

Organisational effects of virtual meetings

How can we gain from fewer handshakes?

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Thesis for the fulfilment of the
Master of Science in Environmental Management and Policy
Lund, Sweden, September 2012

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Published in 2006 by IIIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
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ISSN 1401-9191

Acknowledgments

A few years ago, after more than ten years of work in private industry, I decided to make a real effort to change direction in my work life as well as personal life. My plan was, and still is, to take greater responsibility and help contributing to the conversion to a more sustainable society. So, after two fantastic years of studies at the IIIIEE, retiring some old paradigms and uploading some new, I'm now ready to go out there and shake something up.

First of all, a great thanks to my supervisors, Peter and Oksana, for letting me into the project and serving me with a smörgåsbord of ideas, contacts, information and also constructive feedback. I sincerely hope you will find some useful bits and pieces for the future in all this text. I would also like to thank all the people that were interviewed for this thesis for generously lending their precious time. I was positively surprised at your willingness to help me out in my search for answers.

Thanks also to all the fantastic staff and teachers at the institute. You're doing a marvellous job with this program, and you really succeed in building this special and familiar feeling at the institute. Keep up the good work, and keep batching out. To all my friends in the BBE: thanks for the great time together, for all the laughs, the parties, the games, the discussions, the learning. Sorry about being Rabbit a bit too often, thanks for helping me to be more Pooh.

These two years of studies would not have been possible without the support of my wonderful, amazing wife, Maja, my own personal coach and also my very best friend. Thanks for being you.

Finally I would also like to thank my parents, Lasse and Eva, and also my wife's parents Ulla and Nisse, for all the support you give us and for loving your grandchildren.

Abstract

Virtual meetings and virtual collaboration technologies are applications where ICT could potentially be used to green business activities. There are, however, uncertainties and disagreements about the organisational effects of increased use of these technologies, which makes it difficult to measure and follow up on outcomes.

This thesis explores the potential effects that virtual meetings and virtual collaboration may have on an organisation. It does so by examining the presence and strength of these effects in a number of Swedish organisations, both public and private. Information has primarily been collected through literature review and a number of in-depth interviews with employees in the organisations studied. The interviewees selected all have substantial knowledge and experience from using virtual meetings and virtual collaboration. The results are analysed with a special focus on seeking explanations for diverging opinions among the respondents and literature. Suitable indicators for measuring selected effects are also suggested.

The findings indicate that the organisational effects of virtual meetings and collaboration depend on a number of factors. The effects are to a large extent determined by the organisation's capability to set up and communicate goals with its virtual work methods. Moreover the impact of these meetings depends on how the organisations succeeds to support these goals with policies and training that will in turn contribute to a change in meeting and collaboration culture. Also, the effects depend on the virtual maturity of the organisation, i.e. the length and degree of use and diversity of the collaborative tools.

The author suggests a number of indicators and methods that could be used for measuring the effects of virtual meetings. The selection of indicators to measure and follow up on depends on what the organisation has set out to achieve with its virtual work methods.

Keywords: virtual meeting, virtual collaboration, green ICT, substitution, rebound effects, travelling, meeting efficiency.

Executive Summary

According to an often-quoted estimate from Gartner Group, information and communication technologies, ICT for short, is accountable for some 2% of global GHG emissions (Gartner Group, 2007). However, apart from its inherent emissions, ICT also have the potential to change the environmental impact in other fields. For example, applications of ICT can be used to decrease energy use in buildings and transportation. The potential effect of better use of ICT in other areas, have been estimated to a reduction of 7.8 GtCO₂e of emissions in 2020 (GeSI, 2008).

The Swedish government has decided on a strategy to decrease the environmental impact of its own activities by the help of ICT. To achieve this goal, the government is delegating responsibility for use of green ICT to its public authorities, through the annual appropriations. Among other things, the authorities are suggested to replace travelling with virtual meetings, which is expected to contribute to decreased GHG emissions from business travelling (Regeringskansliet, 2010).

Thus, the government assumes that decreasing emissions is an effect of increased use of virtual meetings. However, this assumption is not undisputed. There are also divergences in opinions over a number of other organisational effects of increased use of virtual meeting and other types of virtual collaboration. The problem is that we have a gap in our knowledge about the full organisational effects of virtual meetings and how these effects should be measured in an effective way. We also have not been able to explain why there are considerable disagreements about some of the effects.

Better understanding about the potential effects of virtual meetings and explaining the underlying reasons to why there are disagreements about them will help us to understand how an organisation can define a strategy for implementation that will lead to the positive effects. In this thesis the author tries to establish what the potential organisational effects of virtual meetings are by help of literature analysis and empirical data. The author also discusses possible indicators to be used for measuring and monitoring these effects.

As a basis for analysis the author has chosen a framework that has been developed in a research project at the IIIIEE, the TERM model (Arnfolk, 2012). This framework explains the potential organisational effects of virtual meetings in four different areas related to the organisation's goal achievement effectiveness: organisational structure, staff, efficiency and sustainability requirements. In order to measure the expected effects of virtual meetings and to ensure that we gain from their use, we need to make use of indicators that are effective and practical to use. The TERM model also contains a number of suggestions for indicators and collection methods that can be used to measure and follow up on the potential effects.

An analysis of existing literature and a review of empirical data quickly reveal some of the disagreements about what the organisational effects of virtual meetings are. Opinions diverge about how meeting efficiency, gender equality, cost savings, employee satisfaction and working methods are affected by virtual work. On the other hand, there is a great consensus about other effects: meeting culture will be affected, availability will increase, use of existing internal and external competencies will improve, and employees will be able to work more flexibly in space and time.

To discuss virtual meetings as isolated phenomena is not quite relevant. In order to understand the full scale of organisational effects, the virtual meeting has to be put into a larger context that involves all types of virtual collaboration tools. The related computer-mediated communication technologies enable not only meetings but also asynchronous

cooperation and fluid workspaces. In combination, the synergetic effects of all these virtual work methods will be greater than the effects of virtual meetings alone. In the long run virtual collaboration will lead to major changes in organisational processes and ways of working and even become an inherent feature of the organisation itself.

The potential effects of virtual meetings and virtual collaboration are dependent on a change in behaviour of the organisation's members. This change can be achieved through clear ownership of travel and meeting issues, clear policies and adequate training. More important, the organisational effects that can be expected depend on the virtual maturity stage of the organisation. In this thesis, the author presents a theoretical model that defines three different stages of maturity: *substitution* stage, *diffusion* stage and *integration* stage.

In the substitution stage, business is run as usual but an early introduction of virtual meeting technology makes it possible to replace some physical meetings with virtual meetings, primarily for practical reasons. The resulting reduction in business travelling will contribute to cost savings, release work time and reduction in emissions. Internal and external use of competencies will be more efficient and some employees will experience a change in their possibilities to control work-life balance. Key performance indicators to measure and monitoring include total meeting costs, travel costs and time, travel time, emissions and employee satisfaction with the job conditions created by virtual meeting capacity.

In the diffusion stage, existing work routines and processes are still unchanged, but virtual meetings are accepted and promoted as a preferred method of working. The value of meeting and working virtually is acknowledged and supported by training initiatives. In this stage we will see a large effect on the organisation's meeting culture and a spread of effects on employee satisfaction levels. Costs and emissions are still interesting points of measurements, since virtual work methods are spreading through the organisation. It is also interesting to start looking for increased meeting efficiency and productivity.

In the integration stage, virtual meetings and virtual collaboration tools and work methods are fully integrated into our processes, and necessary for the organisation to keep up its activities. In this stage, objectives like reducing travelling and its associated costs and effects have become irrelevant since we no longer have a working baseline for comparison. The initial increase in flexibility and availability is irrelevant. Employee job satisfaction levels have also lost some of its relevance. Instead, the organisation will see effects on its employer branding and thereby its capability to recruit and retain the competency it needs, and also improvements in productivity, due to changed work processes.

The technological push for more virtualised organisational structures and work methods is very strong. To be able to gain from this development an organisation must define a clear strategy and set out the goals for what it aims to achieve with increased use of virtual collaboration. Policies, guidelines and business rules have to be set up, communicated and explained to the co-workers. Balanced scorecards or other steering artefacts must be supplemented with new targets. Requirements will be used to acquire, configure or develop the systems and solutions needed. Finally, but not until now, we need to decide on and start measuring the indicators that will be used to ensure that the organisation is on track.

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Abbreviations

AC	Audio conferencing
CDP	Carbon Disclosure Project
CMC	Computer Mediated Communication
CO ₂	Carbon dioxide
EEA	European Environment Agency
EPA	Environmental Protection Agency
EU	European Union
EUR	Euros
FTE	Full Time Employee
GHG	Greenhouse gas(es)
GtCO ₂ e	Gigaton Carbon Dioxide Equivalent
ICT	Information and communication technologies
IIEE	International Institute for Industrial and Environmental Economics
IPCC	Intergovernmental Panel on Climate Change
KPI	Key Performance Indicator
MEUR	Million Euros
MSEK	Million Swedish Kronas
Ppm	Parts per million
REMM	Travel-free Meetings in Public Authorities ("Resfria Möten i Myndigheter")
ROI	Return on investment
RSS	Rich Site Summary
SBTA	Swedish Business Travel Association
TCP/IP	Transmission Control Protocol/Internet Protocol
TERM	Possible Effects of Virtual Meetings ("Tänkbara Effekter av Resfria Möten")
USD	U.S. Dollars
VC	Videoconferencing
VoIP	Voice over Internet Protocol
VM	Virtual meeting
VPN	Virtual Private Network

1 Introduction

1.1 Background

The Intergovernmental Panel on Climate Change, IPCC, has concluded that the existence of global warming is an undisputable fact, and that it is largely due to an increase in concentration of greenhouse gases. IPCC also states that it is very likely that this increase is, at least to some extent, caused by anthropogenic activities (IPCC, 2007, pp. 2-12). The Stern review on the economics of climate change, commissioned by the British government and released in 2007, discusses the effects of global warming on the world economy. The conclusion of the report is that continued global warming will have serious, negative effects on human life and on the environment, already at moderate levels (Stern, 2007). In order to mitigate the negative impacts expected from climate change, governments and businesses must, among other things, cooperate to stabilise the concentration of greenhouse gases, in the atmosphere. For instance the level of carbon dioxide, CO₂, today at around 430 part per million, must be stabilised at between 450-550 ppm (Stern, 2007). This stabilisation, though necessary, comes with a cost. Bringing down annual emissions of CO₂ from current levels by as much as 80% without negatively influencing economic development, especially in poor countries, will require a clear strategy and firm global action.

Mitigation at supranational and national levels

As a response to the emerging threat of climate change and global warming, the European Union has targeted itself to cut GHG emissions by 20% in 2020 (Commission Proposal COM(2008) 30 final). The EU Commission projects that the transition to a low-carbon society and low-emission economy can be achieved through long-term, credible policy-making along with innovation and development of cleaner technologies. Particularly, the Commission aims at restructuring the energy sector, with a strong focus on further developing renewable sources of energy. This change will not only create jobs and economic growth, but also reduce EU dependency on imported fossil fuels. (Commission Proposal COM(2008) 30 final).

In line with EU targets of reducing GHG emissions, which also delegates responsibility for its implementation on the member states, Sweden has set up a target to reduce its GHG emissions by 40% in 2020 compared to 1990 levels (Naturvårdsverket, 2012). The Swedish government will be using different strategies to achieve this goal. By introducing national laws and policies that will push for emission cutting, resource and energy efficiency and research and development of cleaner technology, actors in the private sector will be incentivised to take on investments that will bring down their environmental impact (Naturvårdsverket, 2012b). Along with this, the government will commit itself, and delegate to its own agencies and authorities, to reduce the environmental impact of its own work (Naturvårdsverket, 2009). The Swedish State, and its agencies, employs more than 230 000 people. Thus, there is a great potential for the state to reduce negative environmental impact by greening government activities. Also, whatever good practices and changed routines are employed in State work may partly trickle down to the public sector on regional and municipal level, thereby multiplying the effects.

Information technologies and the environment

Information and communications technologies, or ICT for short, is a commonly used acronym embracing the technical possibilities created by advances in computer technology and telecommunications (Nationalencyklopedin, 2012). ICT is a very broad and general notion, that commonly include both physical devices, hardware, such as computers, screens,

telephones and network components, and software, such as protocols, databases, computer software, logical applications and so on. The purpose of ICT is to provide services that fulfil the users' needs for, among other things, information gathering, analysing and storing, education and entertainment, and synchronous or asynchronous written, oral or visual communication.

The use of ICT has severe effects on the environment. In a frequently cited 2007 estimation from the Gartner group, the aggregated GHG emissions from ICT, its physical infrastructure and use, stands for approximately 2% of global GHG emissions, roughly the same as the aviation industry (Gartner Group, 2007). The estimated emissions from ICT were 0.5 GtCO_{2e} and this is projected to raise to 1.4 GtCO_{2e} in 2020, in a business as usual scenario (GeSI, 2008).

Although there is no doubt that ICT in themselves will always be energy and resource consuming, and a source of electronic waste, these technologies also have a great potential to help decreasing the environmental impact in other areas. For instance, services provided by ICT can enable better energy management in buildings and machines, smart grids and smarter transportation. The potential, positive effect of using ICT in these areas have been estimated to a reduction of 7.8 GtCO_{2e} of emissions in 2020 (GeSI, 2008), thereby outweighing by far its own increase in emissions.

Moreover, ICT can provide systems for better supply chain management, for customer decision support, for monitoring of industrial or manufacturing processes, and for eco-design. ICT can also be used to create and quickly spread information that increases political or consumer awareness about issues that regard to sustainability. Another area where the use of ICT might help decreasing environmental impact is in travelling (Pamlin, Pahlman, 2009). There are reasons to believe that there is a relationship between increased use of virtual meetings and quantitative aspects of an organisation's activities, such as travel time and expenses, energy and other resource use, and environmental impact (Sinnott, 2010; The Economist, 2004). By enabling people to meet and communicate without having to come together physically, ICT and especially CMC, *computer-mediated communications*, might help increasing the amount of information exchanged between individuals without at the same time increasing the need to travel.

Green ICT in Swedish administration

Recognising the potential of making use of ICT to reduce environmental impact, the Swedish government has laid out a strategy for making use of ICT in its work. This strategy is presented in a document called "ICT for a greener administration - ICT agenda for the environment 2010-2015" (Regeringskansliet, 2010). The agenda for green ICT in public administration is communicated to a number of public authorities through their annual letters of appropriation, where the government give each authority the task to report back on how they have fulfilled the actions and strategies laid out in the agenda (Näringsdepartementet, 2011a). By including the ICT agenda in the appropriations, the public authorities are thereby incentivised to prioritise this work.

The ICT agenda for the environment identifies and outlines three different action areas, each with an adjacent objective. First, the government aims to achieve less environmental impact by use of public procurement of ICT services and products, based on the green public procurement action plan (Miljödepartementet, 2007). The second objective of the governmental strategy is to reduce the energy consumption in its own ICT activities.

The third objective of the agenda is to reduce environmental impact by the use of virtual, or “travel-free”, meetings. A virtual meeting is a meeting that will make use of ICTs such as voice or video transmission or CMC in order to include participants that are located in geographically dispersed places. The basic idea of virtual meetings is that by replacing business travelling it will contribute to both a reduction in travel costs as well as less emissions of GHG. Indeed, Swedish EPA has identified video and telephone conferencing as methods of reducing emissions from travel and transport (Naturvårdsverket, 2009).

Consequently, the annual appropriations assigned to many public authorities now contain a number of recommendations related to green ICT and virtual meetings. The recommendations include developing a meeting and travel policy, and facilitating and monitoring the use of virtual meetings in public organisations. Moreover, the Swedish Transport Administration is assigned to finding a way of facilitating travel-free meetings within and between agencies. (Regeringskansliet, 2010).

Following the assignment from the Swedish government, the Swedish Transport Administration has initiated a project called Travel-free Meetings in Public Agencies (in Swedish "Resfria Möten i Myndigheter", or REMM for short). This project aims to increase and advance the use of virtual meetings and involves 18 major Swedish authorities (Trafikverket, 2012c). In order to evaluate various impacts of the aforementioned project, a research project has been initiated that aims to develop a framework for assessing the organisational impacts and a set of indicators that will be used by authorities in order to monitor the effects of increased use of virtual meetings. This thesis is written within the context of this research project.

1.2 Research Problem

The actions and strategies of the Swedish government are based on the assumption that virtual meetings contribute to a reduction in business travelling. However, the relationship between travelling and virtual meetings is not unambiguous. Indeed, there are examples of success stories where virtual meetings contributed to decrease levels of business travelling and thereby GHG emissions (TeliaSonera AB, 2010; If P&C Insurance AB, 2010). On the other hand, there are indications in existing body of literature that virtual meetings may have a limited effect on travel or could even lead to an increase in business travel (Arnfolk, 2002; Plepys, 2002; Adams, 1999). Besides effects on business travelling, virtual meetings are expected to lead to economic savings, organisational efficiency, decreased emissions and more satisfied employees (Arnfolk et al., 2010). However, these effects lack substantial support in well-documented empirical data. Thus, in the case of virtual meetings and virtual collaboration in general, there are still important disagreements about their effects on organisations (Cisco Systems, 2008a; Lee, Shanahan, 2010; Adams, 1999; Plepys, 2002). Considering the growing importance of Internet, CMC and web collaboration tools, managing, measuring and monitoring the effects of virtual meetings and collaboration will be increasingly decisive for an organisation's ability to achieve its goals. This thesis aims to reduce the aforementioned gaps in knowledge.

Better understanding about what the effects of virtual meetings are, and explaining the underlying reasons to why there are disagreements about them, will help map the prerequisites necessary for ensuring positive effects from increased use of virtual meetings and collaboration. This information will also be vital when developing organisational strategies for implementation of virtual collaboration technologies. If supplemented by a thorough framework for measuring all potential effects of virtual meetings and collaboration, this knowledge can be used to unleash the full potential of virtual technologies.

1.3 Aims, Objectives and Research Questions

This thesis aims to contribute to better understanding of the effects that increased use of virtual meetings may have on an organisation. By doing so, the author is hoping to be able to explain if and how virtual meetings can be used as work and communication methods that will contribute to increased organisational efficiency, cost savings and employee satisfaction, while decreasing the environmental impact of the organisation's activities. The objective is to identify or develop a model that will help to explain organisational effects of virtual meetings.

A second aim is to contribute to knowledge of how measuring and monitoring of the effects of virtual meeting can be done more effectively. The goal of this work is to enhance the potentially positive effects of increased use of virtual meeting, such as decreased emissions or more efficient use of organisational resources.

The last aim of this thesis is to provide insights on how measuring effects of virtual meetings could be used in continuous work on strengthening positive organisational effects of virtual meetings and other virtual collaboration methods.

The questions that will be researched in this thesis are:

RQ1. What are the organisational effects of an increased use of virtual meetings?

- a) How convergent are the views about these effects?
- b) What factors influence the presence and magnitude of these effects?

RQ2. How can the organisational effects of an increased use of virtual meetings be measured?

- a) What effects are most relevant to measure?
- b) What effects are possible to measure in practice?

RQ3. How should the results of these measurements be used?

- a) How can suitable organisational conditions be established in order to materialise the potential positive effects of virtual meetings?

1.4 Scope and Limitations

The scope of this thesis is to investigate the effects of virtual meetings only at organisational level, leaving aside effects on societal and individual levels. Some aspects of virtual meetings have effects on several levels. Telework, as an example, might affect an employees' perception of work-life balance or job satisfaction, but the scope of this thesis will only include effects of telework on organisational levels, e.g. as a method to make better use of existing competencies or increased attractiveness when recruiting. Work-life balance, and stress, can be discussed in terms of effects on individuals, but in this thesis, the focus will be on discussing its effects on co-workers' job satisfaction on aggregate level.

The focus of the study will be on public authorities and agencies in Sweden, and more specifically on a sample of the 18 authorities involved in the REMM project. The reason for this focus is that this project offers a manageable context with a number of entities with similar goals. Nonetheless, since effect of virtual meeting to a great extent should be applicable in many types of activities, reference data will also be collected from the private sector and from authorities outside of the REMM project.

Outside of scope for this thesis is a comparative study between different technologies used for virtual meetings. The effects of any type of virtual technology or specific solution will count, and descriptions of various technologies will only be brought up as background or supporting information.

Although the researchable resources of Lund University are abundant, this thesis is still limited by the selection of databases available at this university, and to what is available free of charge on the Internet.

Also, due to the author's knowledge limitations in foreign languages, important information written in languages other than Swedish, English, and to some extent French, have not been taken into account. Thus, organisational effects of virtual meetings that are more apparent in other cultural contexts have been missed or omitted. Also, the effects found and investigated might not extrapolate to other contexts.

1.5 Intended Audience

The author is hoping that the information and conclusions of this thesis might be of use to several groups of readers. First of all, readers interested in learning more about green ICT and how ICT can be used to green business activities should find this thesis valuable. Actors in the ICT field need good examples of ideas and solutions that will come to life by their technology, and virtual collaboration is one such area.

