience of organizations on virtual meetings in Europe and China, the virtual meetings applications are win-win solutions in most cases. Not only environmental benefits are achieved, but also economic and social benefits for the organizations. Virtual meetings grow 20-30% annually in China. The question is do we need interventions for such a win-win solution. The answer is yes because the win-win solutions also need to be scaled up to make more contributions. And the 20-30% annual growth rate is simply not fast enough, especially compared to nearly 80-90% annual growth of car sales and production in China.

Organizations and individuals do have important roles to play in adopting more virtual meetings, but it is not realistic to only rely on organizations and individuals themselves to change their operational behaviours. To promote the virtual meetings applications in the society, various actors should take more proactive approaches.

Based on literature policy research and some interviews, this chapter outlines the suggested approaches for a number of actors in Chinese society including government policy makers, the virtual meetings vendors, investors and NGOs.

System level changes require new actors and new players. This research has identified some new players such as the commercial real estate sector that provides virtual meetings renting services, the brokers that facilitate the booking and scheduling of virtual meetings. Their roles are also highlighted in this chapter.

6.1 Policy makers

6.1.1 Virtual meetings should be included in the "soft measures" of transport policy.

The soft transport policies refer to improving the quality of the alternatives to car and increasing the attractiveness of these alternatives. This also includes providing entirely new opportunities or alternative ways of doing things such as virtual meetings. (Cairns 2004) Soft transport policy is contrasted with hard measures of transport policy which only focuses on the infrastructure.

Soft measures have been adopted by many central and local governments in the world. A UK government report *Smarter Choices—Changing the Way We Travel* (Cairns 2004) has described the potential of "soft policies" in transport policy. Teleconferencing and other ICT applications such as teleworking and home shopping are included as a type of "soft" transport policies in the report. The report argues that soft measures could play an equal or even more important role compared with "hard" measures such as infrastructure expansion. It estimates that soft measures could cut urban traffic by 21% in peak hours and 14% peak-time traffic in non-urban areas, and reduce the UK overall national traffic levels by 11% within 10 years. (Cairns 2004) The report also calls government for public investment on these soft measures, focusing on the specific reasons why people travel and finding alternatives for them to fulfil their needs.

Chinese transport policy makers have traditionally only focused on the hard measures of transport policy, always try to solve problems by building more roads and bridges. As there are more and more challenges from the transport sector, policy makers should also consider soft policy measures to meet such challenges. Since virtual meetings activities are dependent on the

behaviors of all kinds of organizations in the society, it is impossible for transport planners to exert direct control. The role of governmental transport agencies would be to encourage, advise, liaise and monitor such virtual meetings activities.

6.1.2 Efforts should be made to internalize the external costs of transport sector

Currently the external costs of the transport sector, especially the aviation and road transport are not internalized. So the prices of such transport activities are not reflecting their real costs. Since price is an important factor when rational consumers compare different options of activities that can achieve the same goals, this has made physical transport a more attractive option than virtual meetings in many circumstances.

Taxes and other market based economic instruments should be considered more favourably to address the various environmental problems brought by the transport sector. Such policies and measures will not only put pressure on transport sector to address their environmental problems, but also create economic incentives for other sectors such as ICT sector to innovate low carbon services. In this context, virtual meetings services providers will be more motivated to invest in research and development, to provide services with better qualities helping their customers to achieve effective communications comparable or even better than physical face-to-face meetings.

6.1.3 Improve broadband infrastructure and develop common standards

Broadband infrastructure is very important for virtual meetings applications. Firstly, voice over internet or voice over IP (VOIP) services can reduce the cost of voice conferencing and thereby make it more widely accessible. Secondly, broadband especially the high speed broadband makes video conferencing both technically more feasible and economically more affordable. And thirdly broadband connections also enable web conferencing which allows users share documents and transfer data in addition to audio and video conferencing. This makes it easier to form virtual teams and collaborate online. All in all, broadband internet can reduce the cost of virtual meetings and increase its affordability. It can also improve the quality and enhance the functions of virtual meetings. As more and more virtual meetings is converged over the internet protocol, broadband is becoming a more important enabler for virtual meetings to increase its attractiveness and compete with traditional face-to-face meetings.

