ARE TELECOMMUNICATIONS COSTS CHEAPER THAN TRAVEL? AN EXAMINATION OF BUSINESS COSTS IN A BUSINESS SETTING

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1. Introduction

This paper presents an analysis of telecommunications and travel costs for typical business meetings. Technological advances and the popularization of various modern telecommunications technologies have given rise to claims that electronic-based interactions will substitute some face-to-face, travel-based interactions. The potential substitution of travel by telecommunications has drawn the attention of various parties involved in telecommunications and transportation planning and policy-making (5). Substitution may have significant impacts on transportation and telecommunications users, suppliers, on location chice and on society as a whole.

The question as to whether or not, and under which circumstances the two modes of communicating (i.e., telecommunications and face-to-face) are substitutable is a very complex one (2,11). An underlying assumption which supports the substitution hypothesis is that the cost of traversing distance through the use of telecommunication is lower than the cost involved in travelling the same distance. The motivation for this study evolves from the popular notion that telecommunications-based interactions are not very sensitive to distance and hence are more cost efficient for long-distance communications. We examine the validity of this assumption.

An advertisement by a videoconference supplier, for example, presents a calculation where a "conventional" 2 hour meeting between parties located 870 miles apart would cost $467.00 (including airfare, auto rental, and travel and meeting time valued at $31.00 per hour). Videoconferencing, according to that promotional material, would cost only $338.00 (including $138.00 per hour of videoconference and the time value of the participants). For a meeting of more individuals the advantage of videoconferencing, as shown in the advertisement is even more remarkable, $676.00 vs. $934.00, when two people have to travel.

This example is somewhat misleading, as it ignores the temporal dimension. For short meetings, videoconferencing is clearly cheaper. However, as the meeting duration increases, at 2.93 hours the relative advantage of videoconferencing is turned over to the conventional meeting, as can be seen in Figure 1, thus indicating that for longer sessions, it becomes more economical to travel.

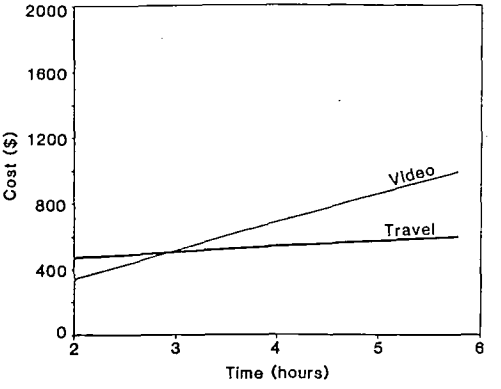

Figure 1: The Costs of Videoconference by Duration

The objective of this paper is to address one particular issue within the substitution debate. It presents analyses of the costs of conducting interactions through telecommunications and travel, focusing on the factors that determine the costs of conducting business over distance. It is not suggested that costs are the single factor which affects the choice. There are many other considerations, but the analysis presented here is based on the assumption that cost may become the determining factor.

Section 2 of the paper presents general issues of business communications. The hypotheses and approach are presented in section 3. A discussion of telecommunication and travel costs is presented in section 4. The case study is detailed in section 5 and the analyses are then presented in section 6. Conclusions and implications are discussed in the final section.

2. Communications in a Business Setting

Interactions for the purpose of communicating information are an integral part of business activities. In conducting business, organizations can use a wide range of communications modes, such as mail, electronic mail, telephone, videoconference and face-to-face meetings. Business people, in their daily routine must make choices among these modes, when there is a need to transfer information.

Two relevant trends characterize the changing business environment: the increasing importance of information as an economic resource, necessary for the competition and the increasing importance of conducting business over distance. The latter is evident as organizations disperse their production and distribution activities to multiple locations and global reach of specialized activities is becoming a common pattern.

Both trends depend on the organization's ability to gather and distribute information for internal intelligence and for remote control of sub-

units. There is an increasing concern in organizations about internal and inter-organizational communication. This is manifested in the purchase of advanced telecommunications, the appointment of (tele)communications officers, and the relocation of certain units to entertain particular locational benefits. Some agglomeration economies are in fact benefits accrued from the proximity to informal communication networks.