This thesis should also be interesting for readers that are particularly interested in the organisational effects of increased use of virtual technologies: environmental managers, ICT managers and commissioners, purchasing departments, human resource departments and project managers. The growing importance of web- and computer enabled communication will continue to influence how we organise ourselves, how we work and how our employees behave in the coming years. The information, conclusions and recommendations in this thesis will hopefully work as a head start for organisations that are looking for ideas of how to further develop their use of collaborative tools.

Since this thesis is written in the context of Swedish Transport Administration's REMM project, the representatives of the authorities involved in this project should find useful information in this thesis. Perhaps its findings and conclusions can bring some new perspective on their work with continuous improvement in the area of virtual collaboration, or at least confirm the feasibility of their work in progress.

Moreover, this thesis will provide some helpful insights to the developers and suppliers of virtual technology solutions that might contribute to a small change of focus in their future product development or marketing.

1.6 Thesis outline

Chapter 1 presents the background to and nature of the problem that will be addressed in this thesis. It also presents the scope of the study, its aims and the research questions that will be investigated.

Chapter 2 describes the methodology that was used to answer the research questions presented. Methods of data collection and research logic will be discussed in this chapter.

Chapter 3 contains an analysis of literature on the subject at hand: articles, books, papers, and reports. The gaps in the existing research will be identified and a framework used to fill out some of these gaps will be presented.

Chapter 4 briefly introduces the organisations that participated in this study. It also presents the findings made and the primary data collected. Moreover, this section introduces the conceptual framework that will be used for analysing findings in literature and empirical data.

Chapter 5 contains an analysis, where findings are analysed by help of the selected framework and the author's own suggestions and ideas are presented.

In chapter 6 the author discusses and reflects on the methodology used while working with this thesis.

Chapter 7, presents a summary of findings and analysis is presented, research questions are answered and suggestion for further research are presented.

2 Research methodology

This thesis mainly employs qualitative research methods, where information collected from in-depth interviews and literature analysis form the base data for analysis. However, there will also be smaller, supporting elements of quantitative data in the analysis, from an online poll from participants of a webinar and also from travel surveys performed at the public authorities.

The purpose of the literature analysis is threefold: first, to give an overview of the context of the topic and introduce related concepts, second, to develop a conceptual framework that will be used as a tool for analysis of empirical data, and third, to identify the research gap that justifies the questions in this study.

The general research approach of this study is inductive. With support of the selected conceptual framework, the empirical data collected is analysed and used to formulate a models, theories and propositions that answer the research questions. More specifically, the selected framework is used to help develop categorisation in which the empirical data can be organised, in accordance with the inductive coding process described by Thomas (2006). The general methodological strategy used for this thesis is depicted in the figure below.

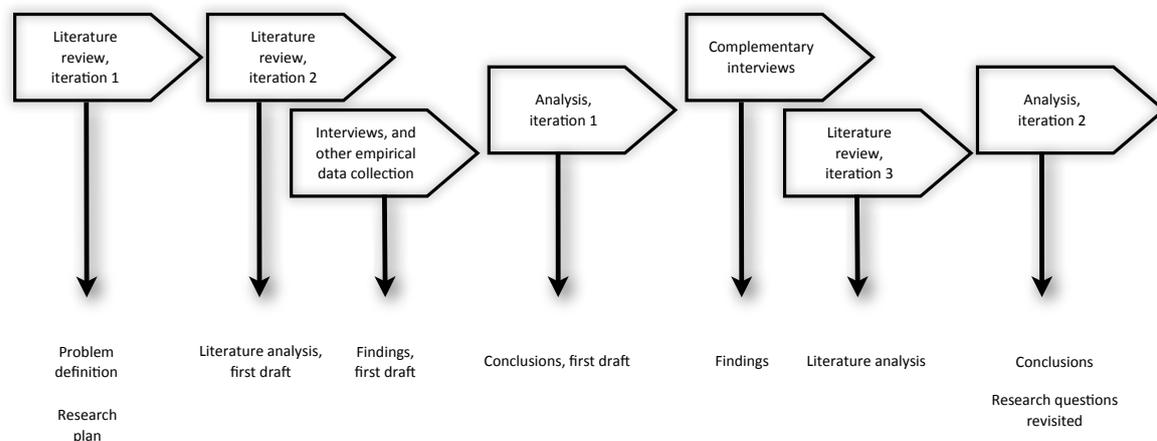


Figure 2-1 Overall methodological strategy

2.1 Primary data collection

Primary data was collected mainly through semi-structured interviews over the phone, with a few exceptions in terms of personal interviews. The interviewees are employed by organisations that have already implemented and started using virtual meeting technologies. The prime targets of the interviews have been public authorities involved in the REMM project. These authorities were selected based on the following criteria:

- Relatively large organisations,
- Relatively long experience from using virtual meetings,
- An assigned working group for the REMM project,
- Availability.

Out of the 18 REMM authorities, five have been contacted and interviewed: Swedish Customs, Swedish EPA, Swedish Tax Agency, Swedish Energy Agency and Swedish Transport Administration. Out of these five, the focus has been on Swedish Customs and Swedish Transport Administration, who each have provided four interviewees in different positions.

Moreover, a number of reference interviews outside of REMM have been done. Swedish Courts make extensive use of virtual meetings today and were interviewed as a case of Swedish public authorities not involved in the REMM project. The European Environmental Agency represents a public authority on supranational level. SBTA, the Swedish Business Travel Association, were interviewed to get the perspectives from a trade association. On top of this, interviews have been performed with a number of private companies as well as individuals. A full list of interviewees and their roles is available in Appendix A.

Primary data has also been collected through documentation and other information in digital form provided by the organisations interviewed and through official statistics and documents, such as annual reports and appropriations.

In addition to the sources presented above, primary data has also been collected from comments and information in travel survey questionnaires that have been sent out to the employees in REMM authorities. Also, the information found in transcripts from interviews performed by a PhD candidate at IIIIEE, Pia Långström, has been used, along with online polls in a REMM webinar the 28th of May 2012. Finally, the author himself has substantial personal experience in using virtual meeting technologies, which has also been used to contribute to the data collection.

2.2 Secondary data collection

The starting point for the collection of secondary data was literature analyses already produced by researchers at IIIIEE. This information was then supplemented by the author's own collection of information in books, research papers, articles and public reports. The origins of this material are research institutes, public authorities and private organisations in the industry.

Main sources for the secondary data have been the collections provided by the online search service at Lund University, Summon, and its accompanying connections to databases like BSCOhost and SciVerse. For printed material, the online catalogue Lovisa has been used. Searches have also been done at external search engines like Google Scholar and Ixquick.¹

2.3 Data analysis

The primary data collected has been analysed by help of a data analysis sheet developed in spreadsheet software, where information and notes from interviews and other primary data have been organised into themes or categories. The selected framework has been used to provide the general outline for these categories.

¹ Search words used in English include combinations of “green”, “ICT”, “IT”, “business”, “travelling”, “efficiency”, “equality”, “virtual”, “meeting”, “collaboration”, “telepresence”, “audio conference”, “videoconference”, “CMC”, “unified”, “communication”, “team”, “project”, “management”, “web”, “emissions”. Search words used in Swedish include combinations of “resfri”, “möte”, “informationsteknik”, “resa”, “affärsresa”, “virtuell”, “kommunikation”, “samarbete”, “videokonferens”, “projekt”, “styrning”, “utsläpp”, “effektivitet”, “effekt”. A few searches have also been done in French using search words like “collaboration”, “virtuelle”, “efficacité”, “réunion”, “équipe”, “visioconférence”, and “émission”.

The coding process has been based on three main assumptions. The first assumption is that the validity of a statement or opinion increases by its frequency. If a majority of the interviewees agree, the opinion is assumed to be more valid. The second assumption is the validity of a statement or opinion depends on the initiation level of the source. For example, a project manager is assumed to have more valid opinions on effects on work methods than a travel manager. The third assumption is the validity of a statement or opinion increase with organisational maturity in the area. The opinions from interviewees working in organisations with deeper or wider use of virtual meetings technologies are deemed to be relatively more valid.

2.4 Interview design

The major share of interviews for this thesis was done according to the interview template in Appendix B. The strategy employed during the interview process was to:

1. Understand the level of use of virtual meetings and virtual collaboration in the organisation of the interviewee,
2. Obtain answers regarding effects of virtual meetings,
3. Collect reflections on to suggestions about effects not mentioned by the interviewee,
4. Understand the interviewee's view on factors or indicators that will influence the effects discussed.

In many cases the discussion about effects was focused on the role of the interviewee, e.g. a project manager have more insight in effects related to work processes than a staff manager who has better information about employee satisfaction, and so on.

Some exceptions to the general strategy include a group interview done at EEA and a few shorter conversations that were designed to collect reflections and comments on specific effects.

3 Organisational effects of virtual meetings

In this chapter the theoretical background to virtual meetings will be presented, together with a brief introduction of its associated technologies and its context in information and communications technologies. Existing literature will be analysed to present what is already known about the expected effects of virtual meetings and their indicators. This is done in order to illustrate the research gap that justifies the questions researched in this study. The reader will also be introduced to a conceptual framework that will be used for analysis later on.

3.1 Green ICT and greening with ICT

As discussed in the introduction, the ICT industry and its activities bring about quite a substantial amount of GHG emissions, estimated at around 2% of the global total, thereby on the same level as the aviation industry (Gartner Group, 2007). According to the Climate Group, 0.5 GtCO₂e out of a total of 40 GtCO₂e of emissions in 2002 come from ICT industry (GeSI, 2008). These estimations have since been reviewed and amended by Greenpeace (Greenpeace International, 20120). The emissions come for example from manufacturing of the electronic equipment, energy consumption during use phase, and finally from dealing with e-waste (Berkhout, Hertin, 2004).

As with any wasteful, inefficient and profligate activity, ICT will eventually have to adapt all their activities and find more resource efficient ways of running them. There is already growing business logic for greening of ICT: energy prices are rising and pressure from investors and customers is increasing (Cisco Systems, 2008a). A green ICT strategy would have to include assessment of environmental impacts, an energy efficiency plan, a waste management plan, procurement guidelines and a process for monitoring and assessing on-going projects (Mingay, 2007).

Apart from the environmental footprint of ICT themselves, there is another important aspect on green ICT: the potential that ICT has in helping organisations to tackle environmental problems (Mingay 2007). This is sometimes referred to ICT's *enabling* as opposed to *direct* effects (Reimsbach Kounatze, 2009). The debate about whether ICT have mostly negative or mostly positive environmental impacts has been on-going for some time (see for example Berkhout, Hertin, 2004), but many people agree that ICT, if used cleverly and correctly and backed up with adequate policies and regulation, have a potential to help decreasing the environmental impact in other areas (GeSI, 2008; Berkhout, Hertin, 2004). ICT have many applications that will be beneficial from an environmental point of view (Williams, 2011). Some examples are smart grids and smart buildings, intelligent systems in transport, supply chain management, decision support, and eco-design. More relevant for this study, are tools for virtual meetings and collaboration, which may decrease the need for travelling.

According to theories about rebound effects, environmental impact (I) is considered to be a function of *population* (P), *affluence* (A) and *technology* (T) (Ehrlich, Holdren, 1971).

$$I = P \times A \times T$$

By looking at the formula above one could easily assume that a decrease in population or consumption or an improvement in technology would automatically lead to a decrease in environmental impact. Unfortunately, due to the rebound effect, this is not always the case (Alcott, 2010). Technical development, like the one in the ICT area, might lead to increase in

population (for instance by helping to lower mortality), or to changes in consumer behaviour that will eventually lead to a bigger environmental impact.

In addition to their own impacts and the impacts of their applications, ICT might also have effect on other levels in society that will eventually lead to changes in environmental impact. For instance, ICT will have an influence on consumption patterns and economic growth, and also on long-term technological development (Williams, 2011). ICT are interwoven into our economic system and influence its evolution.

3.2 Virtual meeting technologies

A meeting can be defined as an “act or an instance of assembling or coming together for social, business, or other purposes” (Oxford English Dictionary, 2012). This implies that a meeting involves more than one individual, that it is synchronous and that it has some kind of objective or goal. A virtual meeting, in contrast, is a meeting without the need for physically coming together. The same prerequisites as for any meeting holds true, but the virtual meeting distinguishes itself by clearly indicating that some or all of the participants may not meet physically. Virtual meeting has been defined in literature as “synchronous communication mediated by ICT, making it possible for two or more geographically remote people to interact” (Arnfolk, 2002, p. 7).

The virtual meeting technologies commonly referred to are audio conference (AC), videoconference (VC) and CMC. An overview of the differences in characteristics is shown in the table below (Davis, Wainfan, 2004).

Table 3-1 Characteristics of AC, VC and CMC. Source: Davis, Wainfan (2004)

Mode	Defining characteristics	Examples
Videoconferencing (VC).	Useful real-time images and voices of other participants; may include other shared images/text.	Group videoconferences in dedicated rooms; desktop videoconferencing.
Audio conferencing (AC).	Voice communication, but no useful real-time video images of other participants; may include other shared images, data and text.	Phone calls, conference calls or conference calls where people are also sharing views of images or documents.
Computer-mediated communication (CMC).	Text, images and other data received via computer, without effective real-time voice or video images of other participants.	E-mails, chat rooms, discussion boards, text messaging, instant messaging, shared databases, application-specific groupware.

The reader should note that the information in the table above is already out of date. For instance, it does not include web meeting technologies, which would end up somewhere between audio conferencing and CMC.

In the last years the development in videoconferencing technology has lead to the distinction between VC and telepresence, where the latter combines rich audio and high-definition video

to provide gives a remarkably more life-like experience (Lee, Shanahan, 2010; Cisco Systems, 2007). Successfully reproducing the significant aspects of physical co-presence is necessary for new forms of virtual communication (Adey, Bissell, 2010), so these features add to the ability of virtual meetings to substitute for physical meetings. Telepresence also has advantages in terms of improved reliability, privacy and security that add to its value as a tool for more complex meeting agendas, such as negotiations (Lee, Shanahan, 2010).

Virtual collaboration and *collaboration tools* broaden the perspective a bit. Virtual collaboration technologies enable asynchronous co-operation: simultaneous file sharing like Google docs or Microsoft Sharepoint, shared project platforms like Teambox or Basecamp, noded project management. Many of these tools are referred to as *cloud* services, i.e. there is no or very little software installed or running on the local client. Instead, the functionality, databases and logics of the service is distributed on servers, whose number and geographic locations is unknown to the user, and might even change constantly.

3.3 A framework for organisational effect of virtual meetings

As part of a research project at the IIIIEE, Lund University,² a conceptual framework has been developed as a tool for mapping and measuring the effects of virtual meetings on society, organisation and individual. This framework, called *Potential Effects of Virtual Meetings*, or TERM which would be the Swedish acronym, is based on the assumption that increased use of virtual meetings will have not only environmental impact, but also impact on high level efficiency and strategic goals of an organisation (Arnfolk, 2012).

From an organisational perspective the assumed effects described in the TERM model are divided into four groups: *organisational structure*, *efficiency*, *staff* and the *environment*. All these groups of effects in turn influence the organisation's possibilities of achieving its goals. The TERM model, presented in the figure below, has been used to develop a number of indicators and identify information collection methods that could be used to measure the effects listed, presented in Appendix C.

² The research project "Implications and reporting of Virtual Meetings"

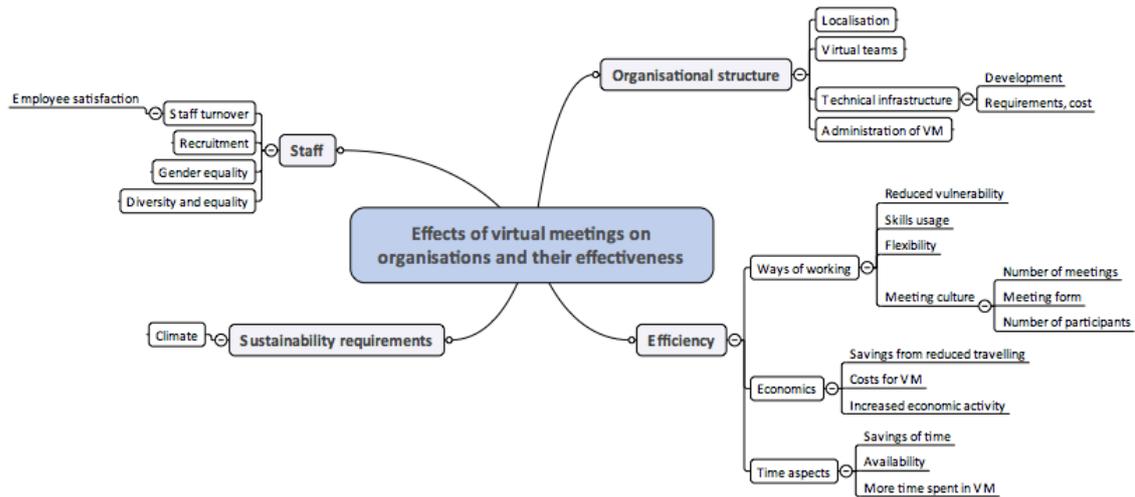


Figure 3-1 The TERM model of organisational effects of virtual meetings

Organisational structure

Organisational structure has to do with how virtual meetings influence geographical and logical structures. Use of virtual meetings is expected to have effects on:

- Localisation: where offices and staff are physically located,
- Virtual teams: how work is organised into teams that don't have to be physically together,
- Technical infrastructure, cost for licensing, equipment, operations,
- Administrative organisation of virtual meetings, cost for services.

Efficiency

From an efficiency perspective, virtual meetings are assumed to affect areas like working methods, time aspects and economics. More specifically, virtual meetings will have effects on:

- Business continuity, being able to keep activities up and running, even in case of force majeure events like natural catastrophes or terror attacks,
- Use of competencies, how existing internal and external competencies are made use of,
- Flexibility, how on-going work can be adjusted to changes in the work settings,
- Meeting culture, how people in the organisation meet and communicate,
- Travel costs,
- Costs for virtual meetings,
- Economic activity, effects on turnover and total output,
- Time spent in meetings and in travelling, how much time is used for travelling and administration of meetings,
- Availability, to competence or specific co-workers, but also to information that can be used asynchronously by co-workers, for example meeting recordings,

- Time spent in virtual meetings, and if less time is spent in meetings, what is it used for?

Staff

On the personnel side, the use of virtual meetings will also have effects. As opposed to the individual effects, these effects are more on an aggregate level:

- Staff turnover,
- Recruitment,
- Gender equality,
- Diversity and equality, that has to do with staff diversity in terms of for instance origins and disabilities.

The environment

Finally, the use of virtual meetings is expected to have an effect on the environmental impact of the organisation, and emissions of GHG in particular.

The TERM framework, described above, will be used as a model for analysing and explaining the findings in this study. Designed for this purpose, the framework provides a good basis for analysing all potential effects of virtual meetings and their associated indicators, which will be of great help when answering the first research questions, put forward in this thesis. Moreover, since it is coming from a context in which a number of Swedish public authorities are involved, it has the added value of being directly applicable on these organisations, in practice.

3.4 Organisational effects discussed in literature

3.4.1 Changes in the level of travelling

The TERM framework does not refer to changed levels in business travelling as an effect per se, which is why the primary focus of this work will not be on this topic. However, a vast amount of literature and reports written on the subject discuss organisational effects in relation to travelling. Also, as mentioned in the background, the point of departure for the Swedish government's own strategy is based on the assumption that environmental impact can be changed by a reduction in travelling, made possible through increased use of virtual meetings. (Regeringskansliet, 2010). With this in mind, the author will therefore briefly discuss what is written in existing literature about virtual meetings and travelling.

Many organisations claim that increased use of virtual meetings and of collaborative tools in general has contributed, or will contribute, to a decrease in business travelling. Some examples include:

- Procter & Gamble, a multinational consumer goods company, who have decreased business travelling due to the introduction of collaborative tools (Cooke, 2010),
- Capgemini, a major, European consultancy firm in ICT, who mentions investments in video conferencing and collaboration-enabling software as an example of a way to reduce travels in their "10 steps to green IT" (Doherty, 2008),
- Cisco, a major supplier of virtual meeting solutions, who claim that the use of virtual meetings will inevitably lead to reduced travelling (Cisco Systems, 2008a),

- TeliaSonera, a telecommunications giant whose annual report on corporate responsibility include accounts for how virtual meetings help decreasing the company's environmental footprint by reduced travelling (TeliaSonera AB, 2010),
- The association of municipalities in Västernorrland, in northern Sweden, who refer to reduce travelling in a pre-study on virtual meetings from 2012 (Risberg, 2012),
- The United Nations (UNEP, 2009).

Noteworthy is that in many cases the authors of these reports and articles are not limiting their discussion to the concept of virtual meetings only. Instead, virtual meetings, and the technologies associated with this, are implicitly being part of something bigger, often referred to as collaborative tools or unified communications (see for example Cooke, 2010; Cisco Systems, 2008a).