China's telecommunication infrastructure has been significantly improved since the mid-1990s. By the end of 2005, there were more than 740 million fixed and mobile telephones in China. There were also nearly 50 million computers connected to the internet serving 111 internet users, half of whom are broadband users. (Qiang 2007) The market has also been opened for competition which has resulted falling of prices. All of these have provided a solid ground for ICT applications such as virtual meetings. However, despite the progresses that have been made, the ICT infrastructure in China is still less developed compared to many other countries in the world. The ICT infrastructure penetration rates in China remain low relative to Brazil, Russia, other Asian countries and high-income countries. The price of the broadband accounts for 10% of the household average income, and this is 10 times higher than some developed countries. (Qiang 2007) As Indian government announced the free broadband plan for all citizens, Chinese government should also take more proactive actions to reduce the price of broadband.

To scale up the virtual meetings use in the society, a common standard is necessary to make it possible for different products connecting together easily. While the standard for video conferencing equipment exists, the standard for web-conferencing software is still lacking in China. As web-conferencing has the potential to develop faster and integrate both audio conferencing and video conferencing, it is important for the government to develop a common standard.

6.1.4 Promote government use of virtual meetings by e-government strategy, green public procurement, and new urbanization policy.

China has implemented the e-government strategy which promotes the government use of ICT technologies to increase the government efficiency. Virtual meetings should be included as part of the e-government strategy.

Green public procurement practice has just started in China, which currently only focuses on the environmental impacts of the products. Virtual meetings equipment or services that could contribute positively to the environment are not included in the scope of green public procurement considerations.

Government institutions could also promote use of virtual meetings for the reasons of eliminating excessive meetings and increasing efficiency, and reducing the corruption chances. Use of virtual meetings in government institutions could also stimulate the use of virtual meetings in other sectors in the society.

China is experiencing rapid urbanization. Urban planning thus presents great opportunity to make urban transport sustainable before the construction of the cities starts. Virtual meetings services offered to the public on a fee per usage basis could be planned for the new urban development. Virtual meetings facilities are planned for the eco-city project in Dongtan, Shanghai for example[15]. Telework centers with virtual meetings features could be developed as alternative workplaces close to home, where people from different organizations can work together. Telework centers have been popular in some parts of United States and Europe. For China there are no such telework centers, but in the future it could be an option for cities to manage their transport issues.

6.1.5 Promote ICT services in rural areas and increase social inclusion

The ICT infrastructure between urban and rural areas in China is vastly different. ICT infrastructure in rural areas lags far behind the urban areas which can be described as an urban-rural divide. In 2003, the fixed phone line penetration rate was 3 times higher in urban than rural areas; Internet penetration was nearly 40 times higher. In the same year, about 28 percent of urban Chinese households owned a PC, contrasted with only slightly more than 1 percent of rural households owned a PC. (Qiang 2007)

The Hunan rural case study has showed that there are multiple benefits to provide ICT services in rural area and increase their accessibility. This is also in line with government strategy for a more balanced development in China, and poverty alleviation strategy, and solves the problem of "digital divide" and "social exclusion".

[15] Shanfeng Dong, Project manager of Dongtan Ecocity project, Arup. Email correspondence April 19 2007.

6.2 Investors

Institutional investors in China should increase their awareness on climate change and push businesses for change. To increase the number of listed companies that account and disclose their carbon emissions is often seen as the first step.

Venture capital investment has been a major driver for the development of IT industry, but it is not clear how many of them consider environmental issues when making decisions to invest in IT companies. Cleantech venture investment has been growing very fast, and there is an "environmental IT" category within the cleantech sector, but it is only account for 4% of the total sector. (Parker 2006)

Investors have a large role to play in the economy. By making investment, they could encourage new business models and innovative solutions that contribute to sustainable development in the society.

