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Influences and impacts on worker productivity: An exploratory study of Videoconferencing Systems in a Global Professional Services Firm

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Abstract

This paper presents the research framework and early results from a study that is exploring the use of Videoconferencing Systems (VCS) and its influences and impacts on worker productivity within a professional services firm. Worker productivity is the quantity of output produced with optimum quality of work and is measured by examining the comparative resources consumption in physical and VCS enabled tasks. The theory framework is based on a combination of Media Richness Theory, Task Technology Fit Theory, and VCS concepts. The study is using a Mixed Methods Research (MMR) approach that includes a pilot and major ethnographic case studies, coupled with business process analysis; automated content analysis; and directed (vector) graph and adjacency matrix algebra to investigate the phenomenon. Some early findings show that a major capital city office of the firm is having some success with realising reduced resources consumption and increased worker productivity where VCS is implemented.

Keywords

Productivity, systems, task, videoconferencing, worker

INTRODUCTION

In the context of modern business, the environment continues to create challenges for organisations, with more competitors entering the market, internal costs increasing, and customers having higher expectations. These competing priorities have prompted organisations to explore ways to become more efficient, including investing in Information Technology and Systems (IT/IS) (Belanger et al. 2001; Palvia et al. 2011). Organisations are also introducing new organisational structures that enable delivery of products and services across wide-spread geographical areas, creating teams that work in virtual environments (Belanger et al. 2001; Palvia et al. 2011). In order to improve conveyance of information and decision convergence, organisations may deploy various Information and Communication Technologies (ICTs), including internet instant messaging, blogs, social networking websites and Videoconferencing Systems (VCS) (Dennis et al. 2008). Importantly, VCS can enable enhanced workplace communications and information sharing services. However, there are inconsistent experiences, and varying evidence that emerges from business settings, and the ICT literature, in relation to the influences and impacts of VCS.

VCS use video images, sound, and information exchange to enable people to communicate and coordinate tasks mimicking the experience of physical meetings (Campbell 1998; Kydd and Ferry 1994). Some workers and firms have reported substantial benefits through VCS utilisation, including reduced business costs, travel time reductions and improved worker performance and productivity (Arnfolk and Kogg 2003; Campbell 1998; Denstadli 2004; Kydd and Ferry 1994; Weinstein and Nilssen 2013). However, other studies portray less positive views on the use of VCS. Indeed, some researchers concluded that VCS, when considered as a technology in isolation from other moderating constructs (e.g. top management support, task and technology fit), have significant limitations resulting in comparatively small performance improvements (Arnfolk and Kogg 2003; Denstadli 2004; Vilhelmson and Thulin 2001). In our study, we argue that investigating the influences and impacts of VCS on productivity should assist in resolving this ongoing debate, and make a contribution to the body of knowledge.

In this study, we narrow the scope of the investigation to productivity, which is the quantity of output produced with optimum quality of work. The literature has a decade of rich studies at the firm and country level which consistently show ICT as having a positive relationship with productivity (i.e. greater productivity growth) (Brynjolfsson and Hitt 1996, 2000; Dedrick et al. 2003; Hitt and Brynjolfsson 1996; Jorgenson 2001; Lehr and Lichtenberg 1999; Oliner and Sichel 2000). However, we argue that these studies of firm productivity are limited to ICT investment decision-making. We also assert that there have been fewer exploratory studies conducted at the worker and task level in relation to the impact of IT/IS on productivity. Arguably, this may be due to

information worker output being difficult to measure, compared to rich organisation-level data (i.e. few useable data sets) (Black and Lynch 2001). Other studies also fail to examine the underlying assumptions that attach to productivity, nor the quality of the output (Drucker 1999). We suggest that volume and quality play a role in improved productivity outcomes (Drucker 1999). Therefore, our study examines the following research questions:

What are the influences and impacts of VCS on worker productivity in a professional services firm?

- *What are the types of tasks that fit well with VCS?*
- *How does virtualised team structure impact worker productivity?*

The balance of our paper will present the detailed theoretical foundation for the study, an explication of the research model and methodology, and a discussion of some of the early test results achieved at the case site.