Despite this overwhelming evidence from business life, where the correlation between virtual meetings and reduction in travelling is a common theme, there is surprisingly little evidence for this in existing research (Mokhtarian, 2002). Instead, it has been suggested that virtual meetings will not automatically impact on travelling levels (Arnfolk, Kogg, 2003), or even that virtual meetings could actually increase travelling (Arnfolk, 2002, p. 72). The use of virtual meetings can help extending the geographical distance at which business relations are practical, which might lead to an increase of travels to physical meetings further away (Plepys, 2002). Societies that make a relatively high use of ICT are also societies that are physically mobile, and elevated use of, for instance, telecommunication can actually work as a trigger for more travelling, not as a substitute for it (Adams, 1999).

In this context it is important to distinguish between *substituted* meetings, where virtual meetings work as a replacement for physical meetings, and *stimulated* meetings, where virtual meeting technologies actually spur the need for more meetings (Lee, Shanahan, 2010). A third distinction is the *complementary* meeting, which is stimulated from virtual communication, but that would not have taken place unless there were possibilities to meet virtually (Mokhtarian, 2002).

The beforementioned, on-going research project on virtual meetings at the IIIIEE may help providing the sought-after empirical data on travel implications of virtual meeting. Preliminary results from a travel survey with more than 7000 respondents in eight different public authorities, indicate that almost every third (31%) of the respondents have participated in a virtual meeting that has substituted a business trip they would otherwise have done. Interestingly, a substituting effect of about one-third is a common assumption used in calculations of savings in cost and emissions. For instance, this is the assumption used at Swedish Customs. Thus, the preliminary findings from the survey provide substantial empirical support for this assumption.

3.4.2 Emission levels

There is strong support in existing literature for the potential of virtual meeting technologies to decrease emissions. The examples listed in previous section all contain arguments that the decreased levels of travelling will also lead to decreased levels of emissions. Other examples include a 2009 report from WWF, where the total potential reduction of using low carbon ICT solutions, where videoconferencing is used as one example, is estimated at 3 GtCO₂e annually (Pamlin, Pahlman, 2009). Horvath and Toffel, both at the University of California, have calculated on a scenario where wireless teleconference replaces a car and air travel between Berkeley and Chicago and found out that there will be decreases in emissions of CO₂, SO₂, NO_x, CH₄ (Toffel, Horvath, 2004). Another example comes from Carbon Disclosure

Project, which has estimated that a global deployment of telepresence solutions in US and UK firms could save an accumulated 5.5 million tonnes of CO₂ between 2010 and 2019. (Lee, Shanahan, 2010).

An experiment performed by scientists in Switzerland shows how telepresence technology, by substituting travel, can decrease GHG emissions (Coroama, Hilty, Birtel, 2011). Hypothetical scenarios including a conference, organised in Davos, Nagoya, or both, were set up and potential attendees were questioned about how they would have travelled in each scenario. The experiment shows that, in a setup like this and despite rebound effects in terms of increased amount of participants, substantial amounts of GHG emissions can be saved from organising a multiple-site conference and link the sites with video (Coroama, Hilty, Birtel, 2011).

It should be noted that all evidence presented above, either hypothetical or reality-based, is based on the assumption that virtual meetings help decrease business travelling. If this assumption does not hold true, the case for virtual meetings' emission decreasing effect fails. Again, there is not much evidence that support a direct correlation between increased use of virtual meetings and changes in emission levels.

3.4.3 Economic effects

In terms of virtual meetings and their effects on an organisation's use of resources, e.g. time and money, literature reports on saving effect of virtual meetings for organisations. Presuming the substituting effect of virtual meetings, and not taking stimulating or complementing effects into consideration, the cost saving effect of virtual meetings can easily be demonstrated. For example, in a simple ROI calculation for an online meeting in comparison to a physical meeting between four people in Washington D.C. and New York City, the calculated savings are almost 430 USD (Webconferencing-test.com, 2012). Another example comes from TDC, a Danish ICT company, that saved an estimated 16 000 work hours, thereby adding 6.5 MSEK to profit, from substituting travelling with video conferencing in 2011 (TDC Sverige, 2012).

The costs and benefits taken into consideration into the two examples above include travel expenses, travel time, costs for connection (such as investments or operations costs, or rent for meeting room or conference call), and avoided travel costs from expenses and wages (Webconferencing-test.com, 2012; TDC Sverige, 2012).

Another real-world example is Cisco, who has calculated on a total travel cost avoidance of USD 90 million during the implementation of 238 telepresence units for internal use. On top of this, they have also estimated an additional benefit of USD 40 million in increased employee productivity (Cisco Systems, 2008b). In a study on telepresence by Carbon Disclosure Project, the biggest driver for investments in telepresence technology is to reduce air travel costs (Lee, Shanahan, 2010). Another area where costs can be saved is in office costs, which decrease due to increased mobility (Cooke, 2010). A typical ROI calculation for an investment in any virtual meeting technology includes investment costs, operating costs, total travel costs saved and, again, increase in productivity (Lee, Shanahan 2010).

As pace of work and employees' pressure to use their time wisely are increasing, there is a growing potential of using virtual meetings as a way to decrease the relative time spent travelling and thereby free up time for work tasks (Räsänen et al., 2010). Time used for travelling to meetings must to a greater extent be traded off against the potential gain of the meeting (Räsänen et al., 2010). In the *optimal meeting*, discussed by Arnfalk and Kogg (2003), the form of the meeting is selected in a way that organisational benefits at a maximum exceed

organisational costs for the meeting. Benefits are the total sum of each participant's use of the meeting plus a social benefit that will be of use to the organisation, and costs include all expenses related to the meeting, as well as losses or gains in time. Ideally, the organisational costs that should be taken into consideration include not only travel expenses and connection costs, but also cost of time not used for effective work during travelling (Arnfolk, Kogg, 2003).

In order to get a full picture of costs and benefits the stimulating and complementary effects, where use of virtual meetings can increase the use of other forms of meetings need to be considered. Virtual meetings can enhance the use of other meeting forms, leading to increases in total meeting costs. They can also help increase the efficiency of other meeting forms (Mokhtarian, 2002). However, no evidence in literature was found that would show ROI or cost-benefit analyses where total meeting costs have been used.

3.4.4 Changed ways of working

Although the main focus in literature is on travelling, environmental and economic effects of virtual meetings, there is also information about other aspects of virtual meetings and the technologies related to it. Especially interesting is the changing perception about meetings in general and how this change affects our ways of working. Organisations are moving from a tradition where meetings were small isolated pockets of agenda and time to a situation where meetings are ever on-going, asynchronous, and where participants upload and share their work from everywhere and at any time (Wallström, 2010).

Virtual collaboration & teams

A few years back, the Economist Intelligence Unit has made a study on collaboration, in which almost 400 business leaders were surveyed or interviewed. Results show that in order to succeed in a changing world, firms will have to collaborate more, not only vertically with suppliers as before, but also with customers, partners, specialised players, distributors and academia (EIU, 2007). In general, the study's interviewees believe that collaboration leads to increased operational efficiency, improved productivity, better problem solving and increased knowledge sharing, and 47% think that the implementation of tools have increased collaboration (EIU, 2007).

Virtual collaboration can be defined as collaboration between geographically dispersed groups that are enabled through ICT (Hossain, Wigand, 2004). Traditionally, organisations and their activities are built on the assumption that there is a time and space limitation to the way they organise the work. With the introduction of virtual meeting technologies and other collaboration tools, this assumption is leavening. The geographically boundaries that used to apply are no longer valid and this will eventually lead to that people will organise into virtual teams, internally within an organisation, or externally between organisations (Lipnack, Stamps, 2000, p. 4).

A virtual team can be defined as "a group of people who work interdependently with a shared purpose across space, time and organisation boundaries using technology" (Lipnack, Stamps, 2000, p. 18). Virtual teams emerge and start working without consideration to boundaries in geography, time or even the organisational structure (Langevin, 2002). The challenge for teams working in virtual collaboration lies in making use of a mix of technologies that support synchronous and asynchronous communication and also help cutting process time and improve quality (Jones, 2002, p. 227).

Virtual teams have been found to increase agility and speed of work, make more efficient use of existing human resources and enhance use of existing skills in an organisation (Duarte, Snyder, 2001, p. 9). However, leading virtual teams is more complicated as much more emphasis has to be put on clarifying the team's purpose and goals (Lipnack, Stamps, 2000, p. 142). There is also an important issue with how to build mutual trust in a virtual team, which presents some additional challenges and must be done with greater care in terms of availability, reliability and patience from the teams' managers (Dwyer, 2007).

As an example, Bausch and Lomb use collaboration tools to bring geographically dispersed teams for product development, thereby making better use of its competencies (Rosencrance, 2005). In this case it is document sharing in combination with audio conferencing that enables distributed development teams to work together and to also to make use of the collective output.

Telework

Through increased use of virtual meetings and collaboration, primarily over the Internet, organisations also enable an increased practice of teleworking, which in its turn decreases travelling from commuting (Illegems, Verbeke, 2004), even though the exact impact on travelling from telework is difficult to measure (Mohktarian, Handy, Salomon, 1995). Existing literature tend to focus on the individual aspects of teleworking, such as work-life balance and equality (see for example Tremblay, 2002). However, there are also some organisational advantages and drawbacks of telework that are more relevant for this study. For instance, some theoretical advantages would be increased flexibility with the work force, improved productivity, positive influence on company image, and less expenses for office space (Illegems, Verbeke, 2004). An organisational drawback of telework would for example be an increased diffusion of the work force, which would constitute a hinder for teamwork and for maintaining organisational culture (Illegems, Verbeke, 2004).

3.4.5 Other effects

What else does literature tell us about the potential or actual effects of virtual meetings and of virtual collaboration in general? The business cases for investments in various technologies sometimes make reference to increased productivity, mostly from time savings. As an example, Carbon Disclosure Project states that two of the main drivers for investments in telepresence are improving executives' and employees' productivity (Lee, Shanahan, 2010). Another example comes from Procter & Gamble, where an employee questionnaire show that 95% think that it is easier to get in contact with a colleague and every user saves 20 minutes a day (Cooke, 2010). This indicates that productivity can be increased, although the company admits that this effect is hard to measure.

The use of virtual meetings and collaboration will also have a growing effect on organisations' possibilities to recruit, as new generations enter the market. The millennium generation, or generation Y, born in the eighties and early nineties, are raised in an environment where networked technology is an integral part of information-seeking behaviour (Weiler, 2005). Recruiting people that are already used to working virtually will become an organisational challenge and companies, like for instance Procter & Gamble see their staking in collaborative tools also as a way to attract well-educated young people (Cooke 2010).

Virtual meetings also have an effect on the organisational structure itself, as the responsibility for development and operations of technology and also for the policies involved must be located somewhere. Often it is the ICT department that is appointed as the owner of the virtual meeting issue, because of its inherent technical knowledge about various tools (Räsänen

et al., 2010). However, as pointed out by WWF, in order to be successful in using ICT to decrease environmental impact, it is important to put the ownership of all meetings on a different level, perhaps by joining responsibilities of both travel and meetings into one department (Pamlin, Pahlman, 2009).

Finally, there are indications in research that virtual meetings will have effects that are related to gender and gender equality. For instance, studies have shown that men do more business travelling than women, and also that travelling may be important for career advancement (Gustafson, 2006). This could constitute a possible source of work-family conflict, since women are still taking more responsibility at home. Having small children reduces business travelling of women, but not of men (Gustafson, 2006).

3.5 Indicators and metrics

In a survey done by the Aberdeen group about the return on investment of video collaboration solutions, 72% of the respondents answered that travel reduction was a benefit from using video in virtual meetings. Interestingly, that same study also shows that only 14% of the companies in the study are actually measuring this reduction in travelling (Park, 2011). EIU study on collaboration also show that there is a deficiency in measurements, as more than 50% of the respondents admit to missing metrics in the area (EIU, 2007).

In general, there is not much written in existing literature about measuring the effects of virtual meetings, and the statistical data that exist is scarce and incidental (Buttazzoni et al., 2009). Some indications can be found in literature, though. For example, Carbon Disclosure Project has produced a suggestion for what indicators that should be used when calculating the benefit of an investment in telepresence, and also for measuring emissions (Lee, Shanahan, 2010). The figure below presents an adapted version of the model with some examples of potential indicators. The primary sources of information in the CDP model are interviews and data and estimates from data warehousing companies in relevant fields.

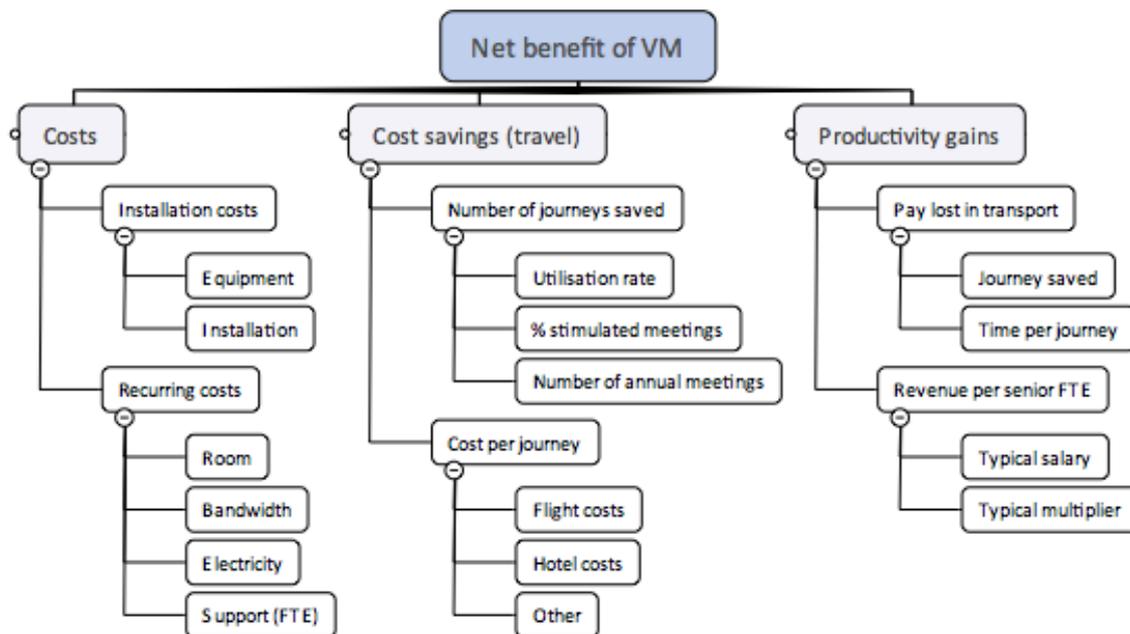


Figure 3-2 A model of indicators used for measuring benefit of virtual meetings

Another example is Advito (2010), a travel management services provider, that published a white paper describing the indicators that they suggest should be used for measuring effects of more effective travel management. In this model, *virtual meetings index* is featuring as one of the strategic KPIs that should be measured. This index is calculated by counting the numbers of virtual meetings and internal trips, and then by dividing those two figures. It should be noted that no value on the efficiency of the meetings is used. Other relevant points of measurements in Advito's model include sum of distance travelled, average total cost per trip, climate impact and sales turnover. The two types of sources of information in the model are in-house, e.g. data on travelling expenses from accounts payable, or outsourced, e.g. industry data from travelling service suppliers (Advito, 2010).

3.6 Knowledge gap

The analysis of existing literature and research shows that there are important disagreements about even the most fundamental effects of virtual meetings and collaboration. One striking example is the actual effect on business travelling, which is decisive for a number of other effects, such as GHG emissions and travel cost savings. Another example is the full economic effects of virtual meetings, which is not described in its entirety. So, there are apparent uncertainties, sometimes-even dichotomies, about the organisational effects of virtual meetings, and there is not much to be found about the reasons for these disagreements. There is a need to fill out the gap in our knowledge about how these disagreements and uncertainties can be explained.

Existing literature about virtual meetings is to a large extent based on the authors' thinking and hypothetical reasoning about potential effects. Though much of this reasoning may seem logical, it is not always supported by empirical data. Also, very commonly, articles and reports on the topic is often honing in on specific effects, seldom taking a holistic perspective or looking at the big picture. In order to get a better idea of the full effects of virtual meetings we need to draw a map of all potential effects. We also need to find empirical data that will confirm more of the speculative thinking around these effects or add new knowledge to existing theories.

In literature, there are also uncertainties in how the effects from virtual meetings should be measured and monitored, and how this information should be made use of. Again, more empirical data would perhaps add to the knowledge about how these issues should be managed. Investigating and analysing real life examples this will contribute to the usefulness of virtual meeting technologies and enable organisations to work more effectively with these tools in order to achieve their goals.

4 Findings

This chapter presents the findings made in interviews and other sources of primary data. For background information purposes, the organisations that participated in the study are briefly introduced. The accompanying findings are organised into themes that will be presented in a rough order departing from the meeting and its inherent characteristics and then expanding into wider organisational effects.

4.1 Organisations studied

The REMM project involves 18 Swedish authorities and out of this population, five were contacted for the work with this thesis: Swedish Customs, Swedish Tax Agency, Swedish Environmental Protection Agency, and Swedish Transport Administration. Moreover, co-workers at one additional Swedish authority, Swedish Courts, and one EU agency, European Environmental Agency, were interviewed, along with some people at organisations in the private sector.

Most of the authorities interviewed in the study have in common that they are implementing virtual meetings according to a 10-step model developed within the REMM project. This model is checklist-based and aims at getting documented positive effects from virtual meetings, mainly through decreased travelling (Arnfalk et al., 2010). All organisations interviewed are well on their way in using virtual meeting technologies; investments in VC and/or CMC are done and utilisation is well spread or growing. The same holds true for the non-REMM Swedish authority, Swedish Courts.

The focus of the interviews have been put on two authorities, Swedish Transport Administration and Swedish Customs, who have provided four interviewees each. These two organisations will now be presented more in detail, in order to describe typical examples of the development of virtual meeting usage.

4.1.1 Swedish Customs - *Tullverket*

The goal of Swedish Customs is twofold: to collect customs duties on imported products, a process called *Managing the Trade*, and to prevent illegal goods to enter or exit Sweden, a process called *Law Enforcement*. Apart from physically guarding the borders, the authorities main strategies for achieving its goals are to cooperate with companies and other authorities, nationally and internationally, to improve its work methods, for instance by use of IT, to effectively disseminate information internally and externally, and to ensure its supply of adequate competence (Tullverket, 2012). Swedish Customs employs nearly 2 000 people, spread out all over the country.

Swedish Customs is governed by the Swedish Treasury and had a budget of 1 589 MSEK in 2011, which makes it a relatively large authority. The organisation has seven main targets related to customs and tax collection, and prevention of illegal smuggling (Finansdepartementet, 2011). Due to its geographical spread and process-oriented working method, Swedish Customs has had a strong drive to implement and make use of virtual meetings. The organisation has not had a clear ownership of the meeting issue and also has not developed a common travel- and meeting policy until very recently.

The focus of Swedish Customs' implementation, so far, has been on dedicated videoconferencing solution as replacement for business travelling. Videoconferencing has been in use since 2004, and has slowly increased in number of installations and also in rates of utilisation (Eriksson, 2012). Nowadays, it is not uncommon to have both development talks and salary discussions over video link.

As far as web meeting, chat, document sharing solutions is concerned, there has not been any development in these areas in the last years. However, the demand for these kinds of solutions is increasing and the organisation is for instance planning to globally implement Microsoft Lync, an instant messaging client integrated into the Windows 7 platform.

4.1.2 Swedish Transport Administration - *Trafikverket*

The Swedish Transport Administration was created from a merger of the Road and the Railroad administrations and also some minor, transport related administrations on 1st of April 2010. The Swedish Transport Administration is responsible for the planning of new roads for transport, on ground, in air, at sea or on rails. It is also responsible for the operations and maintenance of these roads (Trafikverket, 2012a). The Swedish Transport Administration has about 6 500 employees and is located in seven different places with its head office in Borlänge (Trafikverket, 2012b).

The Swedish Transport Administration is governed by the Ministry of Industry. Its budget is to a large extent dependent on running projects and therefore conditional in its use, but the appropriation for the administration of the authority was around 1.5 billion SEK in 2011 (Näringsdepartementet, 2011b).

When the Swedish Transport Administration was created, the authority inherited two different virtual meeting approaches, one from the Road administration and one from the Railroad administration. These two administrations had different videoconferencing solutions and different telephone communication solutions. Today, the old equipment is spread out in different locations and seldom used. Instead the organisation has implemented “Communicator”, a VoIP client for calls and chat, and “Live Meeting” for web conferencing, both Microsoft products (Brubråten, 2012). As of yet, there is no common solution for videoconferencing.

Moreover, the Swedish Transport Administration also inherited two different meeting cultures, something that several interviewees point out as a challenge. The target is to decrease travelling by 25% in 2013, compared to 2010 levels, but the organisation is not there yet. Many issues, like the ownership of the meeting question and other coordinative actions, are still not fully addressed in the merger, which influence the organisation’s possibilities to set policies, measure and follow up its activities.

4.1.3 Private organisations

Apart from the public authorities described above, this thesis also includes a number of interviews with people in organisations in the private sector. Employees at five different private companies and one trade organisation were interviewed. The organisations are briefly described below.