6.3 Various business actors along the value chain of virtual meetings

6.3.1 Innovate with technology and product and service systems (PSS)

Equipment suppliers and software designers can make innovations, improve the sound and picture quality, increase the functions and make it easy to use. Such innovations could make virtual meetings more attractive and present real alternative. They could also provide leasing and renting services to less frequent users and increase the access of smaller organizations.

Commercial real estate companies could learn from Regus to provide rented virtual meetings studios in the commercial buildings they manage. Professional brokers providing booking and scheduling services are also important to make the process of holding virtual meetings easier.

Telecommunication operators can use the virtual meetings technology and package with their other services to provide new attractive solution for the customers. Virtual meetings will benefit from telecommunication operators' extensive sales network.

6.3.2 Consumer education and green marketing

Virtual meeting is still a new thing to many people and organizations. The concept is easy to understand, but the benefits and implications of virtual meetings are normally less known by consumers.

Various actors along the value chain of virtual meetings business should actively provide information on the benefits of virtual meetings, including the economic savings, time savings, management efficiency, as well as environmental benefits.

Using environmental arguments to market their products and services will not only create a good image of the products and services but also enhance environmental awareness among the consumers. The environmental benefits should not be exaggerated, however, during the marketing.

6.3.3 Leading by doing

A good way for companies to persuade customers to use their products and services is to prove it by using the product or service by themselves. By using virtual meetings themselves, various actors along the value chain could not only advance their management efficiency and reduce environmental impacts, but also attract more customers to use the product or service. Companies such as BT and HP has led the way to use their own products and generated positive results.

6.3.4 Corporate lobbying

ICT sector would benefit in general if the externalities of energy such as carbon emissions were properly valued in the economy, because ICT sector itself is not very energy and carbon intensive. It will also increase the value and need for ICT services to replace carbon intensive activities. For example, a price on carbon will increase the cost of travel and increase the value of virtual meetings and other ICT applications that can substitute travel.

This has put ICT companies including the ones that provide virtual meetings solutions a unique position to lobby for carbon emissions legislation. By doing so, it will not only benefit their own companies, but also the planet and future generations.

Some believe that the future corporate changes will come from the ICT sector rather than the old industries. ICT companies are becoming more and more powerful, which can be exemplified by the fact that the combined profits of all the world's car manufacturers are less than those of Cisco and Microsoft. When were asked about the likelihood of future legislation on carbon emissions in US, a senior US EPA official even stated that "if Intel & Cisco were to campaign across US for carbon tax or cap and trade, they would get what they wanted". (Webb *et al.* 2006)

Some world's leading ICT companies such as BT have started their activities on raising awareness about climate change and lobby for a more proactive approach for carbon emissions. BT has been pioneering in addressing the relationships between telecommunications and sustainable development through their sustainability reports, topic papers, research projects and various events advocating that virtual meetings is a way to help addressing climate change issues. Other virtual meetings suppliers such as WebEx and Tandberg have also launched activities raising awareness on climate change and make the linkages between their products and services and carbon emissions.

Chinese virtual meetings suppliers and companies in ICT sector in general have yet to understand more about the linkages between their products & services offerings and climate change and environmental benefits. The only initiative by virtual meetings solutions vendors identified during this research was from V2 Technologies LtD., which advocated resources conservation in China and the role of virtual meetings to make savings. Even though the political system in China is vastly different with that of the western countries, companies can still play important roles in influencing government decisions. Chinese virtual meetings suppliers and other ICT companies should support a more proactive policy towards climate change and environmental protection in China.

6.4 NGO community:

NGOs are the change agents in the society. NGO is still weak in China, but the environmental NGOs are very active. There are activities organized by NGOs around sustainable

development of the transport sector, especially focusing on the environmental impacts of the private cars. However, soft measures such as virtual meetings has not been realized or promoted by the NGOs.

WWF has been advocating the ICT linkages with sustainability and climate change. Audio conferencing and video conferencing are mentioned by its new report *Saving the climate @ the speed of light* (WWF 2007), but its activities on ICT and environment have not yet well developed in China.