LITERATURE

The following section presents a consolidated view of the foundation literature for the study.

Videoconferencing Systems

Video-mediated communications research dates back to the 1980s where a dichotomous relationship of domains (i.e. IS versus communications) and two specific applications of VCS (i.e. telemedicine and online learning) saw studies fall into one of four categories (Ferran and Watts 2008). Given our study is based in a professional services firm, we focused on the literature in the IS and communications domains. The VCS-enabled tasks were categorised as either social (e.g., consensus making, conflict resolution, negotiation) (Anderson et al. 1996; Crede and Sniezek 2003; Doherty-Sneddon et al. 1997; Suh 1999) or intellectual (e.g. decision making, solution formation, capability creation) (Alavi et al. 1995; Sanford et al. 2004; Sumner and Hostetler 2002), with a further division into competitive outcomes (i.e., video was either superior, or inferior, when compared with the face-to-face medium). These types of outcome categories indicate that VCS may render different impacts on tasks (e.g. improved social cohesion, slower decision making).

Another segment of literature focused more directly on the technology, system attributes, and resource complementarities of VCS. In Gowan and Downs (1994), the researchers measured the perceptions and effectiveness of the VCS interface within a North American nuclear power utility. Their study found VCS may work best with tactically directed tasks resulting in significant resource-savings benefits, including reduced business travel and physical meetings; while larger groups and more complex social interactions rendered lower efficiencies. Other studies examined VCS design noting that the fit between the task and the VCS, and the requirement for remote access were important issues for VCS vendors; while personal privacy and social attributes impacted VCS usage patterns (Webster 1998).

Also, Townsend et al. (1998) theorised that the virtual teams using VCS require different social and collaboration skills. This concurs with other studies where technology induced changes to the organisation are mediated through the leveraging and application of worker roles and relationships (Anderson et al. 2007; Dustdar and Hofstede 1999; Konsynski 1993; Leonardi 2007; Powell and Dent-Micallef 1997). The empirical study of VCS adoption found that the usability and usefulness of VCS had a positive impact on perceived system utility, and improved the usability of the VCS leading to more satisfied users (Townsend et al. 2001). The research also uncovered a positive relationship between the utility of VCS and improvements in work group performance, while observing that users' satisfaction with the VCS had a negative relationship with group performance (possibly due to short task timescales). On balance, user perceptions of VCS and task timescales appear to have some impact on the work group performance (Campbell 2006; Townsend et al. 1998, 2001).

Media Richness and Task-Technology Fit Theories

Past studies have used Task-Technology Fit (TTF) theory and Media Richness Theory (MRT) to understand the relationship between the use of ICTs and worker performance (Daft and Lengel 1986; Daft et al. 1987; Goodhue and Thompson 1995). Hence, we have used TTF theory and MRT as our theoretical foundation.

TTF theory presents that to have a positive impact on worker performance; the technology should match well with the work tasks (Goodhue and Thompson 1995). The study also reported that the TTF dimension, coupled with the system's utilisation, was a sound predictor of enhanced work performance. In an extension to the theory, Zigurs and Buckland (1998) combined the central concepts of task complexity and Group Supporting Systems (GSS) characteristics to show that TTF can assist work group performance. This expanded version of the theory states that the enhancement of work group performance requires the type of tasks and characteristics of the GSS to meet optimal fit conditions (Zigurs et al., 1999). Also, several studies have shown suitable combinations of technology and task can lead to improved worker and work group performance (Dennis et al. 2001, 2008; D'Ambra and Wilson 2004; Lim and Benbasat 2000; Maruping and Agarwal 2004).

In relation to task fit, we also draw on the perspectives developed in Venkatraman (1989). First, the strategy to use VCS may, or may not, enhance worker efficiencies (matching). The study aims to confirm whether VCS-enabled tasks are more (or less) productive (e.g. task completion times) compared with physically executed tasks. Second, the coherency between the various types of tasks being undertaken and the VCS is yet to be assessed (gestalt). The measurement of task-technology congruence should provide objective evidence that worker performance has changed. Third, the mediating effects of worker roles and relationships on worker performance, where VCS are used, are yet to be analysed and documented (mediating). An assessment of worker relationships should identify suitable virtualised (formal) and social (informal) work structures.