1. One of the largest and most influential suppliers of virtual meeting and web collaboration solutions globally. Extensive internal use of virtual technologies and a great stake in the positive outcomes of their use with their customers.
2. A company in the financial sector, one of the biggest insurance companies in Sweden. Proven record of successful use of virtual meetings, strong internal policies for use.
3. A company in the service sector, a major Swedish recruitment and consultancy firm. Strategic directives from top management level aimed at replacing travelling with virtual meetings. The drivers are cost efficiency and public image.
4. An international company in the retail sector, making use of an extensive set of collaborative tools to organise work in collaboration with suppliers, outsourcing partners and business commissioners in different locations and time zones.

5. A major Nordic company in telecommunications, with one of the strongest cases for the positive effects of use of virtual meeting technologies.
6. The trade association for business travellers in Sweden. Its tasks include to support their member organisations with knowledge and good practices and to act as a referral body for new legislation in the field.

4.2 Replacing the physical meeting

There is a general agreement among the interviewees in this study that the virtual meeting can never completely replace the physical meeting (for example Thoor, 2012; Nordmarker, 2012; Eriksson, 2012; Lundén, 2012). There are some social elements of the face-to-face, physical meeting that simply cannot be transferred over a video or web channel, at least not with current technology. Really getting to know a person, and from there start building up trust, is something that must be done in a physical meeting. Most interviewees suggest that projects or business relations should be started with a physical meeting, in order to establish mutual trust and a common platform to work from. This initial meeting can then be followed by a number of virtual meetings. This opinion is confirmed in a large number of comments from respondents participating in the travel surveys done in the REMM authorities.

Many of the people interviewed in this study speak of the two agendas of any given meeting: the “substantive” agenda and the “social” agenda. The former has to do with the actual content of the meeting: information, discussions, decisions and tasks, whereas the latter has to do with developing your personal relations with the people you are meeting. The social agenda is much easier to manage in a face-to-face meeting than in a virtual meeting, meaning that if your job success is based on your capacity to build and maintain personal networks you also need a larger share of physical meetings. This is probably why higher-level management have a tougher time embracing virtual meetings, as is the case in some of the organisations in the study.

The exact elements of the physical meeting that cannot be replaced in virtual meeting have not been further investigated in this study. However, there are examples of collaborative situations where the physical meeting will be irrelevant and totally absent. People participating in advanced online games such as World of Warcraft or League of Legends are organising into fully virtual teams which composition is random or self-organised, but is built around and depends on a specific and very clear goal, or “quest” in gaming lingo. These people have no need to meet physically, and sometimes do not know about their team members’ geographical location or even identity (Hansson, 2012).

Another, more business-oriented example of teamwork without physical meeting are *noded* projects, where people at different geographical locations with different competencies form temporary and fully virtual project teams in order to achieve project goals. Trust is built on historic achievements, recommendations and experiences from earlier co-operation (Kristiansson, 2012).

On top of this, there is a non-negligible cultural aspect to the importance of the physical meeting that needs to be taken into consideration. Compared to Sweden (and the Nordic countries in general) it is a lot harder in many countries to start and maintain business and work relations without the personal meeting. As an example, one of the interviewee in this study is travelling frequently to East Asia, both for meetings with suppliers and other external parties, as well as for meetings with internal project teams. Even though they work hard to replace as many meetings as possible with telephone- and videoconferencing and web meetings, there is always an issue of trust. One-way communication, like information meetings

and status updates, work well virtually, but as soon as there is a need for negotiations or a constructive or creative team discussion, the meeting has to be done physically (Bruck, 2012).

Another example is from the Swedish Transport Administration, which has a lot of international cooperation, primarily in the Nordic countries, but also in other European countries. The UIC, *Union Internationale de Chemins de Fer* or International Union of Railways, for instance is located in Paris, France, where the acceptance for using virtual meetings instead of personal meetings is lower than in Sweden (Håkansson, 2012).

4.3 The efficiency of virtual meetings

Are virtual meetings more or less efficient than physical meetings? The interviewees often spontaneously bring up the topic of meeting efficiency. Some people interviewed for this study are very specific in their positions that virtual meetings are more efficient, and vice versa.

A common opinion is that virtual meetings in general are more efficient than physical meetings. By saying this, the interviewees normally refer to the *delivery agenda* of the meeting in terms of information transferred, tasks delegated, decisions made or the like, not to the *social agenda*. Virtual meetings require more preparations, a clearer agenda and a more structured way of working. There is simply much less room for fuzziness and informal chit chat, which means that we economise with meeting time more efficiently (Nordmarker, 2012; Backlund, 2012; Lund, 2012). Discussions become less informal and also concentrated on the topics on the agenda. Typically, participants who are not well prepared and cannot contribute to the discussed issue stay quiet.

However, it is important to point out that a few of the interviewees in this study do not agree that virtual meetings are more efficient. One interviewee even gave a figure: "One hour of physical meeting equals one and a half hours of virtual meeting". The argument behind this position is that all participants are not fully involved in the meeting. They might be listening in for whiles, but in between they are doing other things, like checking their e-mail. Second, and this is something that many agree to, there is a big risk of "over-invitation". It is easy to invite too many or irrelevant people to a meeting that is being held virtually, just in case. If these people accept the invitation and take part in the meeting, the efficiency decreases.

The short answer to the question of whether physical or virtual meetings are most efficient is that it depends. Most importantly, it depends on the purpose of the meeting, what we want to achieve. It also depends on technology, shares of physical and virtual participants, and the number of participants.

So, how can the efficiency of meetings be measured? Not many organisations seem to be doing this today, but many agree that it would be a valuable exercise (Lundén, 2012; Holst, 2012; Håkansson, 2012). Ms Håkansson at Swedish Transport Administration and Ms Holst at Proffice Life Science have similar ideas about how to measure efficiency of meetings. To successfully measure efficiency, we need to set up a taximeter for time spent in the meeting and then relate it to the meeting purpose and agendas, and to subjective perceptions about whether these purposes were met (Håkansson, 2012; Holst, 2012).

4.3.1 The purposes of meeting

Defining the types of meetings employed in an organisation is key to achieve an efficient use of virtual meetings. There must be a system in place that supports the co-workers decisions in what form of meeting that should be used (Fowler, 20112). Lack of ownership of the meeting

issue is referred to as a major obstacle to effective use of virtual meetings in many organisations.

In any interpersonal communication there is always a risk of misunderstandings, but that risk is lowest in a face-to-face meeting (Ekdahl, 2012). In general, complicated and complex issues that require dialogues in larger or smaller groups are less efficiently handled in virtual meetings. The more complex and interactive agenda is, the more sophisticated technology is needed and still some meetings must be conducted face-to-face. The challenge then becomes to select the virtual meeting technology that gives the best trade-off between quality and quantity of communication. A good strategy is to save up complex and social issues for face-to-face meetings and take care of less complex issues virtually (Ekdahl, 2012).

Some examples of meeting types, purposes, forms and efficiency that were discussed in the interviews for this thesis are listed below:

- Meetings involving two individuals, such as development talks, salary negotiations, personal meetings and interviews. If the ultimate purpose is reaching an agreement, the risk of misunderstandings is minimized by a physical meeting, but any type of virtual meeting will still be effective. If the purpose is mutual understanding, getting to know each other, or establishing trust, a physical meeting will be superior.
- Meetings involving several parties from different organisations, teams of departments with the purpose of reaching agreements through negotiations. These meetings need visual communication, like videoconferencing or telepresence, but is still more effective in a physical meeting, due to risk of misunderstandings.
- Broadcasting or mass communication, e.g. higher-level managers giving information about an organisation's performance or goals. These types of meetings are very efficient when done virtually. The added advantages are that they can be recorded for later viewing, and that dialogue can still be kept up by help of chat functions and/or a meeting facilitator role.
- For team or department meetings with the purpose to transfer information about work status, get everyone in the team up to the same level of awareness or make common decisions, a virtual meeting is normally efficient.
- Workshops, brainstorming and creative meetings or meetings involving complex problem solving, is more suitable to be done physically. Especially, this holds true if the participants need to break into smaller groups for discussion, which is often the case in these meetings.
- Education and training can be done very efficiently by virtual means, as can support and "light" communication about specific issues. Instant messaging, for instance, is a very efficient tool for a team member to get quick answers on specific questions from colleagues.

If cultural differences and time zone considerations in the project team are added to this equation, the efficiency of virtual meetings becomes even lower. One solution for these specific problems is to work with proxies, representatives from geographically remote teams that are present physically (Ekdahl, 2012).

4.3.2 Other factors influencing efficiency

As mentioned above, the efficiency of virtual meetings also depends on the technology, or more specifically: the reliability of the technical solution in use. A virtual meeting with failing audio, low quality video or disturbances in network connections will never be perceived as efficient, which is something that several respondents in REMM's travel surveys point out.

Expectations on the meeting organiser or president are generally higher in a virtual meeting. The meeting needs to be better prepared; it also needs a clearer agenda and employment of clear rules when held (Nordmarker, 2012; Håkansson, 2012; Lund 2012). “Virtual meetings are more structured” is a very common comment, and the reason for this is that there is less tolerance for informal discussions and breaks in the agenda. A common situation that influences efficiency is when some participants are physically together and some are joining the meeting virtually. In these situations it requires some skills from the meeting president to keep the meeting focused and get the remote participants to feel as involved as the physically present participants (Rönnegård, 2012; Sjöstrand, 2012).

Another factor that affects meeting efficiency is the number of participants, and in virtual meetings there is a clear risk for “over-invitation”, i.e. invitation of participants that would not have been in the meeting, had it been done physically. When one extra invitation appears to bear no marginal cost, people tend to invite more participants *just in case*, similar to CC:ing e-mails. People attending meetings that are not relevant to their work, and that do not have the required knowledge or information to make any useful contribution, have a negative impact on meeting efficiency. At this point, it is important to point out that not all interviewees in this study agree that “over-invitation” is in fact a real risk.

4.4 The meeting culture

Closely related to the aspect of meeting efficiency, the use of virtual meetings will have an influence of an organisation's meeting culture: what types of meetings that are used, meeting frequencies, the meeting agenda and structure, and who and how many people are invited. The activities in many organisations are already meeting intense. A common estimate is that an FTE typically spends something between a fourth and a third of his or her time in meetings (Fridén 2012; Lund, 2012). Yet, we can see that the time spent in meetings and further need for meetings is increasing (Fowler, 2012).

Meeting culture will be influenced by the strategy employed when introducing virtual meeting technologies. Very broadly speaking, there are two different scenarios for introduction and spread of virtual meetings in an organisation. In the first scenario virtual meeting technologies are introduced on small scale in some organisational sections, most often the ICT department. Management or direction agree to this development, but does not support or pay much interest in it. Initially, in this scenario there is often no effective meeting policy in place and no clear ownership of the meeting issue. Employees need to work out new rules and guidelines for using the new meeting forms and tools.

In the second scenario, management is involved from an early stage, and there is a clear meeting policy, or integrated travel- and meeting policy, set up for the entire organisation. The selection of what virtual meeting technologies to be implemented is done in a more structured way, and training is set up for the users of the chosen solutions.

Virtual meetings need stricter meeting rules. To be successful they require a clear agenda, a list of participants, and also that material is sent out beforehand so that people can prepare (Bruck, 2012). The rules of the meeting procedures must be transparent and communicated.

The data in the findings is vague, but there is a tendency that employees in organisations with stronger directives from management talk about effects on meeting culture in more positive terms. Clear guidelines for how and when meetings should be held, who should be invited and what forms to use tend to work as positive drivers for better use of virtual meeting technologies. On the other hand there are several examples in the study of organisations where use of virtual meetings work very well based only on the “common sense” of the

employees. And there is some common sense out there. The quote below is a comment from an anonymous respondent in a REMM travel survey:

“If possible - avoid meetings. Information from your boss can be sent in writing. If a meeting is really necessary, think about the purpose of the meeting and invite only the people needed to reach this purpose.”

Another aspect on meeting culture is the equality and fairness issue. A meeting where some people are physically present and some are calling in or present on video or web link might be “unfair” in favour of the physically present (Brubråten, 2012). Again, the meeting rules needs to be different from a physical meeting, with the aggravating circumstance that some people are in fact present. It is much more important to keep track of things like who is talking and who is in turn, or there is a risk that remote participants lose involvement in the meeting (Rönnegård, 2012).

4.5 Meeting versus collaboration

Virtual meeting technologies, such as audio conferencing, videoconferencing, web meeting solutions and telepresence, should be looked on as tools in a toolbox. They are but media that enable people to communicate without meeting physically. However, very importantly, a virtual meeting is only one possible application from this toolbox of technologies. When this toolbox is supplemented with other tools, such as instant messaging, e-mail, document sharing, shared project platforms, information subscription solutions like RSS, then our perspective on applications needs to be broadened, from meetings to web-enabled collaboration (Banner, 2012).

In the literature analysis the concept of virtual collaboration was briefly discussed, and the interviews done for this study confirm the importance of looking at the broader perspective. People in organisations that have implemented a wider scope of tools tend to be less able to separate effects of virtual meetings from effects of other virtual collaboration. Thus, the “virtual meeting” is a subset, one application, of the much wider “virtual collaboration”. In fact, the question about the effects of virtual meeting in isolation might be irrelevant (Littorin, 2012).

From an organisational perspective, the importance of the full set of virtual collaboration tools increase with organisational complexity. Running development projects with internal employees, consultants, commissioners and external suppliers in several different locations in different time zones (as is the case in at least one organisation in this study) requires collaborative tools that work asynchronously and seamlessly. Several interviewees strongly stress the importance of opening up for external communication and collaboration (for example Eriksson, 2012). These growing needs work as a driver for development and addition of new web collaboration tools that enable integrated communication, independent of platforms or devices (Banner, 2012). This is what is commonly referred to as UC, unified communications.

4.6 Changes in business travelling

In general, the first thing that comes to people’s mind when asked about virtual meetings are effects related to changes in travelling. This might be especially true in Swedish, where the expression “travel-free meeting” is often used instead of “virtual meeting”. As the case with the REMM project proves, expected decrease in travelling is a key driving force for investing in virtual meeting technologies.

At regular intervals, Statistics Sweden initiates a national survey on travel habits, RES. Among other things, RES give account for the total number of main trips, from start to end, irrespective of travel mode changes. It also includes numbers for long-distance journeys, more than 100 kilometres in one direction. The table below presents available data.

Table 4-1 National travel data for 1999, 2006 and 2011.

	1999	2006	2011 ³
Total main trips, millions.	4 979	4 905	4 991
Whereof work-, study- or business related.	48%	46%	45%
Total long-distance trips, millions.	63	73	No data
Whereof work-, study- or business related.	23%	27%	No data

Sources: SIKÅ, 2000; SIKÅ, 2007; Trafikanalys, 2012

The share of employees that telework have increased from 4% in 1999 to 11% in 2005-2006. Also, in the latter survey, Statistics Sweden started measuring the use of audio- and videoconferencing. The survey shows that 9% of all employees participated in a telephone conference and 2% in a videoconference per month, on average (SIKÅ 2007).

There are also good examples of a positive relationship between increased use of virtual meetings and travelling in absolute terms. For instance, the insurance company interviewed for this study report that the number of business related air travels has gone from 25.000 in 2007 to an estimated 16.500 in 2012, with a stable amount of employees over the period. Although this decrease might partly be explained by the general economic downturn, a large chunk of it is related to the introduction of a new travel- and meeting policy and investments in increased capacity for virtual meetings (Stenvad, 2012).

Another example is TeliaSonera, a large Swedish-Finnish company in the telecommunication field. In the late 1990s this company became a pioneer in virtual meeting, when the CEO at that time, Marianne Nievert, issued a meeting policy which clearly stated that meeting conveners should always first consider the possibility to run meetings virtually. At the time, Telia (as it was called before the merger with Sonera) was an extremely travel intense company, spending around 300 MSEK per year on business travels. Today, that figure is 70 MSEK, but at the same time the company has shrunk from some 12 000 employees to around 8 000 employees. The number of air travels, totalling 100-120 000 per annum in 2001 is down to 20 000 this year (Lundén, 2012).

There are also some examples of public authorities that have seen decreasing levels of business travelling. For instance, Swedish Courts and Swedish Energy Agency report that their travelling has decreased, at least partly thanks to increased use of virtual meetings (Thoor, 2012; Lund, 2012). A very common chain of reasoning is that this decrease will spawn a

³ The latest national travel survey for the years 2011-2013 is currently ongoing. The numbers for 2011 are available on the web site of Trafikanalys (2012), the public authority responsible for these statistics.

number of other effects: for example cost savings, better work-life balance and less stress, decreased environmental impact, increased work efficiency (Holst, 2012; Ericsson, 2012; Håkansson, 2012). Thus, the existence of these effects is mentioned on the basis of decreases in travelling levels.

On the other hand, many of the interviewees in this study state that virtual meetings actually do not have the commonly expected effects on their organisation's travelling, either in terms of costs or number of business trips (Fowler, 2012; Littorin, 2012; Eriksson, 2012). Some even claim that travelling has increased, despite the introduction and increased use of virtual meeting technologies (Sjöstrand, 2012).

An illustrative example of this comes from one of the authorities in this study. This organisation built its educational organisation based on the assumption that a fully functional infrastructure for teleworking and virtual meeting technologies was in place. Co-workers were recruited from various geographical locations around Sweden, but when activities started it soon became clear that the technologies that had so far been implemented did not fulfil the requirements. In the end, this mismatch in time between expected and delivered functionality caused a lot of unnecessary commuting and business travelling.

When discussed, a common explanation for this inconsistency was that a large share of the co-workers lacked training or incentives to use virtual meeting technologies. This might lead to intensive use of virtual meetings in some project groups or teams and almost none in others. This can for example be illustrated by statistics from Swedish Customs that show a difference in utilisation rate ranging from around 75% down to below 5% in different locations (Eriksson, 2012).

Second, there is a general problem with measuring travelling and its associated costs. As virtual meetings increasingly grow into an organisation's working methods or the organisation itself changes, the validity of the existing baselines is eroded. A typical example of this problem is Swedish Transport Administration, which is actually a merger of two major public authorities. This authority has a clear goal: decrease travel costs by 25% 2013. But the problem is: in comparison to what? (Brubrâten, 2012; Håkansson, 2012).

Also on the cost side the measuring problem is clear, but not evident. Meetings carry a variety of costs, whereof travelling is one and time is another. A change in the ratio between physical and virtual meetings may only result in a transfer of costs between cost units, departments or organisations, not to a decrease in total travelling costs or even aggregated costs (Littorin, 2012).

A third explanation is the complementary effect. Eventually, virtual meetings only become a new and added way of meeting with colleagues and partners. A new medium, which can be used to further extend the co-worker's network of contacts and thereby his or her need to meet, also physically. Or as one interviewee put it: "Travelling is increasing, video conferencing is increasing, web meetings are increasing. Everything is increasing!"

In many organisations there is also a certain level of resistance to actually decrease travelling. There are always some people who enjoy the fun of travelling itself, or who consider travelling as a status marker or a privilege that needs to be protected. Especially, this seems to be the case for male co-workers in their twenties or early thirties (Ekdahl, 2012). In some cases there is even an individual, economic aspect on work-related travelling. If travelling a lot, and especially abroad, daily allowances can constitute a considerable share of a co-worker's total wage (Nordmarker, 2012).

4.7 Environmental impact

The predominant opinion among the interviewees in this study is that virtual meetings will, almost by definition, lead to a decrease in the organisation's environmental impact. Comments like "this is generally accepted", "of course it will affect the environmental impact" and "our environmental impact decreases through decreased travelling" are ubiquitous. The natural and logic reasoning behind this is that decreased travelling leads to decreased emissions, and this view is confirmed not least by the Swedish government's own strategy for greening its activities by help of ICT.

Some people are more cautious about the environmental impact, thinking that virtual meetings *should* affect climate but that data is missing or insufficient. And again, there are some interviewees that see no evidence for a connection between increased use of virtual meetings and decreased emissions.

So, is there any empirical evidence that CO₂ emissions and other environmental impacts change when the use of virtual meetings increases? Well, there are some examples of success stories. For instance, Swedish Customs, with its implementation of video conferencing, has collected statistics on its CO₂ emissions between 2004 and 2011. Swedish Customs' annual decrease of CO₂ emissions has gone from almost 31 tonnes in 2004 to 281 tonnes in 2011. The problem with this information is that we do not know exactly how many meeting hours that are spent face to face, virtually or partly face to face and virtually. We also have no information about the average number of participants in the meetings.

Another example is TeliaSonera again, who have been following up their emissions of CO₂ closely in the last 10 years or so. The level of emissions that can be related to travels and transports has gone from around 60 000 metric tons in 2001 to around 15 000 metric tons in 2011 (Lundén, 2012). In the last years, however, the decrease has levelled off and stabilised. Major dips in the emissions during this period can also be related to the economic downturn that in 2008 and the eruption of Eyafjallajökull in 2010 (Lundén, 2012).

An important point regarding virtual meetings and emissions that was also brought up by some of the interviewees is the travelling modes, which influences the correlation between travelling levels and use of virtual meetings. Meeting virtually does not have to decrease travelling but can still have a positive impact on environmental impact (Håkansson, 2012). For example, three 50 km car trips to meetings that can be substituted with VC free up time that can be used for a 200 km train trip to a physical meeting.