In countries like UK, there are many environmental NGOs that have advocated the use of ICT including virtual meetings as alternative means to reduce transport related environmental impacts. Examples include Forum for the Future and SustainIT. There are even NGOs specifically focusing on promoting virtual meetings. The Meeting without Moving Foundation (MWMF) is such an organization which advocates the use of collaborative technologies such as video conferencing in the work place as an effective and environmentally friendly alternative to unnecessary business travel, therefore significantly decreasing the amount of CO_2 emitted by business. The Meeting without Moving Foundation (MWMF) is also active in lobbying and participating policy making process in various government departments. (ROSPA 2007)

Besides policy lobbying, NGOs can also organize awareness raising campaigns to promote virtual mobility as an alternative to business travel, and to reach various organizations in the society and the general public.

6.5 Joint efforts on R&D

There is a general lack of research and development about virtual meetings in China. More R&D investments should be made by the government and industry to reduce the price of the technology and increase the quality of the technology in better meeting people's need for communications. This will increase the attractiveness of the virtual meetings enabled meetings over long-distance travel enabled meetings. In addition to the technology of virtual meetings, it is also important to have more interdisciplinary research focusing on the sustainability aspects of this type of technology.

In Sweden, a Center of Sustainable Communications was recently established at KTH (Royal Institute of Technology), funded by VINNOVA (The Swedish Governmental Agency for Innovation Systems), KTH and partners from Swedish industry and society. The Centre aims to develop innovative applications of media and communications technologies that can contribute, directly or indirectly, to sustainable development by enabling collaboration, interaction and communication exchange between people in different locations. Furthermore, the Centre aims to develop innovative user–oriented services, products, environments, business models, methods and tools. Partners include Ericsson, TeliaSonera, Bonnier AB, Swedish Newspapers Publishers' Association, the National Board of Housing, Building and Planning, Joltid AB, Community Hub Foundation, Stockholm Innovation and Growth, and Swedish National Road and Transport Research Institute.[16]

As can be seen from the project partners for this center, ICT companies and transport research institution are now working together to research sustainability aspects of

[16] For more information about the center for sustainable communications, visit: http://www.csc.kth.se/sustain

communication technology. The government, academics, ICT companies and transport research institutions in China could learn from this experience and form similar joint research initiatives.

7 Conclusions

This thesis aimed to further the discussions of virtual meetings and its implications on sustainable development in a developing country context--China. It is intended to find out what are some characteristics of virtual meetings in China compared with European experience? What are the barriers and success factors to implement virtual meetings in Chinese organizations? And moving beyond a single organization, what are the approaches should different actors take to promote using virtual meetings in China?

1. What are the characteristics of virtual meetings in China compared with European experience?

Some characteristics of virtual meetings in China were identified based on four case studies including one telephone survey about virtual meetings use patterns. These characteristics are compared with European experience base on previous studies.

- It was found that similar to European experience, virtual meetings can provide a viable alternative to accessibility for Chinese organizations. The substitution effects are dominant in the case studies, similar to previous studies in European organizations.
- There are more opportunities for virtual meetings to be used to achieve accessibility in China than in Europe because of the low level of development of transport sector in China.
- Virtual meetings applications in Chinese society still lag behind Europ, since they still heavily rely on economic development and formalization of commercial culture. Within Chinese organizations, there are still big gaps for more use of virtual meetings compared with European best practice companies, including those companies considered best practices in China.
- Compared with European organizations, organizations in China seem to have more control than the individuals in decision making on business travel, especially in the government institutions.
- Major drivers for adopting virtual meetings in both European and Chinese organizations are financial benefits, increased efficiency, time savings and social inclusion. While reducing corruption is more relevant in China and environmental concern is more apparent in European organizations.

2. What are the major barriers for more use of virtual meetings in China and what are the success factors?

The main barriers for more use of virtual meetings in China are grouped into four categories, the organizational barriers, the personal barriers, the institutional barriers and practical barriers. The organizational barriers include the corporate business travel culture, corporate business meeting culture, lack of resources allocation and responsibilities definition, and non-rational factors of decision making processes. The personal barriers mainly include the fact that business travels especially international business travels are perceived as a great opportunity in China. Loss of economic benefits, cultural experience and even corruption chances is also a barrier. Lack of knowledge and skills on virtual meetings as well as low level of environmental awareness also hinder more use of virtual meetings. Practical barriers center on the limited availability, insufficient telepresense, poor reliability and meeting environment. Institutional barriers are mainly the facts that virtual meetings are not addressed enough either by environmental policies or voluntary initiatives.