The communication (telecommunications- and travel-based) pattern of an organization depends on the geographical distribution of its contacts, the nature of the information conveyed to each and the intensity of each contact. Classical location theory suggests that firms seek a place which minimizes the total costs given the expected communications pattern.

The actual communications pattern depends on two level of decisions: the organization's decisions with regard to the purchase of telecommunications technologies, the creation of new contacts through marketing efforts and so on. At a second level, the individual employee, in his or her routine performance has to decide which particular technology to use, given the nature of the information to be conveyed and the destination of the contact.

At the risk of oversimplifications, we are assuming that organizations' decisions are determined by cost considerations or cost expectations (3). In addition, they are also influenced by a more fuzzy concept of some factors which are not quantified by decision makers, such as the notion that more information is better and hence the necessity to gather and control information, so as to remain competitive, or the value of prestige associated with the availability of state-of-the-art telecommunications technologies.

Relatively more is known about the decision of the individual employee. The choice among alternative media, for example, is affected by a series of factors related to the communications context including the informational content of the message to be transmitted, the perceptions and feelings of the individual user with regard to various communications media, and the characteristics of the individual and the organization within which he or she operate (10, 13, 15). The choice among telecommunications and travel-based alternatives has, in most cases been only been analyzed at a qualitative level. Past research indicates that the social/recreational attributes associated with travel need not be overlooked when analyzing the potential impacts of telecommunications on business communications.

In any case, whether one addresses the organization's or the individual's decision, a common assumption is made: that using telecommunications is cheaper than travel-based alternatives. That can be viewed as another characteristic of current business practice: the belief that information technologies' costs are decreasing.

The business context was chosen for analysis because its communication patterns are likely to be more time and cost sensitive than personal communication. Communications in business are usually well established within the organization's modus operandi, unlike private communications.

Also, the business sector contributes more revenue for both the telecommunications and the travel industries than personal communications and travel markets, and is of greater interest from a marketing perspective.

3. Hypotheses and Approach

In conducting business, firms and employees must make choices among alternative modes of communications across distance. To accomplish their objectives, the chosen mode must fulfill some of a variety of criteria set by the user, such as reliability, speed, ability to keep records, security and others. Among these, costs considerations are also playing a role, provided that threshold levels of some dominant criteria are satisfied.

The major hypothesis tested in this paper is that, despite common notions, the costs structure of interacting over space does not always favor telecommunications. There are situations where certain factors affect the costs so that travel is cheaper that telecommunications.

Specific hypotheses relate to some of the costs factors: First, as distance increases, the cost ratio between travel and telecommunications increases. Second, as the duration of interaction increases, the ratio between the costs decreases. Third, as the number of individuals participating in an interaction increases, the ratio increases, thus favoring telecommunications. These relationships are moderated by some intervening factors, such as market structure and institutional intervention, which create discontinuities in the cost schedules.

The testing of the hypotheses in this paper is confined to the effects on costs alone. We assume that competing technologies (travel and various telecommunications-based options) are equal in all other attributes, namely, from the users' perspective, there is no marginal value in sending a message by either mode, aside from cost savings.

General relationships between costs of distance for telecommunications and transportation cannot be studied analytically because they vary with contexts and circumstances. The variability in travel costs, for example, makes a theoretical non-site specific study infeasible; airline fares do not increase linearly with distance, as they are based more on demand than on distance, and consequently, are market specific. Moreover, the current competition among airlines has resulted in a price differentiation that is more a function of ticketing procedure than actual costs.

Therefore, we have employed a case study approach for the purpose of costs analyses. The case study approach has allowed us to make specific assumptions and get usable information to make the comparisons. Although the results are derived based on specific locations, the basic findings of this study are not site specific. A limitation of the case study approach is that it is based on current technologies and costs. Since both could change quite rapidly, the results may not always be applicable. The quantitative

analysis was done by developing simulations of business meetings to test the effect of distance, duration, and the number of participants.

4. The costs of transportation and telecommunications

Overcoming distance for the purpose of conveying information involves costs, composed of time, money, energy, and effort. The costs structure of the two basic modes of interaction, physical travel and telecommunications are similar in some respects but differ with regard to factors which may be crucial from the user's perspective. In this section we identify the major cost factors which warrant attention in the current context.