4.8 Productivity and economic activity

What can be said about virtual meetings and collaboration and their effects on organisational productivity, i.e. the effectiveness of productive effort, as measured in terms of the rate of output, per unit of input (Oxford English Dictionary, 2012)? In other words, do virtual meetings lead to increase in economic activity, given the amount of resources does not change?

There is little evidence in empirical data indicating that productivity will be influenced by increased use of virtual meetings or by virtual collaboration in general. None of the organisations in this study have been able to show any metrics that indicates that relationship actually exists.

Nonetheless, a few of the interviewees bring up this hypothetical effect spontaneously. Ms Fowler at SBTA talks about the importance of looking at these issues from a more holistic

perspective. Measuring effects on too detailed levels becomes cluttered and petty. Instead, we should focus on broader perspectives and look at such aspects as total productivity (Fowler, 2012). Other people in the study mention effects in terms of being able to “deliver more” or “positive effects on our capacity to deliver” (Eriksson, 2012; Backlund, 2012; Håkansson, 2012). In fact, when confronted with the question, most interviewees are inclined to agree that their economic activities and productivity increases with increased use of virtual meetings. The cost saving effects of virtual meetings will free up resources that can be used for producing more service.

4.8.1 Cost savings

Swedish Customs have been collecting data regarding occupancy in their video conferencing facilities since 2004, when video conferencing was introduced. Based on the *assumption that travel costs for three people for every third meeting is avoided*, they have been able to estimate the annual savings resulting from the use of video conferencing. In 2004, the first year of measuring, the savings were roughly 1.6 MSEK. Since then, this has climbed every year and in 2011 the savings were estimated at 14.2 MSEK. The annual gross savings in hours spent in meetings have gone from almost 500 in 2004 to almost 3 800 in 2011 (Eriksson, 2012).

Few people disagree with the initial time and cost saving effects of virtual meetings, which are often brought up spontaneously in the interviews. On the other hand, many also mention the fact that replacing some physical meetings with virtual ones free up time that can be used for additional meetings, which their turn can generate more work and even more travelling. When probed about the total cost for meetings, including travelling, equipment, support, operations, and total time spent in meetings, the uncertainties in responses become bigger.

4.9 Employees

Although not often the first thing that comes to mind, many people agree that increased use of virtual meetings will, at least eventually, have effects on their staff.

4.9.1 Employee satisfaction

Almost all organisations have some kind of system in place for measuring employee satisfaction at regular intervals, normally every year. Employee satisfaction index levels based on these surveys are often used as basis for work improvements and sometimes used as specified goals or written into balanced scorecards.

The systems used for employee satisfaction surveys can be developed by the organisation itself, which has the advantage of being fully customised. They can also be purchased from third party suppliers, which has the advantage of access to industry and general data that can be used for benchmarking. Parameters measured in these surveys range from job satisfaction, work-life balance, and organisational efficiency, to trust in management and colleagues and motivation, to mention a few examples. In the case of public authorities in Sweden, there is a certain level of co-operation between some of the authorities around the contents of employee satisfaction index surveys, through an existing network on director-general level.

Most interviewees in the study agree that virtual meetings has an effect on employee satisfaction, and also that this effect should be measurable by use of the existing systems. Some of the interviewees from organisations in the private sector with extensive use of virtual meetings claim that the effects of virtual meetings clearly can be seen in their employee satisfaction index. Mostly, the effects on employee satisfaction mentioned are individual: stress levels and work-life balance in particular. But there are other indicators in use as well. As an example, Swedish Tax Agency is already successfully measuring their employees' satisfaction

with travel management (Sjöstrand, 2012). A few interviewees see no connection whatsoever between virtual meetings and employee satisfaction levels, but most agree that it would be interesting and worthwhile to find the connection and try to measure it. The most common suggestion for indicator in this case is employee perceptions about work-life balance.

4.9.2 Recruitment

Virtual meetings affect recruitment in several different ways. First, the technology facilitates the recruitment process: it saves time and you can interview more people at geographically dispersed locations, which give a broader range of selection (Stenvad, 2012). Second, by use of virtual meetings and other collaborative tools, organisations have a bigger possibility to recruit new employees that live in places further away from where the offices are located.

Third, by being clear in an early stage of the recruitment process about the expectations on travelling and the possibilities to work and meet virtually, an organisation can attract new types of applicants. One example comes from Swedish Customs, who have been able to recruit more people that are confident, experienced and already established in their local communities by offering basic education online (Nordmarker, 2012).

Another important aspect on recruitment is that organisations will also have to attract younger applicants, people from the generations born in the 80s and 90s, “Generation Y”, that are now entering the job market. People of this age are generally perceived as much more accustomed to working virtually and are also familiar with a larger code system in virtual communication, e.g. smileys and abbreviations, which can be used to express a variety of sentiments (Ekdahl, 2012). Generation Y are expecting a high level of personal freedom when working, but at the same time they will have to adapt to existing organisational cultures, which is a challenge for both sides (Sjöstrand, 2012). Interestingly, the new generation, especially in a management position, also tend to bring back a bit more control. Their level of trust in co-workers working remotely actually doing what they are supposed to do seems to be lower than formerly (Rönnegård, 2012).

4.9.3 Gender, diversity, equality

With few exceptions, the interviewees themselves do not bring up any effects that regard equality, diversity and gender equality. When asked, most people agree that the travel substituting effect of virtual meeting will logically have an effect on gender equality, but that this correlation is uncertain. One person in the study even found this effect one of the most important to try to measure. Extended use of virtual meetings could mean more women at positions that are traditionally travel-intensive (Thoor, 2012). It could also mean, an example provided by Mr Stenvad, that men already in those positions suddenly have time to “go pick up the kids from child care”.

When it comes to other forms of equality, disabilities for instance, the link to virtual meetings is unclear. The same holds true for diversity, even though some interviewees agree that virtual collaboration in general should also be viewed in the light of the diversity plans that all public authorities in Sweden must comply with. For organisations that have the freedom to involve people on a global scale, it means that more contracting can be done abroad, which will increase the diversity of the teams, at least in terms of origins (Kristiansson, 2012).

4.10 Working virtually and organising virtual work

“I’m convinced that virtual meetings has been the rescue for many projects, to meet the deadlines and keep the team members together”, says Mr Eriksson at Swedish Customs (2012). This statement is quite typical and shows that possibility to work and meet virtually

will affect how organisations work and organise themselves. Clearly, the studies made for this thesis indicate that the substituting effect, replacing physical meetings with virtual meetings, will eventually subside. Instead, after being successfully implemented, at the latest, virtual collaboration will quickly become a driver for changes in organisational processes.

Mr Littorin (2012) at Swedish EPA discusses this development in three phases. First, there is a substituting effect where virtual meetings are seen as an emergency solution without inherent value. In the second phase, the value-adding capacity of virtual meetings becomes evident to a greater number of users. The use of virtual meetings in the organisation grows, but the existing processes and work routines are still intact. In the third phase, the driving force of the virtual technology has become so strong that it will enforce changes in processes and ways of working, just like national laws are eventually adapted to the behaviour and values of the country's citizens. We will now look into some effects that will have an influence on an organisation's ways of working.

4.10.1 Flexibility

There are several aspects on flexibility that relate to working virtually. Collaborative tools and technologies enable organisations to organise their work and their teams in a much more flexible way. For instance, many organisations are sitting on internal competencies that are bound to certain geographical locations, simply because the employees with these competencies have to live somewhere. Virtual collaboration technologies remove this boundary, and suddenly we can involve co-workers with specific competencies in our project or team, regardless of their physical location. The same holds true for external competencies. Mr Lund (2012) at the Swedish Energy Agency, recounts that his organisation regularly makes use of external experts and consultants, whose special competencies can now be used more flexibly and effectively.

Moreover, virtual collaboration technology enables the organisations themselves to organise more flexibly. For example, Swedish Tax Agency now partly works in permanent, distributed teams of experts that belong to the same department in the organisational chart, but are physically dispersed (Sjöstrand, 2012). The same tendency can be seen in Swedish Customs (Fridén, 2012).

Another aspect is the personal flexibility that virtual methods of working offer to the individual co-worker. Being able to work asynchronously, to make contributions at any time from any location and to take part of recorded meetings will make it possible for the individual to work more freely in time and space. A typical example of this is the use of videoconferencing at the daily planning meetings at Swedish Customs, where the tips and threats are presented and reviewed. This is a core activity at Swedish Customs and since these meetings now take place over VC, the meeting leader can work remotely and the co-workers can take part of the meeting afterwards (Eriksson, 2012).

4.10.2 The virtual organisation

Virtual meeting technologies and collaborative tools in general open up for completely new ways of organising, as we have seen in the literature analysis. This is confirmed in the empirical evidence collected for this thesis. A clear example comes from the Swedish Tax Agency who has seen a development towards a more decentralised and distributed organisation where experts in the same fields belong to the same organisational units, but do not sit physically together (Sjöstrand, 2012). Another example is from Swedish Courts and one of their projects that were run to create six new land- and environmental courts in different

parts of Sweden. This project involved a number of people at different locations and made extensive use of videoconferencing and web meeting technologies (Thoor, 2012).

Virtual work enables organisations to make better use of their existing internal competencies (for example Ekdahl, 2012; Fridén, 2012; Brubråten, 2012). Teams can be set up involving the people whose competencies are most needed, irrespective of their physical location. Also, we can make much better use of external competencies, consultants and field experts, who are needed for specific tasks (Lund, 2012).

Although not always a primary objective for an organisation, virtual meeting technologies, in combination with other types of virtual collaboration tools and infrastructure, enable its employees to telework more. This is an effect that some of the interviewees discuss from a decreased travelling point of view, since it telework will decrease the need for commuting to work and back. But teleworking and virtual meetings also have effects on availability. Co-workers will be more available to answer questions, provide information and participate in meetings, thereby decreasing the delays in communication (Brubråten, 2012; Thoor, 2012; Rönnegård, 2012). The flip side of this coin is that increased availability will have effects of work-life balance and stress levels, which might in turn influence job satisfaction. Moreover, increased availability does not necessarily mean that co-workers are present, mentally. You can be available to participate in a meeting, but still not be there in your mind (Holst, 2012; Stenvad, 2012).

In some cases, especially in the private sector, the possibilities to collaborate virtually will have an effect on the geographical localisation of organisational activities. For example, development projects can be organised in a way that make use of competencies in other countries, such as India or Romania (Kristiansson, 2012; Ekdahl, 2012). This effect is not significant in the public sector, where localisation is more commonly based on political decisions (Thoor, 2012). There are also signs of a backlash against last years' tendency to spread out activities geographically. Organising virtually is not suitable for all types of organisational activities and sometimes not cost efficient, which has lead to that some organisations now try to decrease geographical spread and centralise more (Håkansson, 2012; Rönnegård, 2012).

Virtual meetings and collaboration make the organisation less vulnerable to unexpected events or catastrophes, thereby keeping up business continuity (Rönnegård, 2012). A good example, provided by Mr Lindberg at EEA, is the European Centre for Disease Prevention and Control that make use of virtual meeting technologies in order to reach their experts in case of a pandemic with accompanying travel ban (Lindberg, 2012).

The ability to work and meet virtually enables an increase in the frequency of communication between colleagues, team members, partners and other stakeholders. Over time, this change of preconditions can also lead to a change in work methods. If we can keep up constant dialogues with customers, suppliers and colleagues, our way of working becomes more adaptive and agile, based on shorter feedback loops. This also enables work to be done in shorter cycles and more iterations (Ekdahl, 2012; Rönnegård, 2012; Ericsson, 2012).

4.11 Risks and mitigation

What are the risks that can be seen from increased use of virtual meetings and collaboration? And what are the conditions or actions that will mitigate these risks? Some risks have already been mentioned, such as “over-invitation”, resistance and risks of misunderstandings and technical hassles. Other risks are related to employee satisfaction levels and staff turnover, such as increased stress levels and changes in work-life balance. Further risks include that the

complementary effect leads to an unnecessary increase in the number of meetings or that a sloppy implementation leads to decreased trust in the technical solutions (Ericsson, 2012; Brubrâten, 2012).

Many people see a risk in the decrease of social interaction that follows virtual meetings and collaboration. For instance, managing a team of co-workers is more difficult when the team is dispersed (Holst, 2012; Stenvad 2012). Also, the forming phase of new teams might be negatively affected by less social interaction (Håkansson, 2012).

To mitigate these risks it is important that there is a clear ownership of meeting and travel issues in the organisation, and preferably also a set of pronounced policies in these areas (Brubrâten, 2012; Fridén, 2012). Direction and management must be involved and define a strategy for virtual meetings and collaboration. This has to be communicated to the organisation, and adequate training has to be provided (Littorin, 2012; Banner, 2012). Advantages of virtual work must be explained. It is also important that management themselves make use of virtual meeting technologies, and act as role models. To further mitigate risks, the organisation should also involve external partners in the development of policies and processes (Stenvad, 2012).

4.12 Measurements and indicators

Part of the goals with the interviews in this study was to find out how organisations measure the effects of virtual meetings today, and also what they would like to measure if they could. The table below shows the gross list of indicators in use today, or indicators on the wish list.

Table 4-2 Indicators in use today or on wish list

Indicator	Comment
Travelling costs.	Commonly used.
Travelling time.	Can be split up into productive travel time and unproductive travel time.
Number of business trips.	Should be divided into travel modes.
Number of avoided trips.	
Number of physical meetings.	
Number of virtual meetings.	Preferably divided into different types, such as videoconference, telepresence etc.
Time spent in meetings.	Should be divided into physical versus virtual meetings.
Number of meeting participants.	
Meeting efficiency.	
GHG emissions.	
Productivity.	In terms of deliveries that fulfil requirements in

	time, cost and quality.
Employee satisfaction.	Work-life balance, stress, performance, and so on.
Demographic indicators.	Information about gender, diversity and equality.
Organisational distribution.	
Utilisation rates.	How various types of virtual meeting solutions are used.

The collection methods used or suggested include statistics from internal systems, such as financial or technical systems or time reporting tools, and employee surveys and questionnaires. A common opinion among the interviewees is that many of these indicators are hard to measure, especially the more subjective ones. Moreover, as one interviewee pointed out, measuring and monitoring is pointless unless we have a clear picture of what it is that we want to achieve (Banner, 2012).

4.13A final piece of empirical data

The figure below shows a screen shot taken from a virtual REMM project workshop the 28th of May 2012. The participants in this workshop, 11 in total, were presented with a list of possible effects from using virtual meetings and were asked to vote on their probability, significance (question on the left) and whether it would be interesting for their organisation to measure and follow up on these effects (question on the right).

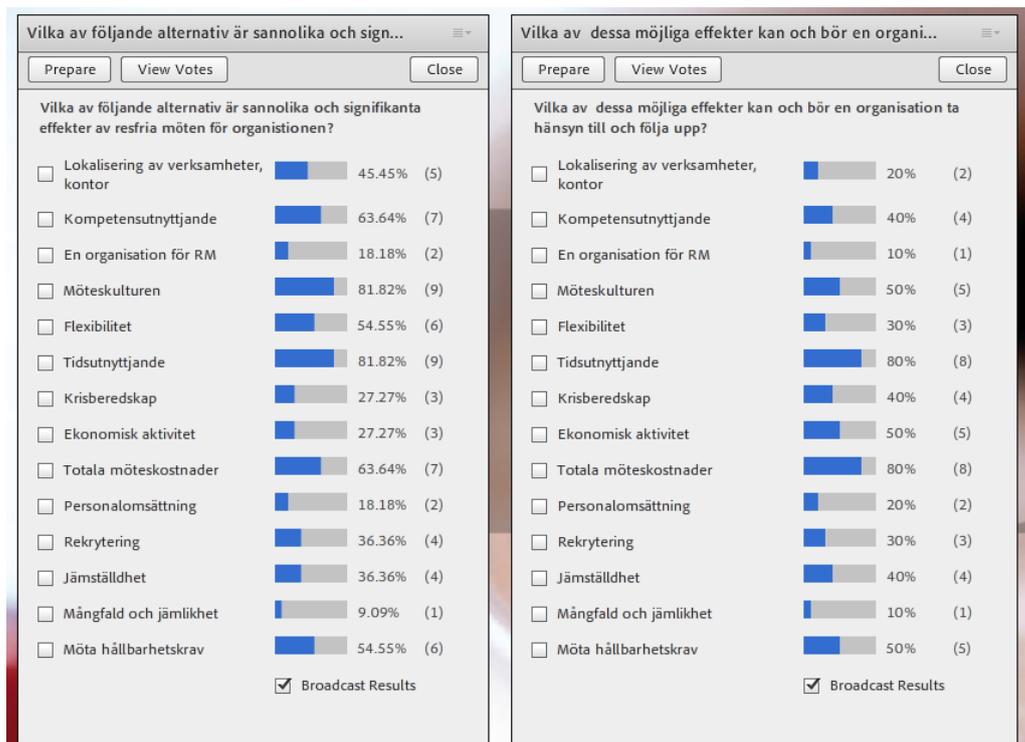


Figure 4-1 Online poll of effects of virtual meetings.

The list above contains the following potential effects, in order: localisation, use of competencies, organisation for administration of virtual meetings, meeting culture, flexibility, use of time, business continuity, economic activity, total costs for meetings, staff turnover, recruitment, gender equality, diversity and equality, sustainability requirements.

For example, the information in the polls above show that 55% of the respondents believe that virtual meetings have an effect on how an organisation can meet its sustainability requirements, and that 50% of the respondents think that this effect should be measured and followed up. It also shows that less than half of the respondents believe that virtual meetings have effects on business continuity, staff turnover, gender equality, diversity and recruitment, among others.

This simple exercise illustrates the divergences in opinions over the effects of use of virtual meetings all too clear. In the next section the author will make an analysis of existing evidence and try to find some explanations for these apparent dichotomies.

5 Analysis and suggestions

This chapter starts by analysing the findings through the lens of the selected framework, the TERM model. Agreements and divergences in empirical data will be looked into and discussed, and some new suggestions on how the topic of organisational effects of virtual meeting should be perceived will be presented.

5.1 Analysing the findings

The information collected through literature analysis and through empirical studies will now be analysed with help of the TERM model presented before and for convenience also below.

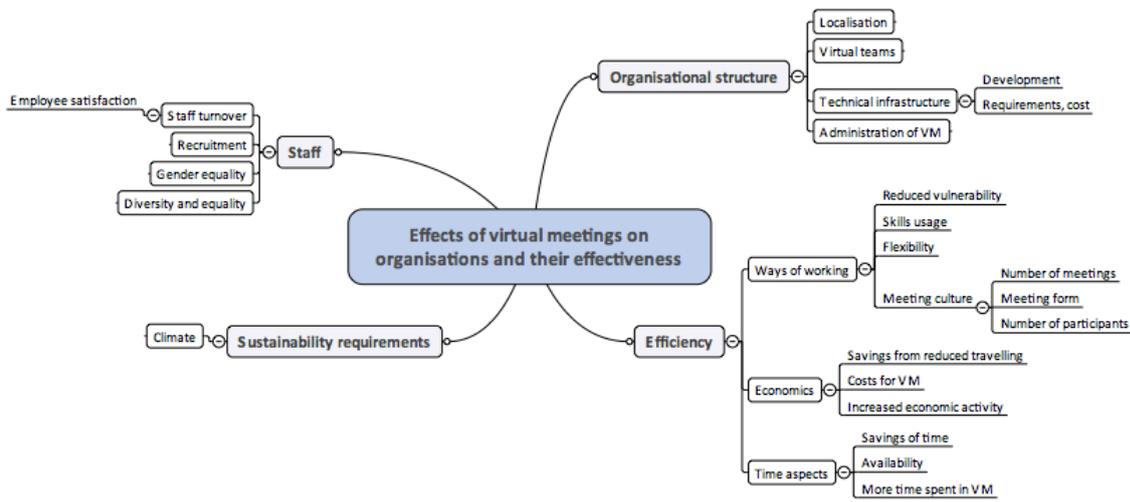


Figure 5-1 The TERM model of organisational effects of virtual meetings

5.1.1 What no one mentions

Of all the potential effects in the TERM model, there are a few that are less frequently referred to in the interviews done for this study. In the author's opinion, there are probably two reasons for this: either the issue is less relevant or significant in this context, or the link between the expected effect and virtual meeting is perceived as too weak.

The first example has to do with developing, operating and administering the technical solutions used for virtual meetings. These costs are discussed in literature and in real life, and they are important matters that influence which technical solutions that will be selected or developed and implemented. However, these costs are not real *effects* of virtual meetings. Instead, they are parameters that should be taken into account when calculating return on investments or net cost savings of virtual meeting solutions.

Second, the link between diversity and equality seems to be very far-fetched or insignificant in many people's opinions. Indeed, no one disagrees that they are potential effects, and some interviewees suggested that virtual meeting utilisation should be connected to diversity plan, but the sample of interviewees and literature that discuss these effects is very small. One suggestion for further research would be to find more relevant interviewees that have personal experience of this and will be able to provide better empirical data on the matter.