MRT predicts that communication and task performance will improve when workers use richer media for equivocal tasks while using leaner media for less equivocal tasks (Daft and Lengel 1986; Daft et al. 1987). In this context, equivocality is a term similar to ambiguity, where there are multiple and conflicting interpretations of a problem. Although MRT's central proposition is to examine communication or task performance (e.g. how does the richness of the media for equivocal tasks improve performance?), MRT was dominantly used in prior research to illustrate and explicate media choice (Dennis and Kinney 1998; Kahai and Cooper 2003; Kanawattanachai and Yoo 2007; Yoo and Alavi 2001). Accordingly, the rich interactions available through VCS enabled work should allow us to examine the linkages between VCS and productivity.

Work Tasks

A task can be defined as the behaviour requirements for accomplishing stated goals, via some process, using given information (Zigurs et al. 1999). Tasks have also been defined as the action which turns inputs into outputs (Goodhue and Thompson 1995). In combining these concepts, the TTF defines task types based on the four dimensions of outcome multiplicity (i.e. more than one desired outcome); solutions multiplicity (i.e. more than one possible solution); conflicting interdependence (i.e. the adoption of one solution can conflict with the adoption of another); and, solution scheme-outcome uncertainty (i.e. the adoption of a solution may not deliver the desired outcome) (Zigurs et al. 1999). Following this, Zigurs et al. (1999) observed five task types in the form of simple, problem, decision, judgement, and fuzzy tasks. Simple tasks are those where there are no multiplicity or conflict dimensions, while problem tasks have a set outcome but may have multiple solutions. Decision tasks involve the outcome multiplicity dimension, whereas judgement tasks possess the conflicting interdependence dimension. The fuzzy task is the most complicated where the problem is not well defined and many solutions with high levels of uncertainty are attached to the outcomes.

Daft et al. (1987) separated tasks into the categories of uncertainty and equivocality. The condition of uncertainty has been defined as the difference between the amount of information required to perform the task and the amount of information already possessed by the organisation (Galbraith 1973). Hence, in attempting to resolve this uncertainty, workers seek to obtain and analyse data and develop structured information. As we noted earlier, equivocality is much like ambiguity, and often connotes a meaning of confusion, disagreement, and a lack of understanding (Daft et al. 1987). In addressing equivocal tasks, workers face difficulties in knowing the questions to ask, what judgements to make, and what data sets to use; thereby relying on experience, secondary data, or luck. Thus, we would propose that uncertain and equivocal tasks lead to the exchange of views and information so as to solve problems and resolve disagreements (Campbell 2006; Webster 1998).

Productivity

In reviewing the literature, prior studies which examined the relationship between TTF or media richness and their impacts on worker performance did not clearly define performance. Also, studies in the VCS literature depict a long list of outcomes that purport to represent performance shifts including increases in worker productivity and reduced travel time and costs (Weinstein and Nilssen 2013). In general, the definition of productivity is the relationship between inputs and outputs (Belanger et al. 2001). As noted earlier, prior studies neither provided assumptions, nor examined the quality of the output when determining productivity (Drucker 1999). In order to address this gap, some studies started to define performance. For example, Belanger et al. (2001) examined the relationship between IT and telecommuters perceived productivity and performance, defining productivity as the quantity of output and performance as the quality of work. In our study, we combine the definition Belanger et al. (2001) used for productivity and performance as a productivity definition.

Productivity can be measured in different ways. For example, recruiters use the speed of filling vacancies as an important measure of productivity (Aral et al. 2012). Given that our proposed study is concentrated within a global professional services firm, we will examine time spent on completing a task by extracting billable hours and utilisation data from the case site's information system and comparing it across face-to-face meetings and VCS enabled meetings (Wu et al. 2009). Furthermore, we will be able to access each worker's output metrics (e.g. utilisation, realisation, billable and administration hours) that are used to measure daily productivity (Wu et al. 2009), and output quality (via a quality management system).