From the user's perspective, the major differences in the costs are: the relationship between costs and rates, the structure of the rates and the payment or billing mechanisms.

Providers of transportation and telecommunication services incur costs for the services, which are transferred through some formula to the users. The rates by which users are charged are not necessarily monotonically related to the costs, and may be deformed, due to regulatory intervention, marketing or technical considerations.

In principle one should analyze the cost differences considering both capital and operating expenses. However, there can be wide disparities in the methods for treating capital costs in different contexts, often driven by regulations. Fundamentally, the decision-maker facing a choice situation between modes considers whatever costs the market and the regulatory environment define. Ultimately, capital costs are included, often implicitly, and in distorted fashion.

4.1 Factors affecting costs

Four major factors that affect the costs of interaction technologies: distance, time, number of participants and various barriers are discussed.

4.1.1 Distance is expected to have a positive relationship with rates, as providing service for longer distances requires more resources.
The operating costs of both transportation and telecommunications are characterized by some sensitivity to distance. In the case of transportation, fuel, labor costs and depreciation of equipment are proportional to the amount of usage, hence are related to distance. In the case of telecommunications, the costs of distance are not so obvious, and in fact the popular notion is that there is no cost to distance at all. However, long-distance telecommunications requires more equipment (transmission channels, repeaters, switches and labor for their operation and maintenance). Therefore there is a justification to charge for distance so as to recover the capital invested in the long-distance link and its operation. The sensitivity to distance in operating costs alone (without capital recovery) is lower in telecommunications than in transportation.

4.1.2 Time: While transportation costs are clearly more sensitive to distance, telecommunications rates are very sensitive to the duration of the interaction and to time of day. Charges for duration are common for long distance calls and, increasingly, for local calls as well (6,9). This is done to ensure efficient use of the infrastructure. In addition, in order to reduce peak-load demand, telecommunications charges are, in most cases also sensitive to time-of-day. The peak rates are charged during most business hours and therefore apply to business communications. However, in some countries discount rates also apply for some of the business hours. The rational for peak load pricing is straightforward and advocated in many systems characterized by supply levels which must meet peak level demand.

4.1.3 Number of participants: Another difference arising from the basic rate structure of the two modes is the sensitivity to the number of participants in an interaction. In telecommunications, the marginal costs of more participants at a node that is connected is very low, as simple technologies allow multiple users to participate. Connecting additional individuals who are located elsewhere, usually involves a surcharge beyond the charge for the additional call. With videoconferencing, this charge could be substantial, however for a basic telephone call, it is marginal.

In the case of transport, however, the marginal costs of participants depends on the mode considered and may be very high if individual travel fares and expenses are paid, and lower costs if participants share costs of travelling in a single vehicle. Hence, the transport mode used (automobile, airline or company jet) affect the costs to be borne by the company.

4.1.4 Barrier effects: In both travel and telecommunications there are barriers which affect the costs. Some barriers are physical, such as rivers which may require a change of transport mode and consequently, transshipment costs. Other barriers may be administrative or political, such as time costs associated with passing international borders.

Telecommunications services, being in most cases regulated by some public agency, are subject to barriers which are determined by the jurisdictional boundaries of the regulatory agencies.

The basic form of telecommunications is telephone service, which in the United States is divided into two levels, local and long distance, each of which is provided by a separate company. In Illinois, for example, local service is defined as intra market service area (MSA). MSA's are groups of telephone exchanges divided geographically for telecommunication purposes. There are 19 MSA's in Illinois. In other states, exchanges are grouped into Local Access and Transit Areas (LATA) which are larger than MSA's but perform the same functions. The local service is provided by local exchange carriers (LEC) (8). Long distance service is provided by interexchange carriers (IXC's). The best known are AT&T, U.S. Sprint, and MCI. Long distance is considered interMSA calls (within states), interstate calls and international calls. The various state public utilities commissions or com-

merce commissions regulate both the LEC's and the IXC's for intrastate service, and the Federal Communications Commission regulates the IXC's for interstate and international service.