Of these four categories of barriers the organizational barriers and institutional barriers are more important as policy interventions can be designed towards them. Interventions on institutional barriers are addressed in research question No.3, and the organizational barriers are addressed by presenting some success factors that could contribute to overcoming the barriers. The major success factors summarized in this research are top management support, clear targets and control, accumulation of experience about virtual meetings and toleration of some possible difficulties. To be a successful organization on virtual meetings, it should also allocate resources and define responsibilities, organize promotion and training activities. CSR and environmental initiatives may also help since they can improve the employee morale and gain their support.

3. What approaches should be taken by different actors, particularly policy makers, virtual meetings business chain, investors and NGOs to encourage utilizing virtual meetings in China?

To encourage more use of virtual meetings, policy makers should

- Consider including virtual meetings in the "soft measures" of transport policy.
- Make efforts to internalize the external costs of transport sector.
- Improve broadband infrastructure and develop common standards
- Promote government use of virtual meetings by e-government strategy, green public procurement, and new urbanization policy.
- Promote ICT services in rural areas and increase social inclusion

Institutional investors in China should exert more pressure on companies to demand reporting on environmental management, and venture capitalists should consider more about environment when investing in ICT, or consider more about ICT when investing in cleantech.

Various business actors along the value chain of virtual meetings should all innovate with better technology solutions, qualities and business models to increase the attractiveness of virtual meetings. Product and service systems (PSS) are particularly important as leasing, renting and sharing services are efficient and more scalable. They should also provide consumer education about the various benefits of virtual meetings, including the environmental benefits. Corporations should lead the way by using their own products and services and promote the policy change towards better environment for virtual meetings use.

As the change agents of the society, NGOs should also actively advocate for virtual meetings by awareness raising campaigns and policy lobbying. Finally joint efforts on research and development of virtual meetings should be promoted.

Future research can be developed focusing on testing some specific characteristics of virtual meetings in China summarized in this research, or focusing on more detailed studies on the roles of a specific actor in the society, e.g. investors.

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Appendix I List commercial office buildings that provide video conferencing services in Mainland China surveyed in this research

Beijing Lufthansa Center

Beijing Kerry Center

Beijing China Life Tower

Beijing NCI Center

Beijing Pacific Century Place

Beijing Tongtai Building

Beijing China Resources Building

Shanghai One Corporate Avenue

Shanghai Oriental Center

Shanghai Regus Bund Center

Shanghai Regus Silver Center

Shanghai Shui On Plaza Center

Shanghai Far Eastern International Plaza

Shanghai Xintiandi

Shanghai China Merchants Tower

Shanghai Jinmao Tower

Shanghai Portman Ritz-Carlton Hotel

Guangzhou Regus Center Plaza

Guangzhou Teem Tower

Shenzhen Anlian Center

Shenzhen Shangri-La Hotel

Dalian World Trade Center

Tianjin Zijinshan Road Center

Appendix II List of Interviewees

Chris Tuppen, British Telecom, Email correspondence, April 5, 2007

Jianping Chu, Marketing manager, V2 Technologies. Email correspondence and personal communications. Several occasions.

Dafeng Wu, Information Office, SPDB. April 28, 2007.

Xia Gao, CSR officer, SPDB. Several occations.

Zilong Li, the information office at SEPA, April 5, 2007.

Anonymous, the meetings management office, SEPA April 15, 2007

Mr. Liu, section chief, information center of Shandong EPB, April 9, 2007.

Yvonne Zhang, Regus Shanghai video conferencing sales manager. May 12 2007.

Shanfeng Dong, Project manager of Dongtan Ecocity project, Arup. Email correspondence April 19 2007.