Summary

The literature has a decade of rich studies at the firm and country level which consistently show ICT investment has a positive relationship with productivity (Brynjolfsson and Hitt 1996, 2000; Dedrick et al. 2003; Hitt and Brynjolfsson 1996; Jorgenson 2001; Lehr and Lichtenberg 1999; Oliner and Sichel 2000). However, while it is possible to argue that VCS can provide firm level benefits, some previous studies portray less positive views. Some researchers concluded that VCS when considered in isolation from other moderating constructs (such as top management commitment) have significant limitations and achieve minimal benefits (Arnfolk and Kogg 2003; Denstadli 2004; Vilhelmson and Thulin 2001). These studies found that organisations did not take sufficient account of the social aspects of the work tasks, worker attitudes and personal preferences. In particular, Vilhelmson and Thulin (2001) investigated the relationship between the emergence of IT and business travel, finding that a better understanding of people's everyday activity patterns is required when explaining the lack of VCS penetration into business operations, and a minimal reduction in work-related travel due to IT/IS. In a further example, Arnfolk and Kogg (2003) argued that a firm's business travel did not reduce solely on the basis of new IT/IS, with other factors, such as worker attitudes, skills, and preferences, considered important.

Pivotaly, there have been fewer attempts to study the technology-productivity nexus at the worker and task level. Researchers face difficulties in conducting research at this unit of analysis because most of the output that information workers generate is difficult to measure and worker productivity datasets are limited (Black and Lynch 2001). Recent communication studies show how executive recruiters use IT and their social networks to understand the impact on worker productivity (Aral et al. 2007; Aral et al. 2012). For example, Aral et al. (2012) investigated the different types of information diffusion observed through email exchanges and its effects on productivity (i.e. differences in information diffusion patterns will strongly predict worker productivity) (Aral et al. 2012). Also, Wu et al. (2009) studied the positive relationship between information worker productivity and social networks, mediated by email communications technology, in the context of a global consulting services firm. In sum, this study is seeking to build into the cumulative tradition of the literature while enhancing our understanding of the relationship between VCS and productivity.

RESEARCH MODEL AND METHOD

The following sections present the research model and method for the study.

Research Model

In combining the literature and theories, we have constructed a research model as shown in Figure 1. The model shows that tasks undertaken by workers can be classified in different categories based on definitions contained in TTF theory and MRT. These tasks will be executed using a formal structure, with VCS enabling work group structure virtualisation in some cases. In a virtualised form, social (informal) structures between co-workers will also be present, and may impact performance. Further, the congruence between work tasks and technology should influence work group performance. Finally, completion of tasks using face-to-face means, or VCS, will produce outputs that allow observation and measurement of worker productivity differences.

The model also supports three research themes. First, by investigating VCS usage, it should be possible to determine whether this video-based IT influences and impacts worker productivity. A comparison between VCS-enabled and physical tasks should allow us to compare relative productivity with respect to factors such as task completion times, speed of decision-making, and work outputs (Gowan and Downs 1994; Townsend et al. 1998, 2001; Venkatraman, 1989). Second, by acquiring and analysing the performance data, and measuring the congruence between the various work task and VCS, we should be able to assess differences (if any) in worker productivity. Arguably, the fit between the various tasks and the VCS should allow us to explore and explain any perceptual variations in worker performance (Campbell 2006; Gowan and Downs 1994; Townsend et al. 1998, 2001; Venkatraman 1989; Zigurs and Buckland 1998). Third, the assessment of any effects that worker roles and relationships have on performance, where VCS are used, should assist in determining best practice team structures (Campbell 2006; Gowan and Downs 1994; Townsend et al. 1998, 2001; Venkatraman 1989; Webster, 1998; Zigurs and Buckland 1998).