The barriers in costs are translated into discontinuities in the rates that users are charged. In addition, suppliers also set a step-wise rate schedule due to revenue considerations. In some cases, these discontinuities follow the boundaries of "area codes", perhaps defined from a marketing perspective, but in many cases the discontinuities are based on distances and multiple rates can appear within an area code.

4.2 Relationship between costs and rates

While there is a rationale for tariffs to reflect the actual costs of distance, some notable exceptions are evident. The supplier may depart from a direct cost-based pricing scheme. Depending on its assessment of the demand elasticities for respective market segments, the supplier may alter tariffs to develop promising markets. However, since the telephone industry is regulated, the companies must receive approval for any rates they charge. The regulators' objectives may, differ from those of the supplier. For example the State of Illinois currently allows Illinois Bell to earn a rate of return of 15%, so the average cost of a telephone call to Illinois Bell is fifteen percent less than the price they are charging the consumer (4). The rate represents the average cost of the call throughout the system and may not reflect the actual cost of the particular call in question, so as to maintain geographical equity among users. The average cost concept represents a cross subsidy from densely populated areas to the less densely areas. It is much less expensive to install equipment and place a call in the Loop area of Chicago than in Galena, Illinois, yet, since both are served by Illinois Bell, the service charges and the rates are the same (7).

The cost per distance concept is not very clear cut. Longer distances require more infrastructure and maintenance. But, demand also affects the incremental costs. For example, there is more demand for calls to San Francisco from Chicago than to Bismark, North Dakota which is much closer. Therefore, the incremental cost per call is much lower for the San Francisco-Chicago call than in the latter, but the price of the call is higher, because charges are based on distance.

4.3 The billing mechanism

The billing structure is very different between these two modes of interaction. In transportation, the "billing" is almost always in the form of users directly paying for fares or travel resources (e.g., fuel), excluding the costs of some externalities. The user may pay only indirectly for the infrastructure costs, usually through taxes, some of which are usage dependent (e.g., fuel taxes). Billing in telecommunications is centralized, allowing the supplier greater flexibility in applying pricing schemes. In other words, the pricing of telecommunications does not necessarily reflect

the actual costs in the same manner that transport costs are related to the actual out-of-pocket expenses borne by the user.

The billing mechanisms also differ in the immediacy of the payment. Out-of-pocket costs borne by the automobile or public transportation user are likely to be perceived as more restricting than costs which are billed only at the end of the billing period.

5. The Context of the Case Studies

In this section we discuss the setting within which the case studies were formulated. First, the interaction options (telephone, videoconferencing and travel) are described. Then the other parameters in the case studies are described.

5.1 Telecommunications

Two basic types of telecommunications were included in the analysis: telephone and videoconferencing. The conventional telephone usually serves two users, but "telephone-conferencing", where multiple users can participate in an interaction is also widely available. Videoconferencing is a method allowing two or multiple locations to be connected by a video link that allows the transmission of both voice and visual display. Depending on the type of technology used, the video link may enable only "freeze frame" slow scan of graphics, or full motion display. The former can use compression instruments which enable the transmission through narrow band networks, such as telephone cables, whereas the latter requires a broader band transmission facility, with a capacity of, for example 768kbps or 1.5 Megabits per second (Mbps). This rate, known as T1, offers full motion video. The T1 transmission lines are becoming the industry standard because of their quality, and because their capacity can be divided up to carry voice, picture and data using special multiplexing equipment.

5.1.1 Telephone Rates: The data used for the case study is based on Illinois Bell rates during the peak-period (0800-1700). There is a hierarchial structure for telephone service consisting of three different rate scales. The first scale is the local rates that apply to intraMSA calls. Illinois Bell provides intraMSA service, and its rates are shown in Figure 2. The second rate scale applies to intrastate, interMSA calls, which are served by the interexchange carriers. The rates charged by AT&T, the major common carrier in this market, for inter-MSA intrastate, as well as interstate calls are also shown in Figure 2. Note that interstate calls are cheaper than some intrastate rates. This may be a result of larger volumes in the interstate market than the latter, since the interstate rates apply across country, not just in Illinois. It also may be a result of regulation since the two types are regulated by different agencies.