5.1.2 Issues of general agreement

Empirical data from the conducted interviews show that in some areas there is a great extent of convergence of opinions. This indicates that these areas are, if not significant, at least important for the topic of virtual meetings.

Skills usage

Meeting and working virtually is expected to enhance our possibilities to make better use of the skills and competencies available inside our organisation. It is now possible to form virtual teams that include people in remote locations that we could not have made use of otherwise. The organisation can also more easily make use of co-workers with special competencies for shorter assignments or for advice in special issues. The same holds true for external competencies, like experts and consultants.

For an individual co-worker, fully using and getting appreciation for his or her skills might work as a motivator at work. But from an organisational perspective, the skills usage effect might at best work as a factor that will contribute to more efficient use of resources. Therefore the level of skills usage as such is not interesting and trying to measure this effect might not be entirely relevant.

The information collection method suggested in the TERM model to find out about the use of competencies involves interviews with management, project managers and other key persons. In the author's opinion, the value added from knowing exactly how skills usage is spread geographically, in relation to the amount of work needed to acquire this knowledge, is low. Perhaps this energy should instead be spent on working more with competence management and on providing more and better channels for formal and informal communication between like-minded within the organisation.

Availability and flexibility

Virtual meetings, and collaborative tools like instant messaging and document sharing, will increase the availability of the co-workers. Disregarding the individual effects that this might have on stress levels and work-life balance, this increase in availability potentially leads to shorter feedback loops and less delay in work. These tools make it possible to organise work and teams more flexibly in space and time. They also allow for co-workers to work more flexible, from home or on the run. Additionally this may also result in better conditions for business continuity, in case of unwanted business interruptions. More availability with co-workers and a flexible way of organising makes our business activities less vulnerable to unexpected events.

Together, these two effects will push for changes in work processes, towards shorter cycles of deliveries. As an example, this tendency can be seen very clearly in the area of systems development, where the trend in the last years have been to work in shorter, repeating iterations. By involving stakeholders, like commissioners and suppliers, at shorter intervals, misunderstandings and wasted time can be minimised. On the other hand, the risk with increased availability is that communication becomes sloppy, fragmented and excessive.

Measuring availability and flexibility requires collection of subjective opinions through interviews or questionnaires, as is also suggested in the TERM model. Again, we should ask ourselves for what purposes we must put a number on these effects. In the author's opinion, measuring availability and flexibility only makes sense if our goal is to specifically achieve changed levels here. A typical example of this would be to get data that would support the

development or revision of the organisation's business continuity plan, a tool used in order to decrease operational risks.

Meeting culture

Many people also agree that virtual meetings have an effect on meeting culture. Adding new forms of meetings also adds to further needs for clearer rules on how and when meetings should be held and who should be invited. There is a clear tendency in empirical data that virtual meeting capabilities lead to more frequent and shorter meetings. There is also a tendency that virtual meetings lead to unnecessary participation, which decreases the efficiency of the meetings. In order to be on top of its meeting culture, an organisation needs to provide guidelines or policies that define meeting types, meeting forms and set standards for what roles that should be present in what meetings.

From measuring and monitoring perspectives, it makes perfect sense to assess the number and length of meetings, preferably divided in types and forms, and the number of participants in each meeting. This information is valuable data that can be used for historical comparison or related to other data, for instance to get indications of efficiency or productivity. In theory, meeting data can easily be retrieved through a time registration system. In practice, however, data collection might be more difficult than you would think, since the issue of time registration is still a sensitive issue in many organisations. To succeed, an effort in training employees and explaining meeting policies and the purpose of meeting time registration might be required from management or direction.

5.1.3 Points of disagreement

The secondary and empirical data collected for this study contains a number of controversies. In many cases, findings in existing literature, statistics and opinions of the people interviewed simply do not comply with each other. In this section, the most important controversies will be presented and discussed.

Level of physical travelling

Although not the main focus of this thesis and not an organisational effect in the selected framework, the issue of travelling levels needs to be discussed. A number of the potential effects in the TERM model are based on the assumption that virtual meetings affect business travelling, environmental impact being the most important example. This way of seeing things is also very common among the interviewees, especially in organisations that are in early stages of virtual meeting use.

From the evidence in the findings, we have seen that organisations such as TeliaSonera and If have been able to demonstrate a real decrease in travelling and its associated emissions due to virtual meetings. On an aggregate level, as in the Swedish example, we can see that business travelling is decreasing at a slow pace (SIKA, 2000; SIKA, 2007; Trafikanalys 2012). However, this decrease might very well also depend on the current economic downturn, or other factors.

We also know that research show that use of virtual meetings will not automatically lead to decrease in travelling (Arnfolk, 2002). "Historically, telecommunications have primarily served as stimulus for travel, rather than substitute for it" (Adams, 1999, ref 91, p 120). The divergence in opinions is clearly confirmed in the empirical data, where indications are pointing in all directions: decreased travelling, static travelling and increased travelling.

The most common suggestions for measurements that comes from the people interviewed in this study are indicators related to travelling: travelling costs and time, number of business trips, mix of travel modes and so on. It is important to show, at least in the initial stage of implementation of virtual meeting technology, that travelling and its associated costs are decreasing. This information can be used to build the business case for further investments and implementation, but also to communicate a better image of the organisation, especially when combined with data on decreases in emissions.

The author will get back to discussing travelling levels further down. At this point, the important lesson learnt is that virtual meetings' effect on travelling is debated.

Environmental impact of virtual meetings

The issue of environmental and climate impact is delicate and complex, not least because there is a lot of sentiments and personal hopes involved. Literature found in this area often focus on *potential* savings in emissions, and this is done with the assumption that business travelling, and especially air travelling, will decrease thanks to increased use of virtual meetings and virtual collaboration in general. So, at first sight, the idea of virtual meetings leading to decreased emissions of GHG is directly linked to the idea of virtual meetings as substitute for business travelling. No decrease in travel – no decrease in emissions, or so it seems.

But the overall picture is more complex than this. In theory, it is thinkable that increased use of virtual meetings will not decrease travelling but instead change the composition of it, the mix of travel modes, into something that will have less negative impact on the environment. For example, by the use of virtual meetings a project manager might skip four 50 km car trips to see parts of the project team, and instead go for a 1000 km train trip to meet with a project sponsor. This leads to more travelling, yet less emissions. On the other hand, the project manager in the example above might as well use the time and expenses saved from skipping his car trips to fly to China or India and meet with the development team there, which will lead to an increase in emissions.

When discussing environmental impacts, one must keep in mind the potential rebound effects, as has already been discussed in literature, for instance by Plepys (2002) and by Mokhtarian (2002; 2011). It is possible that use of virtual meetings will in fact not lead to a decrease in CO₂ emissions from business travelling. But it is also possible that virtual meetings will lead to a decrease of emissions even though total travelling is not changed, or even increased. So how can the organisation try to manage this issue and get it to work in the desired direction?

Some of the answer to this last question is known and can also be confirmed by the empirical data in this study. In general, organisations that have been successful in this area are typically working in a plan-do-check-act cycle. First, the organisation sets the direction, decides on and communicates the goal, for instance that reduction of GHG emissions is a prioritised target. Second, the organisation explains the connection between meetings and GHG emissions and set out the strategy for how employees should behave in this respect. In this case, the implementation of a combined travel- and meeting policy is a common tool. There are several examples in this study of organisations that successfully implemented these kinds of policies.

Third, the organisation measures outcomes and make adjustments in policies or in their implementation, in training or in follow-up. Indicators for measuring GHG emissions are key and often quite accessible, but the difficult part is measuring how well we live up to our policies. One of the organisations in the study already has tools in place that is used to

monitor the “degree of fulfilment” of their internal rules and guidelines, through regular questioning of people at identified positions. The fulfilment gaps are then used to identify needs for improved communication or training.

Meeting efficiency

There is another important controversy about the effects of virtual meetings, namely whether virtual meetings are more or less efficient than physical meetings. On the one side, there are people who think that virtual meetings are *not* as efficient as physical meetings, due to increased risks of misunderstandings, unfairness, over-invitation, cultural aspects and technical hassle. On the other side, there are people who think that virtual meetings are *more* efficient, than face-to-face meetings, due to better preparations and better structure during the meeting.

Arguments for both sides can be found in literature. For instance, in an article in Computerworld from 2005, the author lists a few pros and cons of virtual meetings (Rosencrance, 2005), whereof meeting flexibility, social interaction and meeting disruptions are but a few. The issue is considered as important and relevant, and good indicators for measuring meeting efficiency is high on the wish list of many interviewees. In theory, meeting efficiency could be measured by collecting information about total time and cost spent, including time spent on preparations and in meeting, travelling costs, and other, like operation costs for virtual meeting technology. This data must then be compared to more intangible indicators, like “degree of meeting goal fulfilment”.

Why is the efficiency of virtual meetings relevant? Meeting efficiency is an important determinant for a number of effects. Increased efficiency is a major contributor to cost and time savings, and it also influences the performance of virtual teams and the meeting culture. In addition, it can have a psychological effect on the general opinions and feelings about using virtual meetings. For example, if virtual meetings are generally perceived as inefficient, the organisation will have a harder time to push for increased use of virtual meeting forms.

Here, it is important to remind the reader that the empirical data collected for this study is entirely done in Sweden. In the Swedish language there is no distinction between efficiency and effectiveness, which also means that the interviewees (as well as the interviewer) cannot always distinguish between these two concepts in their discussion. Nevertheless, the real debate is about virtual meeting efficiency and not about effectiveness.

Cost efficiency and productivity

Although there is a debate on how travel costs are affected, there is extensive agreement about the cost saving effects of virtual meetings. Benefits, either in time or money savings, will be greater than costs, primarily invested in technology and training. In some cases this statement is supported by statistics, in turn based on assumptions. In other cases it is supported by with the interviewees’ sentiments or opinions.

So, there is strong support for the positive cost saving effects of virtual meeting. But what if the resources in time or money freed up by these cost savings are spent on more meetings? How can we be sure that total meeting costs, including all time spent in meetings, travelling and virtual meeting infrastructure does not increase? We cannot, unless we measure and compare all meeting related costs, which apparently is not a common thing to do. Indeed, when looked at from this perspective there is also evidence that some people instead tend to agree that total meeting cost might actually increase, even though most do not.

In order to show increased cost efficiency we need to relate the total meeting costs to the output of these activities. If output remains the same, and costs are lower, efficiency per unit of production, in this case meeting euros spent, has increased. Another possibility is to show an increase in productivity. If output increases more than meeting euros spent, productivity has also increased. Through financial data and time registration systems we could easily obtain the total meeting costs. The problem in both cases is to find out what output to compare that and how to measure this: is it possible to measure only the output related to the meetings or do we have to look at the output from the entire organisation? And if so, is that really relevant?

In the opinion of the author, the question about productivity is key in the long run. The effects related to reduced travelling will subside as work processes adapt to the evolving ways of virtually collaborating. Thereby, the measurements of reduction in environmental impact gradually lose a valid baseline for comparison. However, if we show that virtual meeting and collaboration contributes to increased productivity we can show that we get more service output per kilogramme GHG emitted from travelling and virtual technology operations. Therefore, from an environmental perspective, in the long run it will pay off to focus less on measuring business travelling levels, and instead focus more on the relationship and measurements of total meeting costs and productivity.

Employee satisfaction and staff turnover

The empirical support for the correlation between employee satisfaction levels and staff turnover on one side, and virtual meetings and collaboration on the other is weak. Although most organisations do measure employee satisfaction through recurrent questionnaires, few have questions that can be directly related to the use of virtual meetings.

Despite this, employee satisfaction with virtual work is something that many people find interesting and relevant to investigate and follow up. A common view is that virtual meetings and, very often mentioned in this context, teleworking, will have an effect on the employees' perception on work-life balance and satisfaction at work. The basic assumptions for this is that individual employees will experience a decrease in their travelling and also more control over their own time, which will make them feel more efficient. On the other hand, there are also a few people who think the connection between virtual meetings and employee satisfaction is far-fetched.

If the use of virtual meetings and collaboration contributes to more satisfied employees, this might also work as an advantage for the *employer branding* of the organisation. In turn, this might help the organisation to recruit and retain the competencies it needs. Measurement of the employees' satisfaction with the use of virtual meeting and collaboration could be done through the employee satisfaction surveys. For instance, adding a few questions about the travel- and meeting policy and the employee's perception of the efficiency of existing collaborative tools will reveal needs for improvements in training or technical solutions.

The example of young Mr Hansson, the teenager in this study, clearly shows that there is a change in some old paradigms with the coming generations. Fourteen years old, Mr Hansson is already fluent in English and also used to quickly organise into virtual, global teams without any need for physical meetings. His example gives us a hint of what features of an organisations we can expect to attract and retain young people in the coming years: flexible work hours, freedom to work from wherever there is a network connection, and extremely goal-oriented way of working.

Gender equality

The influence of virtual work on gender equality is also contentious. Empirical data show support for the potential effect on gender equality, but also for a very weak correlation. Again, this is based on divergence in the opinions and thinking of the people interviewed for this study. The author has not been able to retrieve any data on how virtual meetings influences gender equality. Still, quite a few of the interviewees think it would be an interesting thing to measure.

Theoretically, the effect on gender equality is based on the assumption of a decrease in business travelling. This will make it thinkable for women to apply for jobs that used to be too travel intense and also for men who used to travel a lot to take greater responsibility at home. How do we find out about whether this is true or not? Is it relevant?

In Sweden, the Non-discrimination Act (SFS 2008:567) that came into force in 2009 states that it is the employer's responsibility to promote equal treatment in their organisations. This law replaced the Gender Equality Act (SFS 1991:433) that was specifically aimed at gender equality. The gender equality work in Sweden has a long ancestry, and many organisations have been working actively with the question through equal treatment plans or targets set in, for instance, balanced scorecards. Therefore, the issue of gender equality is highly relevant.

Measuring and analysing the gender equality effect is tricky. The TERM model suggests using employee questionnaires for this purpose, but it does not say much about how this information should be analysed. Perhaps a better idea, which is also suggested by some interviewee, would be to somehow connect the travel- and meeting policy to the organisation's equal treatment plan. This idea will be discussed more in detail in suggestions for further research in chapter 7.

5.2 Why do we have these controversies?

Why is it so hard to agree on even the most basic assumptions regarding the effects of virtual meetings and virtual collaboration? How can people disagree on significant effects and organisations still be investing time and money in virtual meeting technology?

First of all, the opinions and evidence discussed in the controversies above are not mutually exclusive. They are false dichotomies, and as such they can be both right and wrong, depending on conditions. Let us now take a look at some of these conditions and factors that might explain how the apparent divergences in opinions have emerged.

5.2.1 The virtual toolbox

The view on the organisational effects from virtual meetings and collaboration is strongly dependent on the perception of what tools are included in the concepts of "virtual meetings" and "virtual collaboration". In some organisations virtual meetings are associated with AC and VC only, and the effects are discussed from this perspective. Other organisations, virtual meeting technologies are seen as a part of a more complete set of collaborative tools, which opens up for other effects to emerge.

In order for the author to give an account of his view on the virtual toolbox, a simple model will be now be presented to illustrate the relationships between the concepts discussed in this thesis. The model is shown in the figure below.

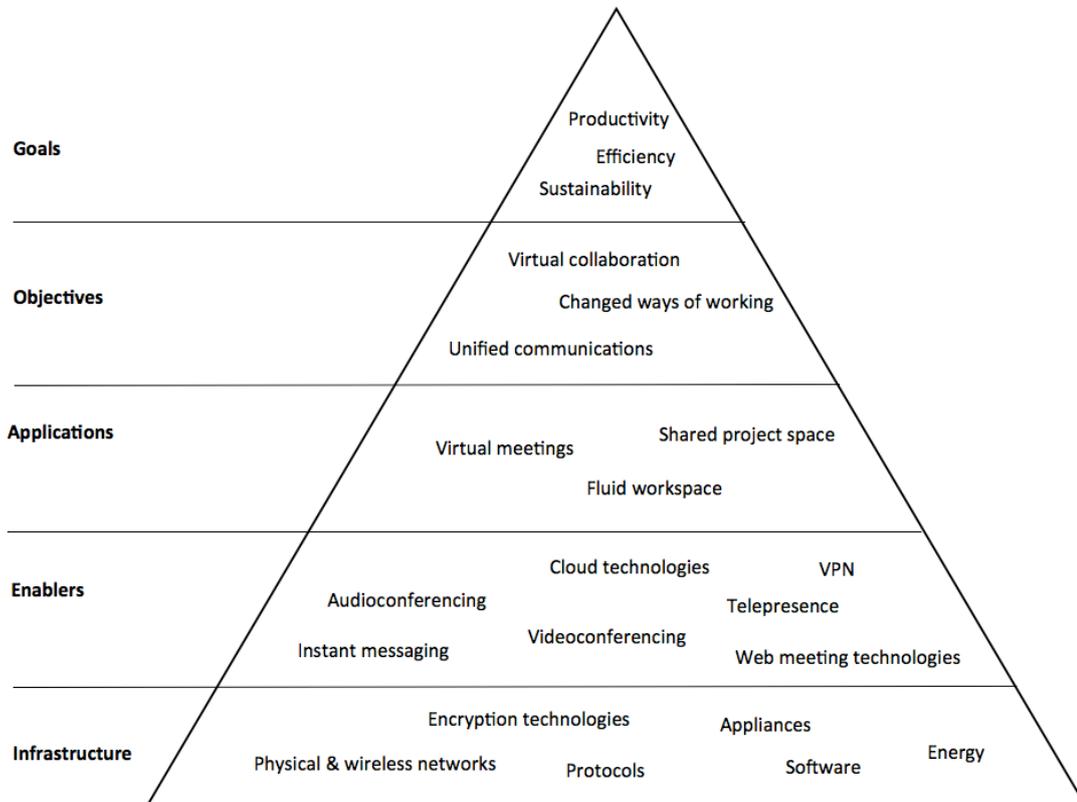


Figure 5-2 The virtual toolbox

At the bottom of the model's pyramid we find the infrastructure, the basic technologies of virtual communication. Infrastructure includes networks of all kinds, physical appliances, protocols (such as TCP/IP, GPRS, VoIP), various kinds of software, encryption technologies for secured communication, and electricity. This infrastructure together creates the conditions for the development of enabling technologies, on the next level. These enablers include all types of meeting technologies, but also asynchronous solutions like document sharing, cloud services and instant messaging. VPN stands for *virtual private network* and is a technology used to open encrypted "tunnels" through public networks into, or between, private networks.

The enabling technologies have three major areas of application: virtual meetings, fluid workspace and shared project space. Fluid workspace is an extended version of teleworking, not limited to working from home, or other static settings. The idea is that co-workers connect and work from wherever they are, as long as there is a mobile network available. The shared project space is enabled by cloud services and shared document management, which enable team members to work asynchronously or simultaneously with the same tasks.

These applications together will work as a strong driver for changed ways of working. Old work processes will go obsolete and new processes will emerge. Increased frequency of communication and increased availability of co-workers, managers, suppliers, customers and other stakeholders will lead to shorter work cycles. The integration of technologies, standards and platforms is driven by ambitions for more collaboration, not only within an organisation, but also between different organisations. Unified communications, seamless and independent of technical solutions, will set aside differences in organisational standards, and work as a driver for increased collaboration between organisations. Eventually, if the virtual toolbox is

managed and used in a clever way, it has a potential to contribute to the business bottom line as well as the triple bottom line.

The main point with this theoretical model is to show that looking at effects of virtual meetings in isolation is a rather limited way of discussing the full potential of all virtual applications. This is a common pitfall when discussing the organisational effects, and it might also explain some of the divergences in the empirical data collected for this study.

5.2.2 Organisational diffusion and maturity

As organisations widen the use of virtual technologies, the noticeable effects of virtual meetings and virtual collaboration change over time. The substitution effect, virtual meetings replacing travelling, and its side effects are most prevalent in the beginning of an implementation of virtual meeting technologies. As virtual collaboration integrates into an organisation's working processes, the baseline loses validity and the savings in emissions, cost, travelling becomes irrelevant and incomparable. On the other hand, secondary effects will appear that was not thought of from the start. The hypothetical scenario described below will prove this point.

You are a project manager and your task is to successfully manage your projects and achieve your goals in terms of quality, time and cost. It is now 2012 and your project, A, is running. The organisation introduces a new videoconferencing tool for virtual meetings that makes it possible for you to involve resources with unique competencies in remote locations. It also makes it possible for you to decrease your costs, in time and money, for travelling. In fact, the time saved can be used to increase project delivery with the same budget and still stick to the deadlines given. On top of this, your project is not the biggest culprit for your company's emissions.

In 2013 you are making a project plan for project B. You now have access not only to videoconferencing, but also chat rooms and a shared project space, which you take into account when planning. In order to prove any cost, time or emission savings from reduced travelling you must calculate how much your team would have travelled during the project, if no collaborative tools had been in place. The problem is that if you would not have any virtual collaboration in place, you would not have organised the team in the same way and the project plan would have looked totally different. On the other hand, you can plan for the same amount of deliveries using much fewer resources.