5.1.2 Videoconferencing - At the present time, AT&T and U.S. Sprint appear to be the largest suppliers of teleconferencing service. They both offer turnkey service, which is complete planning, setup and operation of the

video conference itself. U.S. Sprint uses 768 kbps as its basic bandwidth but offers transmissions in 1.5 Mpbs. AT&T uses mainly 1.5 Mbps. Data was obtained from the respective carriers.

The two companies have much different rate structures. U.S. Sprint divides the United States into two regions along the Mississippi River, and applies only two rates: within and between regions. Their rates also include hook up charges. This structure introduces strong distortions of the distance-based pricing rational.

U.S. Sprint's rates for multipoint conferencing are the same for three, four, or five sites as long as the conference stays in the same billing category. AT&T's rate for videoconferencing, like their telephone rates, are based on mileage bands. A hookup fee of 42.40 dollars is charged for both locations in two-way calls. There is no difference between intra- and interstate rates for videoconferencing.

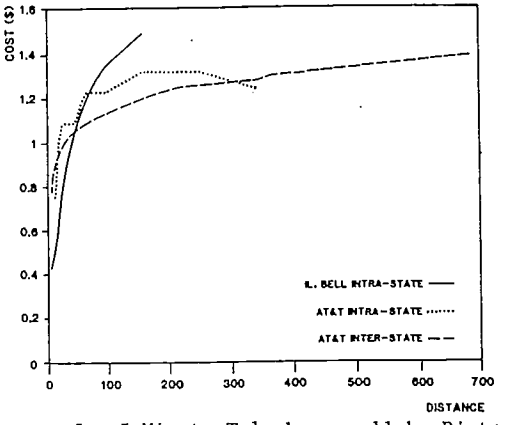

Figure 2: Costs of a 5 Minute Telephone call by Distance in Illinois

5.1.3 Related Telecommunications Costs: A videoconference requires a room equipped with at least a camera and monitor. Public rooms are usually equipped to both receive and transmit signals, and cost 150 to 500 dollars per hour to rent depending on their location and the facilities they provide. A private room is usually owned and operated by the firm or company in which it is located, and is not available for public use. Videoconferencing rooms are quite expensive to install and equip, as much as $100,000 (14).

The case study has been formulated assuming terrestrial transmission of the videoconferencing signals, although, satellite is a viable alternative. Table 1 summarizes the costs of telephone and videoconferencing (AT&T) for the cities included in the analysis.

5.2 Travel

The basis for face-to-face communication is travel. Although, there are many modes of travel, only flying and driving were included. For most cases, only airline travel was considered as distances were beyond realistic driving times. Travel costs include, in addition to the actual movement costs (fares), the time spent at the destination, accommodations, local travel, and the costs of time spent traveling.

5.2.1 Corporate Travel Policies - In order to gain an understanding of the costs involved in business travel, we contacted several companies to inquire on their travel policies. We found that companies produce guidelines instructing their employees to try to travel as inexpensively as possible.

Our informal survey indicates that travel choices are left up to the employee, and depend on the specific circumstances. The costs used in this case study are intended to reflect values that are acceptable to most firms for midlevel management in the cities involved.

5.2.2 Travel Costs - The basic mode choice here is between driving and flying with some variations within each mode. If the distance is reasonable to drive, the employee still may have three options: use of private car, (to be reimbursed by the company), use a company car, or renting an automobile.

When air travel is involved, the options become more complicated. The fare depends on the particular destination, on how far in advance the ticket is purchased, the season, and the class of the ticket. For purposes of the case study, we are assuming that the meeting participants use a full fare coach ticket, despite the availability of a large number of discount fares.

Table 1 shows the travel costs used for this study. The cost per mile of airline tickets follow the same trends as those for telecommunications. As distances increase the cost per distance decreases. Note that airline fares are not entirely distance dependent. The Madison, Wisconsin fare is high because the carrier, Air Wisconsin, faces very little competition.

5.2.3 Related Costs: Costs are incurred while traveling besides the actual travel fares. These include accommodation, meals, car rental, parking, and the cost of lost time due to travel. There is a wide range of costs for these items. We used some average figures which were derived from our informal survey.

The final cost element in travel is the cost of the traveler's time. There is no clear cut definition of the value of time, although a likely measure is the employee's salary, since this reflects the cost to the employer. There is also the question of whether or not the time spent traveling is really lost time. It is likely to be lost if the employee is driving alone, but work can be done on some modes of travel.

5.3 Other Factors:

Locations: We used Chicago as the base for the interactions, whether face-to-face or telecommunication-based. The seven other locations for meetings and meeting participants are listed below. Waukegan, Illinois was included, because it is located within the same MSA as Chicago. Springfield, Illinois and Indianapolis, Indiana are included because they are approximately the same distance from Chicago and illustrate the difference between of intra-state and interstate communication. The inclusion of Madison, Wisconsin is intended to illustrate small city interstate communication and travel. The last three cities: New York, New York; Dallas, Texas; and San Francisco, California were chosen to illustrate the effects of long distances.

A number of different combinations of locations were simulated, including pairwise combinations between Chicago and each of the other seven cities, and three-, four-, five-, six-, seven- and eight-way combinations always including Chicago.

Number of Participants: The number of participants at each location were varied. For simplicity the number of participants at each location were always equal at both ends.

Meeting Length: The length of the meeting was varied. It was assumed that the meeting lengths would be the same for all the media, even though it is claimed that telephone and video conferences are often shorter than comparable face-to-face meetings.

Table 1: The Fares and Costs used in the Case Study

Location	Distance (1)	Drive (2)	Fly	Telephone (3)	AT&T Video (4)
Waukegan Il.	27	9.87	na	1.09	25.45
Springfield, Il.	174	43.68	90	1.32	76.46
Madison Wi.	109	33.39	174	1.13	76.46
Indianapolis, In.	177	37.17	190	1.25	76.46
New-York, NY	733	175	318	1.39	203.
Dallas, Tx.	802	195.9	240	1.39	203.
San-Francisco,	1846	463	268	1.41	306.

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1) Distance in miles from Chicago. 2) Figures are excluding the value of time, which is included in the calculations. See text. 3) For a 5 minute call. 4) For a 30 minute videoconference.

5.4 Summary

The case study variables are summarized below:
LOCATIONS: (Distance from Chicago, miles)
Chicago, Illinois (meeting site)
Waukegan, Illinois (27)
Springfield, Illinois (174)

Madison, Wisconsin (109)
Indianapolis, Indiana (177)
New York, New York (733)
Dallas, Texas (802)
San Francisco, California (1846)
MEETING LENGTH: (hours) 0.5, 1, 2, 3, 4, 8, 16.
NUMBER OF PARTICIPANTS: 1, 2, 4, 6.
MEETING TYPES: Face-to-Face, Telephone Conference, Video Conference

6. Analysis

In the comparison of telecommunications and travel, there are quite a number of variables involved. It is well beyond the scope of this study to consider all of them in depth. We have, in the following calculations, assumed that costs alone affect the choice, and we have focused on the factors which affect costs.

The development of a case study requires the employment of many assumptions. We have mentioned some above, and due to space limitations, we will not detail all assumptions here. A more complete account of the assumptions is reported in (12). However, in making inferences from the results presented below, caution must be exercised.

6.1 Results

An illustration of the impact of distance on cost is given in Figure 3. It represents a two hour pairwise meeting with two participants at each location. The costs of the three telecommunication medium and travel are plotted against the distance from Chicago to the other locations. Travel makes the steepest increase with distance. The peak in the 200 mile area is due to Springfield. It is less expensive to fly there than drive. But for the other cities of the same distance from Chicago, Madison and Indianapolis, driving is less expensive, thus airfare to Springfield creates a peak.

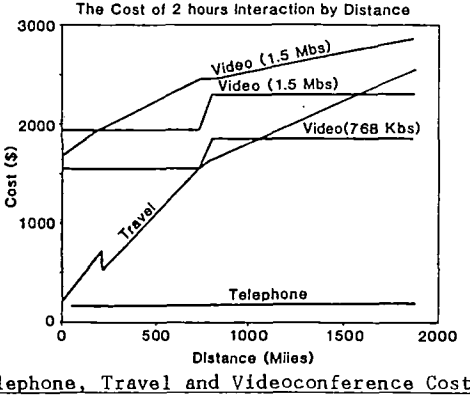

Figure 3: Telephone, Travel and Videoconference Costs by Distance

Telephone costs hardly increase with distance, which explains its advantage over travel and videoconferencing. Both videoconferencing categories are more expensive than travel for the shorter distances, but less expensive at the longer distances. The jump in costs for both the 768 kbps and 1.5 Mbps bandwidth is between New York and Dallas, where the U.S. Sprint rates increase, since Dallas is across the Mississippi from Chicago.