In 2014 it is time for project C. Your company has now transformed itself from a staff/line matrix organisation in two locations, to a distributed organisation with virtual competence teams in many locations, whereof some are literally the homes of the employees. The methods of collaborating virtually are now inherent to the organisation itself. In order to estimate cost, time and emission savings, you will now have to make assumptions about how the whole organisation would have worked without collaborative tools.

This development is sometimes described, for instance by Mr Lundén and Mr Littorin, as running in stages or phases. The effects that can be seen in the first phase, like cost savings, and decreased travelling and emissions will sooner or later wear off and stabilise at a new level. In the coming phases, new effects will take their place. For example, this is the case at TeliaSonera, who have seen their travelling levels stabilising in the last years, and who are now looking into what to measure and follow up on next.

5.2.3 Changed behaviour

When debating virtual work methods and their effects, it is tempting to end up in a discussion that focuses on comparisons between different virtual meeting and collaboration solutions and their effects. But the effects of virtual work methods are not caused by the development or implementation of specific techniques. Instead, they are enabled by changes in *behaviour* with the members of an organisation. Successful implementation of any virtual meeting technology

must be supported by a clear strategy for how we want co-workers and partners to use the tools. Mr Banner at Cisco puts it this way: “It does not matter if the tools you select are rubbish, as long as you do the implementation in the right way” (Banner, 2012).

The importance of changed behaviour with the organisation’s members is not something new. The Swedish Transport Administration’s existing manual for implementation of virtual meetings, the 10 step model, already include a number of important actions that are related to changing behaviour (Arnfolk et al.) The findings in this study will only further confirm this view.

Many of the interviewees in this study mention the importance of a clear ownership of the meeting issue. It is not uncommon, especially in organisations that are less mature in their use of virtual meeting technologies, that there is no ownership at all and that the question ends up at the desks of the people providing the tools, the ICT department. In order to be successful the organisation needs global guidelines for meetings and meetings types, and this also has to be connected to travelling and travel policies. It is not possible to separate these two issues (Grankvist, 2007). This also means that top management must be involved and up in the driving seat.

In order to do so, top management must first decide on what they want to achieve. Are they looking for cost and time savings only, or decreased emissions, or are they also interested in longer-term effects? Is the purpose to improve public image in environmental issues, to increase productivity or both? The strategy is vital as input to the policies and guidelines that needs to be set up. It will also affect the carrot-and-stick range of incentives that needs to be created in order to achieve the change in employees’ behaviour that is necessary.

Policies and guidelines are of little use unless they are properly communicated and explained to the co-workers. Employee awareness about the importance of this issue must be raised and training in the selected tools and methods must also be provided. Management must also set a standard and work as role models for the use of virtual meetings. These efforts will slowly produce a change in organisational culture that is necessary for the desired change in behaviour to occur.

5.2.4 Observing the effects

“If a tree falls in a forest and no one is around to hear it, does it make a sound?” We only see and hear the things we are looking and listening for. This is also an important reason why opinions over organisational effects diverge: sometimes the views on the effects of virtual meetings is based on too little observations, simply because we are not certain of what to search for.

A prime example of this is the Aberdeen survey cited above, where 72% of the respondents thought that travel reduction was a benefit from using video in virtual meetings, while only 14% were actually doing any measuring (Park, 2011). The conclusion of this is that companies to a large extent are building business cases for this type of investments on assumptions that are not always measured and followed up.

Even though virtual work methods have potential effects in many areas, we cannot monitor everything. Measuring comes with a cost in time, money and effort, which is why we need to be careful with what we search for. And again, this depends on what the organisation wants to achieve. In Appendix D, the author has compiled a list of indicators that he thinks is relevant, depending on what the organisation wants to achieve. The list is based on the gross list in the

TERM model and also on the findings in this study, which were used to filter out the indicators with bigger relevance and significance.

5.2.5 Rebound effects

As we have seen, many of the desired effects of virtual meetings take off in assumption that there will be a decrease in business travelling. But what if the time we save from not travelling to some meetings are used for travelling to new meetings instead? This rebound effect could partly explain some of the divergences in opinions about the outcomes of increased use of virtual meetings. Perhaps virtual meetings are not a way to decrease impact from business travelling. Instead, it might be a way to create growth without increasing the impact.

Let us go back to Ehrlich and Holdren’s formula from 1971, where environmental impact is considered to be a function of *population*, *affluence* and *technology*:

$$I = P \times A \times T$$

As a thought-experiment, this formula can be transferred to our context. In this case *I* would stand for impact on emissions from all meetings. It could also stand for the impact on the total meetings cost level in our organisation or for productivity. The *P* stands for the population of meetings, in numbers or in man-hours. The *A* is the mixture of meetings forms and the associated levels of travelling, utilisation rates of existing technical solutions or meeting efficiency. The *T* is the availability and spread of virtual meeting technologies, for instance measured in euros invested or in a geographical factor. Thus, we can make use of the indicators shown below.

Table 5-1 Impact, population, affluence, technology indicators

Impact	Population	Affluence	Technology
GHG emissions, per meeting or meeting man-hour.	Number of meetings. Number of meeting man-hours.	Number or length of travels, or time spent travelling in different travel modes.	Euros invested. Geographical spread.
Average meeting cost, total meeting cost divided by meeting man-hours.		Utilisation rates of available virtual meeting or virtual collaboration technologies.	Diversity in solutions.
Value of output, per meeting or meeting man-hour.		Meeting efficiency.	

Now, by investing more money in virtual meeting technologies we are hoping to see a decrease in emissions and total cost. But due to potential rebound effects, this decrease might never materialise. Instead, the investments or spread of *T* might lead to that the meeting *P* goes up. People meet more instead of travel less. In another scenario, increased *T* might lead to a change in the travel mix that will eradicate any positive effects on *I*. The different scenarios in this hypothetical experiment also help explaining why some organisations see some effects and others do not.

Provided that the organisation wants to keep I down, is there any way to mitigate rebounding? Yes there is, and we already know parts of the answer. For example, meeting policies and measurements of P will create incentives to keep this factor levelled. Same thing with travel policies, training, organisational culture and measurements of A that will keep this factor levelled. Policy compliance can be measured and monitored through intermittent questionnaires.

5.3 Virtual maturity stages

Organisational activities are built around a number of boundaries in time, resources and geography. When these boundaries change our ways of working will eventually be affected. In the interview with Mr Littorin, at the Swedish EPA (2012), three stages of maturity of use of virtual technologies were discussed. In the first stage, virtual meetings are seen as emergency solutions that replace “real” meetings. In stage two, the inherent value of virtual meetings are recognised and the use of it is promoted, but we still work in the same way. In the last stage the use of virtual collaboration has also changed our work methods and processes.

This way of thinking works very well as an explanation for why there are such profound disagreements about many of the effects of virtual collaboration. The author will now elaborate a bit on the reasoning of Mr Littorin and propose a connection to the effects in the TERM model. Needless to say, the division into maturity stages discussed below is a rough and simplified description of reality. An organisation can be in different stages simultaneously or even jump stages, depending on what part of the organisation we look or what historical conditions exist.

5.3.1 Substitution stage

In the substitution stage, business is run as usual but an early introduction of virtual meeting technology makes it possible to replace some physical meetings with virtual meetings, primarily for practical reasons. The implementation and use of virtual meeting tools has often more of a rebel activity character than a controlled process. Even if management approve of the development, they are not necessarily on top of it. As physical meetings are replaced with virtual meetings, some benefits appear rather quickly in the areas where it is being used. Reduction in travelling decrease costs, release work time and contributes to reduced emissions.

Some of the staff will be less stressed or find better work-life balance by not having to travel, which will affect employee satisfaction. Moreover, we will quickly be able to make use of internal or external competencies that we could not employ as efficiently before. Someone, perhaps the ICT department or ICT services commissioners, needs to take on new costs for developing, supporting and administering the solutions implemented.

At this stage it makes sense to discuss virtual meetings in relation to objectives like reduced meeting costs, reduced travelling and emissions from travelling. It also makes sense to talk about effects on employee job satisfaction, flexibility, availability, business continuity and usage of skills. The main objective is to show that investments in virtual meeting technology pay off in terms of reduced costs and reduced emissions. Key performance indicators to measure and monitoring therefore include total meeting costs, travel costs and time, travel time, emissions and employee satisfaction with the job conditions created by virtual meeting capacity.

5.3.2 Diffusion stage

In this stage, existing work routines and processes are still unchanged, but virtual meetings are accepted and promoted as a preferred method of working. The value of meeting and working virtually is acknowledged, for instance in project methodology and travel- and meeting policy. The organisation is pushing for standardisation of tools; and this development is supported by training initiatives.

In the diffusion stage we will see a large effect on the organisation's meeting culture. As new forms for meetings are added and taught, the number and types of meetings will change. Since the use of virtual meetings is spreading we will also see the positive effects on employee job satisfaction spread. On the other hand, some staff will be more unsatisfied since their status or perceived privilege of travelling is taken away by the new policies enforced. Virtual work methods will also start to influence how we organise our work in teams and where it is located geographically. Organisational culture will start moving towards more goal-orientation, where employees are allowed to work more freely in time and space as long as targets are achieved.

In this stage, costs and emissions are still interesting points of measurements, since virtual work methods are spreading through the organisation. It is also interesting to start looking for increased meeting efficiency and productivity. Even though travelling costs and emissions could be stabilising on a new levels, the push for further development will come from evidence that virtual work methods lead to more efficient use of resources and to increased economic activities.

5.3.3 Integration stage

Virtual meetings and virtual collaboration tools and work methods are fully integrated into our processes. In fact, they are necessary for the organisation to keep up its activities. The organisational structure and its connections to the outside world are built on the premises of working with and through virtual methods. We have reached a new level of collaboration where competencies and resources from inside or outside the organisation are tied together in virtual, goal-oriented teams.

In this stage, objectives like reducing travelling and its associated costs and effects have become irrelevant since we no longer have a working baseline for comparison. The initial increase in flexibility and availability is irrelevant. Employee job satisfaction levels have also lost some of its relevance. Instead, the organisation will see effects on its employer branding and thereby its capability to recruit and retain the competency it needs.

For a period, but not indefinitely, the organisation should be able to show improvements in productivity, due to changed work processes. Emission reductions related to decreased travelling are obsolete, but as long as productivity is increasing, emissions in relation to value of the output will be a relevant target. Theoretically, there is a backlash in business continuity capabilities with the fully virtual organisation. Due to its dependency on virtual technologies, the organisation will be more vulnerable to catastrophes and political risks.

5.3.4 Where are we?

In order to know more about what objectives and measurements we should focus on, we need to find out roughly in what virtual maturity stage we are. One way of finding out is to question the users, i.e. the employees, of the availability and efficiency of the existing tools, training and policies. A suggestion on how this can be done is provided in Appendix E.

5.4 Summary and concluding remarks

There is no doubt that decreased business travelling, and all the side effects that come with it, is one of the prime targets for an organisation that is on the verge of extending its use of virtual meetings, for instance by investing in video or web meeting technology. However, one should be aware that the organisations that have been using these technologies for a longer period seem to have growing difficulties in relating virtual meetings to decreased travelling. Instead, virtual meetings lead to more communication, changes in work process, more business activity and a drive for additional implementation of collaborative tools.

The propositions that have been put forward in the analysis section can be summarised like this:

- Virtual meetings should be seen as a subset of, and a driver for, virtual collaboration.
- Due to potential rebound effects, virtual meetings will not by default lead to decreased levels of travelling and decreased emissions.
- Through training, organisational culture, and implementation of effective policies an organisation can drive changes in behaviour that will mitigate rebound effects.
- It is important that the organisation decides on what it wants to achieve with its virtual meeting strategy. This will help identifying the indicators that are necessary to measure and follow up.
- Virtual collaboration will eventually lead to fundamental changes in work processes, organisational structure and the way that internal and external collaboration works.
- The presence and magnitude of organisational effects of virtual meetings and virtual collaboration partly depends on level of virtual maturity.
- In the long run, as virtual collaboration becomes inherent to the organisation, all organisational effects will wear off.

However, strategies, indicators, technologies and integrated travel- and meeting policy are only the beginning. As we can learn from our gaming teenager there is a lot more to come. The entire range of technologies that is now quickly emerging will have much bigger impact in the coming years. Try to imagine what kind of organisations we will have in a decade when Mr Hansson enters the job market, and start preparing for those conditions now. Virtual collaboration will increasingly affect how we organise our work, how we run projects, how teams are set up, who we want to employ and so on. Some of the old boundaries in time and geography will become obsolete, and Mr Littorin leaves us with this question: “What happens to an organisation as ‘room’ becomes irrelevant?”

6 Discussion

In this section the author will make some reflections on the methodology used in this study, the selected framework and the sensitivity of the data collected. The aim of this exercise is to try to provide the reader with a better view of how the conclusions of this thesis should be valued.

6.1 Methodological choices

This thesis was written with an inductive research approach. Empirical data and literature was analysed using an existing analytical framework, aiming to build models and theories that would answer the research questions put forward. The thesis was written in the context of an existing research project at the IIEE, aiming to support the REMM project with new knowledge related to virtual meetings and their effects.

The list of interviews, by far the largest source of empirical data, contains a number of people with different roles, for example project, travel, environmental and sales managers. Each of these roles also have different insights in how virtual meeting and virtual collaboration is used in their organisation, and what effects that come out of this. Also, the interviewees are spread out over a rather big number of organisations. For increased comparability it would have been wise to use either a bigger number of interviewees in similar positions, or a wider spectrum of roles within fewer organisations. Nevertheless, the author is of the opinion that the selection of interviews provided an acceptable basis for answering the research questions in this thesis.

6.2 Research questions

Three research questions were investigated in this thesis. The first one was about what the organisational effects of virtual meetings were, the divergences in opinions about them and the factors that influence their presence. This question turned out to be much more complex and also became the main focus of this study. The main reason for this is that it is difficult to separate effects from virtual meeting from other forms of virtual collaboration. The mix of effects, and their interdependence, is affected by the organisation's full mix of collaborative tools in use, which is an important finding which will be relevant for future research.

The second question was about measuring and analysing the measurements of organisational effects of virtual meetings. Again, the focus could have been put on effects from all kinds of virtual collaboration, but the question is still valid. Measuring of effects can be done on any level of virtual work methods, as long as the organisation knows what it wants to achieve.

The last research question was about the use of the result from the measurements done, and also about the organisational conditions that work as enablers for the positive effects of virtual meetings. To a large extent, the answers to these questions can be extracted from the findings about why some organisations see some effects and others do not. To fully understand the answer, though, the ideas and suggestions in the conclusion should ideally be put to a test, preferably by surveying the interviewees.

6.3 Portability analysis

The cultural influence on the importance of personal meetings was briefly discussed in the thesis. Although some of the empirical data comes from transnational companies, this study is based on organisations whose business activities originate in a Swedish, or at least Nordic, context. It is likely that some of the findings and conclusions made in this thesis cannot be transferred to other cultural contexts, where the importance of personal relations and social interaction is higher, or where trust in virtual technologies is lower.

Empirical data in this study comes from a variety of fields in both private and public sector. Nonetheless, there is no coverage at all in some areas, notably health care, social work and industrial production. Public administration on regional and municipal levels is not represented. Also, there is no empirical data from academia or non-governmental organisations. Even though it would be desirable to broaden the span of empirical data and include more types of business activities, it is uncertain whether this would have had any substantial effect on the conclusions. In the author's opinion, meetings, communication and collaboration is likely to work in similar ways, independent on an organisation's business purposes. As long as there are meeting agendas, project goals or information that must be transferred between individuals, the findings and conclusions in this study should be applicable.

Technical advancements in the ICT area are occurring at unprecedented pace. In 1965, Gordon Moore, co-founder of Intel, predicted that the number of transistors that can be placed on a circuit doubles every four years (Moore, 1965). This prediction has later been adjusted, but is still referred to as Moore's law and often used as an illustration of the extremely fast development in information technology. The point is that we cannot predict what computers are capable of doing in five or ten years, which over time may affect the validity of the findings and conclusions in this study. For example, what if our organisation can be represented in negotiations by artificial intelligence instead of physical individuals in the future? How would this affect our need to meet and communicate?

6.4 Sensitivity analysis

Some of the most important findings in this study originate from a small sample of interviews with people that have similar experiences of long term use of virtual meeting technologies in their organisations. These people are in middle or higher management positions in relatively large organisations with resembling implementations of solutions for virtual work processes. It should be noted that the conclusions and findings in this thesis is sensitive to the opinions of these interviewees. Opposing opinions from a small number of other people in similar positions but other organisational contexts would have had great impact on the conclusions of this thesis.

7 Conclusion

In this chapter the research questions put forward in the introduction will be revisited, and an attempt to answer them will be made. There will also be some reflections on the thesis work in its entirety and suggestions for further research.

After analysing available literature and speaking to a number of people at different roles and positions, both within private and public organisations, the author can conclude that there is little consensus around the issues related to virtual meetings. In fact, the difference in opinions about the use, usefulness and effects of virtual meetings is sometimes striking.

7.1 Research questions revisited

What are the organisational effects of an increased use of virtual meetings?

First of all, virtual meetings and the technologies associated with this should preferably be discussed in a wider context. They should be seen as just examples of media for interpersonal communications taken from a wider range of tools. Virtual meetings do not reach their full potential unless used in combination with other media of computer-mediated communications.

The significant, relevant and potential effects of virtual meetings, assuming that they are supplemented by the use of other collaborative tools, are listed below. The evaluation of “significance” and “relevance” is an assessment based on a synthesis of information collected from empirical and secondary data. The effects being “potential” means that their presence and magnitude is dependent on factors that will be discussed further down.

Effects on organisational structure:

- Localisation. Use of virtual work methods will influence the geographical spread and localisation of business activities. It will not affect public organisations’ decisions on where to locate, this is normally a political decision. However, it will open up for better possibilities to, temporarily or permanently, bring in people and competencies that are physically located elsewhere.
- Virtual organisation. Virtual meeting capabilities and collaborative tools make it possible for many organisations to organise their activities totally different. Departments and teams can be set up without regard to boundaries in space and also in time. Project resources can be gathered externally, from partners or supplier, and internally from other departments in order to optimise use of existing competencies.

Effects on efficiency:

- Economic effects. The organisation will experience some type of economic effects. Depending on factors described below, e.g. virtual maturity, these effects could be in terms of total or average meeting costs, time spending in meetings or travelling, increased or decreased meeting and work efficiency and effects on economic activities and productivity.
- Time aspects. Apart from the meeting and work costs in time, there will also be other time related effects. For instance, the availability of the employees will be affected, but also the employees access to internal information, which will affect the length of the feedback cycles. Moreover, the serviceability of the organisation will be affected since

work can be moved over time zones in a “follow-the-sun” structure.

- Collaboration. Unified communications will open up for increased collaboration both within and between different sections of the organisation and between the organisation and its external partners and stakeholders, for instance customers, suppliers, academia, public authorities, trade associations and more.
- Ways of working. Virtual work methods will have an effect on skills usage, meeting culture, and on delivery cycle lengths. It will also enable a change in work flexibility and in our possibilities to manage business continuity.

Effects on staff:

- Employee job satisfaction. Primarily an individual effect, but also has an impact on the employees’ perception of being able to work efficiently. This will in turn affect staff turnover.
- Competence management. Virtual work methods can become tools that support employer branding and employment offerings and thereby ensure the supply of needed competencies. This way it can also be used to support the organisational equal treatment plan by recruitment.

Effects on environment:

- Climate. Changed levels of GHG emissions, either absolute or in relative terms, for example in relation to meeting man-hours or value of output produced.

How convergent are the views about these effects?

There are two levels of agreement regarding the organisational effects. First, we need to understand if there is any evidence in secondary or empirical data about whether the effect is actually present or relevant. Second we need to know if there is agreement about the *quality* of the effect, i.e. in what direction they affect organisational activities.

There is a high level of agreement in literature and among the people interviewed for this study about the quality of some of the effects described above. Specifically, people to a large extent agree that virtual meetings and collaboration will:

- Contribute to a better use of skills and competencies,
- Increase availability,
- Contribute to reductions in GHG emissions,
- Increase employee job satisfaction,
- Save time, and
- Increase work flexibility.

On other effects there are clear divergences in opinions, either because the existence or relevance of the effects is controversial or because there are disagreements about their qualities:

- Business travelling. There will be an effect on business travelling, but there is a controversy about how.
- Meeting efficiency and meeting culture. Virtual meetings will have an influence on these two areas, but again there are disagreements about in what directions and how.
- Cost savings. There is a great uncertainty about how costs on aggregate level will be

affected.

- Recruitment, gender equality, diversity, equality. The support for the correlation between increased use of virtual meeting and collaboration and these effects is not unanimous. The ones that do agree to this commonly think that there will be positive effects.
- Increased economic activity. Same as above.
- Changed ways of organising and changes in work processes. Not everyone agrees, but some people think that the effect on these areas will be immense.

What factors influence the presence and magnitude of these effects?

The organisations that have developed a clear strategy for how virtual meeting and collaboration technologies should be used and also what they want to achieve by using them, have a much better chance of reaping the benefits from their use. Clear policies on travelling and meeting, more training, and good implementations of well selected tools will work as drivers for the behavioural change that is needed for attaining the desired effects. It will also promote better collaboration with external partners, with whom we can now build better platforms for inter-organisational communication.

After deciding on what the goals are, the organisation must start measuring and monitoring progress. Many of the opinions about the organisational effects are based on intuition, thinking, personal experience, logic reasoning and desires. All this is well, but knowing what and how to measure will provide better facts that can be used to support the development in the desired direction.

The perception of the possibilities offered by the tools and technologies involved is also an important factor. A better understanding of the entire virtual toolbox will also contribute to a wider perspective of the range of possible uses. For example, organisations that are limited to audio- and videoconferencing in their scope of thinking will not be able to imagine or start looking for the effects that are made possible from a wider range of collaborative tools, such as shared project platforms, document sharing and instant messaging that will enable asynchronous communication.

Ultimately, presence and magnitude of organisational effects also depend on the level of virtual maturity in the organisation. Organisations that just started out with replacing physical meetings with videoconferencing will experience different effects than organisations where virtual collaboration is an integrated part of, and necessary for, existing work processes and the organisational structure itself.

How can the organisational effects of an increased use of virtual meetings be measured?

Retrieving the information and data necessary for investigating organisational effects must be done using a variety of methods. For cost related data we need to go the organisations' financial systems. Statistical information about business travel should be available in our travel booking systems. Utilisation of virtual meeting and collaboration technologies can be measured through a booking system or by statistics provided from the appliances that run these services. Time use must be followed up in a time registration system, which is already a normal procedure in many companies.

Questionnaires, self-assessments and surveys are also important methods that could be employed to collect information about the employees' views on how efficiency and job

satisfaction is affected by the availability of collaborative tools. It could also be used on a managerial level to get information about how well solutions are implemented, how effective existing policies are and the degree of collaboration within and outside of the organisation. These methods can also be used to investigate the compliance of existing rules and guidelines.

Finally, there is also the method of interviewing people. Employees entering and leaving the organisation, human resource managers, project managers, environmental managers, and other staff and line managers will be able to provide valuable information about effects on working methods, recruitment, meeting efficiency and so on.

What effects are most relevant to measure?

The answer on this question depends on *what the organisation wants to achieve*. There is no point in investing time and resources measuring things that do not add value. It also depends on what we *can* achieve, given the existing circumstances, which in turn is depending on the organisation's virtual maturity, as discussed above.

Appendix D will provide a table that shows the author's suggestions about relevant points of measurements in different situations. In summary, the indicators suggested include:

- Total travel costs,
- Travel expenses per employee, or in relation to turnover,
- Average meeting cost: total meeting cost per meeting man-hour,
- Percentage compliance with travel- and meeting policy,
- CO₂e emissions per meeting man-hour,
- Percentage of employees stating that virtual work methods contribute to attractiveness of employer,
- Percentage of employees stating that lack of virtual work methods was a reason to leave employer,
- Percentage of HR professionals stating that virtual work methods contribute to employer branding,
- Level of satisfaction with work-life balance,
- Level of satisfaction with virtual work tools,
- Level of satisfaction with organisational efficiency,
- Level of meeting agenda fulfilment per meeting man-hour,
- Output per meeting man-hour,
- Output per meeting man-hour, related to utilisation,
- Output per unit CO₂e emitted.

What effects are possible to measure in practice?

Of course, anything is possible to measure in practice, but the law of diminishing returns will teach us that the last pieces of detailed information will be extremely expensive. The meaning of "possible, in practice" should be interpreted as information collection that is judged to be feasible from an economic perspective.

The effects that are cheapest to measure are the ones that involve only information available in existing systems: effects that are related to and can be deducted from time use, costs, utilisation rates, travelling expenses and emissions. This is probably also an explanation to why these effects are more commonly referred to in literature and empirical data. If you can prove

that benefits exceed costs already from this information, the incentive to keep digging might be quite low.

Measuring effects that can only be investigated through questionnaires, surveys or even interviews is increasingly expensive, and might not bring much extra value in the first stages of implementation of virtual meeting technologies. However, as maturity evolves, these effects become more important to monitor.

How should the results of these measurements be used?

Data collected from measurements of organisational effects should be used to ensure that we are on the right track in reaching the goals we have set out. If not, the information should be used to make adjustments in targets or to re-plan. As always, measurements are an important part of the plan-do-check-act cycle to secure that the implementations done and actions taken are actually working according to plan, and to define actions in case it does not.

Measurements can also be used for benchmarking against other organisations. Many of the organisations in the REMM project are public authorities that have similar needs for meeting and working virtually, and also similar objectives set out in the appropriations from the Swedish government. For example, the greening by ICT instruction set out in the government's ICT agenda for 2010-2015 apply to many of the public authorities. Comparing measurements and looking at the strategies and solutions of the other authorities might work as a shortcut to increased effectiveness of virtual meetings and collaboration.

How can suitable organisational conditions be established in order to materialise the positive effects of virtual meetings?

The technological push for a development towards more and more virtualised organisations is untameable. Each organisation has to ask itself whether it wants to be on top of this development or to just go with the flow. In the author's opinion there is no doubt that the organisations that work proactively with these issues and lay out a clear strategy will also be the organisations that gain the most from this development.

Visualising our organisation where "room" is irrelevant will be a good start, even though this scenario might never become a reality. How would activities be organised? Where will the interfaces between our partners and us be? What kind of competencies would be needed in such an organisation? What will work and communication processes look like? What happens to our capacity to deliver? From this vision it is possible to deduct the long-term effects on the organisation that are prioritised.

Next step is to transform the vision into strategy. What mix of virtual collaboration solutions will we eventually be using? How will we co-operate with our supplier, partners, and customers in order to reach a level where external collaboration works as good as internal? How will the mix of training and recruitment be used to get the necessary competencies into our activities? What kind of organisational culture should be promoted in order to get the desired change in co-worker behaviour?

A defined strategy will then have to be turned into actions, business requirements and short and medium term objectives. Policies, guidelines and business rules have to be set up, communicated and explained. Processes employed in operational work, projects and human resources have to be adjusted. Balanced scorecards or other steering artefacts must be

supplemented with new targets. Requirements will be used to acquire, configure or develop the systems and solutions needed.

Finally, but not until now, we need to decide on and start measuring the indicators that will be used to ensure that we are on track.

Repeat procedure, every two or three years.

7.2 Suggestions for further research

In this thesis the author just briefly discussed the national-cultural dimensions of the physical versus virtual meeting. As globalisation increases and a growing range of important functions, such as human resources, accounting and finance, is outsourced to low-salary countries, this dimension becomes more important. A suggestion for further research is to investigate how cultural dimensions influence virtual meetings' efficiency, and how the virtual meeting is perceived in terms of reliability and other aspects in intercultural communication.

The Competence Council for Development within the State, KRUS, is a public authority that have been driving the issue of women's possibilities to enhance their careers as government employees. Among other things, the authority has published a report on how different authorities have worked to improve chances for women to reach senior management in their organisations (KRUS, 2010). Even though the KRUS will be dismantled by the end of 2012, the responsibility for driving the question of gender equality in public authorities will be transferred elsewhere. A suggestion for further research would be to investigate how the State's work with gender equality and with green ICT, and virtual meetings specifically, can be coordinated and reciprocally supported by each other.

The information collected in this study is insufficient for the author to be able to provide a suggestion about how the collection of measured data should be analysed and interpreted. The author's suggestion is that this should be further researched, preferably when there is real-life data available to use for testing of selected models or frameworks.

Another suggestion for further research is to investigate the organisational, individual or societal effects of the entire spectrum of virtual collaboration tools. One of the main findings of this thesis is that it is difficult to separate effects of virtual meetings from effects of other collaboration tools, which is why the author wants to suggest that coming studies work with the full scale of virtual collaboration tools as a point of departure.

Finally, a suggestion for further research is to develop an elaborated method for measuring meeting efficiency, something that was on the wish list of many of the interviewees in this study.

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Appendix A: List of interviews

Interviews are listed in chronological order. The names of the interviewee's organisation have been omitted in some cases, due to company policies. All interviews were done over telephone, with some exceptions. Personal interviews are noted with an *

Date	Name	Role or title	Organisation
5 th of June 2012	Johan Banner	Sales Manager	Cisco Systems
7 th of June 2012	Ewa Fridén	Travel Manager	Swedish Customs
13 th of June 2012	Ellen Brubråten	ICT Commissioner	Swedish Transport Administration
13 th of June 2012	Bengt Littorin	Project Manager	Swedish Environmental Protection Agency
14 th of June 2012	Elizabeth Thoor	Project Manager	Swedish Courts
14 th of June 2012	Tobias Lund	Project Manager	Swedish Energy Agency
15 th of June 2012	Ulf Stenvad	Business Meeting Manager	If
18 th of June 2012	Catharina Ericsson	Travel Manager	Swedish Transport Administration
19 th of June 2012	Urban Nordmarker	Training Manager	Swedish Customs
19 th of June 2012	Inga-Lill Backlund	Environmental Manager	Swedish Customs
21 th of June 2012	Anders Ekdahl	Project Manager	
25 th of June 2012	Birgitta Sjöstrand	Travel Manager	Swedish Tax Agency
25 th of June 2012	Hans Rönnegård	ICT Strategist	Swedish Transport Administration
28 th of June 2012	Jan Eriksson	ICT Solution Architect	Swedish Customs
28 th of June 2012	Lotten Fowler	General Manager	Swedish Business Travel Association
28 th of June 2012	Lena Håkansson	Unit Manager	Swedish Transport Administration
3 rd of July 2012	Johan Bruck*	Business Area Manager	
12 th of July 2012	Sigfús Bjárnason, Tarja Porkka, Örjan Lindberg*	various	European Environment Agency

19 th of July	Stellan Kristiansson*	Lead Designer	Vergic AB
31 th of July 2012	Axel Hansson*	Teenager	
14 th of August 2012	Nina Holst	Sales manager	Proffice Life Science
22 nd of August 2012	Dag Lundén	Environmental manager	TeliaSonera

Appendix B: Interview template

Briefly introduce the interviewer and the project.

Investigate the interviewee's organisation, role, perspective and relevance to topic.

Investigate how virtual meetings are used in the interviewee's organisation, what tools are implemented, how many are using them, who the users are, and also how the use has developed historically.

On general level, ask about the effects of using virtual meetings. The interviewee will give his/her spontaneous thinking. Ask for metrics or statistics on effects mentioned.

If not mentioned, go through the following areas and ask for comment on effects on:

- Organisational structure
 - Localisation
 - Virtual team
 - Technical infrastructure
 - Administration of VM
- Ways of working
 - Reduced vulnerability
 - Skills usage
 - Flexibility
 - Meeting culture
- Economic aspects
 - Savings from reduced travelling
 - Cost for VM
 - Increased economic activity
- Time aspects
 - Savings of time
 - Availability
 - More time spent in VM
- Environmental impact
 - Climate
- Staff
 - Staff turnover and satisfaction
 - Recruitment
 - Gender equality
 - Diversity and equality

Discuss potential risks and problems involved in using virtual meetings.

Investigate how the interviewee thinks that the potential effects should be measured, by which indicators, and also what is important to measure.

Sum up what has been discussed and ask about the most relevant effects.

Appendix C: Indicators TERM

Table 0-1 Organisational structure effects and indicators with collection methods.

Effect	Collection method	Indicators
Localisation.	Interviews: Direction. Documentation: Basis for decisions.	The degree of consideration taken to virtual meetings when deciding where to locate.
Virtual teams.	Interviews: Management and people responsible for geographically dispersed teams.	Virtual meetings significance, in per cent, for the capability of building the organisational structure in the desired way.
Technical infrastructure.	Interviews: IT department. Statistics.	Annual cost (per employee) for technical equipment that can be allocated to virtual meetings.
Administrative organisation of virtual meetings.	Interviews: IT department, direction. Existing statistics, surveys or interviews.	Annual cost (per employee) for maintenance in terms of bought services, full time employees or part time employees.

Table 0-2 Efficiency effects and indicators with collection methods.

Effect	Collection method	Indicators
Business continuity.	Interviews or questionnaires: Direction, project managers, travel managers. Questionnaires: all employees.	In per cent, share of planned physical meetings, that would have been cancelled due to unexpected events, but that could be held anyway thanks to virtual meeting technology.
		In per cent, share of planned physical meetings, that would have been cancelled due to travel or economic restrictions, but that could be held anyway thanks to virtual meeting technology.
		Share of virtual meetings that have not been able to be held, due to technical/connection problems.
		Share of virtual meetings that have been limited in functionality by 50% or more, due to technical/connection problems.
Use of competencies.	Interviews: Direction, management, project	In per cent, share of projects and other forms of cooperation that has made use of specific

	managers, identified key persons and also other employees.	competencies that would not have been available without the possibility for meeting virtually.
Flexibility.	Interviews: Management, project managers and other that call for and initiate meetings, training, seminars and so on.	Share of meetings, and other forms of cooperation, where participation was desirable but only made possible by the use of virtual meetings. The value of being able to take part of meeting information afterwards, for instance through recordings.
Meeting culture.	Interviews/questionnaires: employees about number of physical and virtual meetings. Interviews: managers and project managers about meeting efficiency and number of participants.	Number of meetings, physical and virtual, that was participated in. Percentage of increase, annually, for total number of meetings. Percentage of increase, annually, for share of virtual meetings. Average time used for preparations and after meeting work for a meeting that requires travelling. Average time used for preparations and after meeting work for a virtual meeting. Efficiency, in per cent, of a virtual meeting compared to a physical meeting. Degree of a social comfort in a virtual meeting, compared to a physical meeting. Number of participants in a virtual meeting compared to a physical meeting.
Travel costs, time savings and economic savings.	Interviews: Travel manager. Questionnaires: employees.	Average time saved per replaced business trip. Average time saved in administration (booking, arranging, reporting, reimbursing) of business travels. Average time used for booking and arranging virtual meetings. Share of time savings used for other travels. Share of time savings used for non-travelling work. Annual cost for business travelling. Increase or decrease to be compared with cost for virtual

		meetings. Annual cost for business travelling per employee, in order to normalise and enable comparison with other organisations.
Costs for virtual meetings.	Questionnaires: employees.	Annual time used, per employee, to keep up competence in virtual meeting technologies and the use of virtual meetings.
Economic activity.	Interviews: CFO, director general, politicians.	
Time spent in meetings and travelling.	Interviews: Travel manager. Questionnaires: employees.	Average time saved in total per replaced business trip. Average time used for administration (booking, arranging, reporting, reimbursing) of business travels. Average time used for booking and arranging of virtual meetings. Share of time that can be saved and used for other travelling. Share of travel time that can be used for non-travelling work.
Availability.	Interviews: Managers, project managers, employees.	Degree of increased or decreased presence frequency of convened participants in virtual meetings compared to physical meetings. Share of meetings, seminars, trainings or networks where virtual meetings have enabled desired participation. Share of virtual meetings where technical problems have impeded participation.
Time spent in virtual meetings.	Interviews/questionnaires: employees.	Optimal distribution of virtual and physical meetings within a project with a number of planned meetings. Share of saved time for replaced business trips that are used for other meetings.

Table 0-3 Staff effects and indicators with collection methods.

Effect	Collection method	Indicators
Staff turnover.	Interviews: HR department, employees.	Employee satisfaction, in per cent, in network, projects based on virtual meetings, compared to the same based on physical meetings.
Recruitment.	Interviews: HR department.	Share of candidates that asked for the possibility to work flexibly. Share of recently recruited employees that asked for possibilities of using virtual meetings and flexible work.
Gender equality, diversity and equality.	Questionnaires, interviews: employees.	General perception about if and how use of virtual meeting is influencing gender equality, diversity or equality.

Table 0-4 Environmental effects and indicators with collection methods.

Effect	Collection method	Indicators
GHG emissions.	Interviews: Environmental department. Statistics.	In per cent, to what extent do virtual meetings affect use of energy, emissions of GHG and other significant environmental aspects.

Appendix D: Suggested list of indicators

The table below shows some suggestions for key indicators. The point of departure is the goal that the organisation wants to achieve. Whether data collection methods are practical or not depends on the current prerequisites, for example if there is already an employee satisfaction survey or a policy monitoring tool in place.

Table 0-1 Suggested indicators.

Goal	Collection method	Indicators	Relevance
Reduce travel costs.	Financial data ⁴ . Data from travel booking systems.	Total travel costs. Travel expenses per employee, or in relation to turnover.	Substitution stage.
Reduce meeting costs.	Time registration. ⁵ Financial data. ⁶ Data from travel and meeting booking systems.	Average meeting cost: total meeting cost per meeting man-hour.	Substitution stage.
Reduce emissions from business travelling.	Employee or manager surveys. ⁷ Time registration. Environmental statistics. ⁸	Percentage compliance with travel- and meeting policy. CO ₂ e emissions per meeting man-hour.	Substitution stage.
Attract and retain competency.	Employee entry and exit interviews. Interviews: HR department.	Percentage of employees stating that virtual work methods contributed to attractiveness of employer. Percentage of employees stating that lack of virtual work methods was a reason to leave employer. Percentage of HR	Diffusion stage. Integration stage.

⁴ Travel expenses: tickets, daily allowances, hotel costs etc.

⁵ Time registration system must be granulated to catch time spent in different meeting forms. It must also catch improductive time spent for actual travelling.

⁶ Same as (a), but also including depreciation for investments in virtual meeting/collaboration as well as operating costs.

⁷ Although not very common, there are existing tools that can be used to monitor policy compliance on regular intervals.

⁸ Include emissions from travelling and also from use of virtual meeting/collaboration tools.

		professionals stating that virtual work methods contribute to employer branding.	
Increase employee satisfaction.	Employee surveys. ⁹ Utilisation rates. ¹⁰	Level of satisfaction with work-life balance. Level of satisfaction with virtual work tools. Level of satisfaction with organisational efficiency.	Substitution stage. Diffusion stage.
Increase meeting efficiency.	Interviews or surveys. ¹¹ Time registration.	Level of meeting agenda fulfilment per meeting man-hour.	All maturity stages
Increase productivity.	Financial data. ¹² Utilisation rates. Time registration.	Output per meeting man-hour. Output per meeting man-hour related to utilisation.	All maturity stages.
Reduce emissions per unit produced.	Financial data. Environmental statistics.	Output per unit CO _{2e} emitted.	All maturity stages.

⁹ Existing employee surveys should be complemented with questions related to efficiency and availability of virtual meeting/collaboration tools.

¹⁰ Utilisation rates of implemented virtual meeting/collaboration tools.

¹¹ Any meeting initiator: project managers, operational managers and so on. Also participants.

¹² E.g. turnover or aggregate service value per employee.

Appendix E: Virtual maturity questionnaire

Respondents: All employees

The purpose of these questions is to understand what tools are used in the organisation, whether these tools are perceived as efficient and also whether the employees lack some tools. High diversity and high level of use of virtual collaboration tools indicate high virtual maturity.

In my work, I use the following tools on a regular basis (check all that apply)

- E-mail
- Audioconferencing
- Videoconferencing
- Telepresence
- Instant messaging
- Web meeting software
- Shared document management
- Shared project space

In my work, I would use the following tools were they available (check all that apply)

- E-mail
-

My work tasks would not be possible to execute without (check all that apply)

- E-mail
-

The training and support that I get in using these tools is sufficient.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Using [E-mail/AC/VC...] increases my efficiency at work.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Respondents: HR managers

The purpose of these questions is to find out how HR managers perceive the connection between virtual work methods and employer branding, recruitment and equality. A clear connection indicates high virtual maturity.

The use, and related policies, of virtual collaboration tools in our organisation positively contributes to our branding as employer.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

The use, and related policies, of virtual collaboration tools in our organisation positively contributes to gender equality.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

The use, and related policies, of virtual collaboration tools in our organisation positively contributes to diversity and equality.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

New employees entering the organisation sometimes state that their perception of use of virtual collaboration tools influenced their choice of employer.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Employees leaving the organisation sometimes state that one of the reasons for doing this, is lack of possibilities to work virtually.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Respondents: Project/Operational Managers

The purpose of these questions is to investigate how project or operational managers perceive the importance of virtual collaboration tools in their ways of working and defined processes.

Increased use of virtual collaboration tools positively influences our working methods.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Increased use of virtual collaboration tools increases our possibilities for successful deliveries in terms of cost, quality and time restraints.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Respondents: Environmental Managers

The purpose of these questions is to understand the environmental manager's view on virtual collaboration. High level of agreement with question 1 indicates lower virtual maturity and vice versa with question 2.

Use of virtual collaboration tools leads to decreased environmental impact from reduced business travelling.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Use of virtual collaboration tools leads to decreased environmental impact, but not from reduced travelling.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Respondents: Travel/meeting Managers

The purpose of these questions is to get a view on how travel- and meeting policies are implemented. Clear policies and high compliance indicate high level of virtual maturity.

The organisation's travel- and meeting policy is clear and well communicated to our employees.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable

Employees tend to comply with our organisation's travel- and meeting policies.

Fully agree – Somewhat agree – Somewhat disagree – Disagree – Don't know/Not applicable