Next, we analyzed the effect of duration and the number of participants. In this comparison, travel telephone conferencing, and videoconferencing costs for U.S. Sprint 768 kbps and 1.5 Mbps were generated for a series of city groups. The calculations produced matrices, where the columns represent the length of the meeting and rows represent the number of participants. In comparing telephone conferencing costs and travel costs, the three combinations that include only local cities, travel is less expensive in the cases where the number of participants are low (1,2, or 4) and the length of the meeting is long. The cases where travel is less expensive increases with the number of locations. However, when the long distance cities are included (or are used exclusively) telephone conferencing is much less expensive. In fact, in 13 of the 16 scenarios we studied in depth, telephone conferencing was less expensive for all combinations.

The results of the comparison of videoconferencing costs and travel costs were calculated in a similar way. When the meeting length is kept constant and the number of participants is increased, videoconferencing is less expensive than travel. However, when the meeting length increases, travel costs become less expensive. In other words, travel costs increase more rapidly with the number of participants and telecommunication costs increase with the length of the meeting.

This comparison shows that not only do travel costs increase with the number of participants, they also are more sensitive to distance than telecommunication. The travel times involved in the "long distance" meeting, Chicago-San Francisco, also increase the cost advantage of videoconferencing. Therefore, travel is more cost effective in this shorter distance.

The impact of distance is also apparent for larger meetings. For example for a Chicago-Springfield-Indianapolis meeting travel dominates more than for a Chicago-New York-San Francisco meeting. In the former, there are only three cases when telecommunications dominates, but in the latter there are twelve cases. Travel costs are much higher in the latter case making telecommunications much more attractive.

7. Conclusions

This study has shown that there is no one threshold level where telecommunications are preferable to travel or where travel is preferable to telecommunications. The costs depend on many things including location, type of technology, number of participants, length of meeting, and the carrier. The basic conclusion is the larger the number of participants the more attractive is telecommunications, and the longer the meeting, the more

attractive is travel with respect to cost. In addition, longer distances favor telecommunications and shorter distances favor travel.

A firm must look at its own circumstances before making a decision as to which is more cost effective for their purposes. But, other factors must be considered before deciding on the appropriateness of a medium for the meeting. These factors include the type of meeting to be held, message that is to be conveyed the value of personal contact, and the other needs for travel or for telecommunications. Cost alone is not enough. It is beyond the scope of this study to try to include all the other factors in the "cost" matrix.

The claim that telecommunications allows information to be footloose, independent of location or distance, is not quite true. Presently, the costs of transmitting the information are distance dependent, thus contradicting the footlooseness concept. In addition, telecommunications is not location independent. Even in the small sample used here, there were locations where some services (videoconferencing via terrestrial transmission) were not currently available, and there are probably many more cities or towns without service. If the information cannot be transmitted everywhere, it is not truly footloose. Perhaps in the near future, the telecommunications network will expand as to make the footloose term universally valid.

Finally, it should be emphasized that the study is based on current prices and technology. In recent years, the technology has been improving causing telecommunication prices to decrease. A similar future study might yield different results.

Beyond the issue of choosing the most cost-effective mode of interaction, the findings of this case study may also have implications on location decisions. We argue that the decision-maker in a (re)location decision should calculate the total interaction costs involved in conducting business. We cannot suggest that certain locations are preferred for all information-intensive activities. However, any relocation decision which considers the above, must take into account that no economic activity can operate without some reliance on physical transport. Hence, remote locations are likely to increase the required transport budget. We can suggest that a firm with a particular spatial interaction pattern should consider its idiosyncratic interaction patterns. Therefore, this paper presents the existence of preferred locations, and the need for a locating firm to search for them.

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