Case Site

FourStars LLP (pseudonym) is a large global professional services firm headquartered in Europe, employing over 150,000 workers in over 150 countries, with over US\$17 billion in annual revenues (as of September 2013). In 2007, FourStars adopted VCS in order to reduce downtime and business travel, and improve operational efficiencies, productivity and collaboration. In Australia, FourStars internal reports claim that the deployment of VCS has achieved over 90% VCS utilisation, increased client satisfaction (i.e. high quality of work at a cost-effective price), reduced business travel and realised Return on Investment (ROI) within 24 months.

We are conducting our research at FourStars ACT office that employs over 300 workers (over 90% of the staff members have client facing roles) across 6 service lines (Reform and Restructure (RR), Business Performance Services (BPS), Governance, Risk and Compliance (GRC), Information Technology Advisory (ITA), Financial Services (FS) and Economic Modelling Services (EModS)). There are two teleconference rooms each equipped with a screen and a camera with a call connection speed of 1472kbits per second at 50 frames per second. Usage is managed through the Events Management System (EMS). While the site was chosen partly on an opportunistic basis, this unique internal relationship with the firm provides ready and structured access to rich data, firm reports, VCS operations and activities, work group members, and fully audited (reliable) corporate information; thereby confirming the suitability of the office for VCS related research (Eisenhardt 1989; Dutton and Dukerich 1991; Yin 1994).

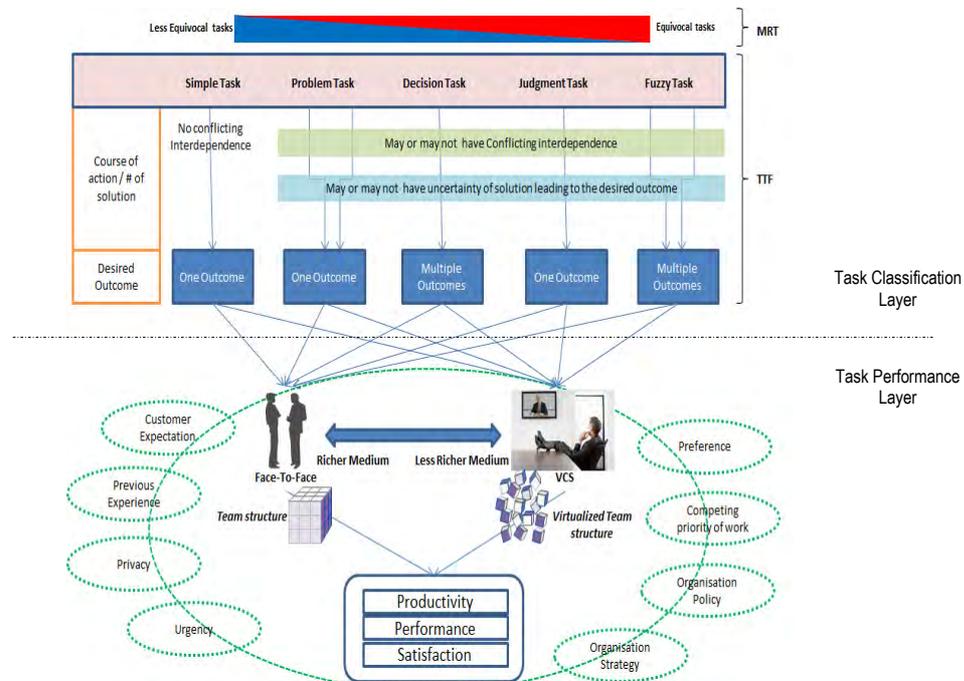


Figure 1: Research Model

Research Method

We are using a Mixed Methods Research (MMR) approach, that includes instrumental case study, ethnographic and social network analysis (directed graph and adjacency matrix algebra) techniques, to examine this relatively unexplored area of IT/IS (Baxter and Jack 2008; Benbasat et al. 1987; Denzin and Lincoln 2011; Fetterman 2009; Gibbert et al. 2008; Leech and Onwuegbuzie 2009). The use of MMR has enabled the creation of a VCS study that adopts a post-positivist perspective, combining and comparing quantitative productivity data analysis with qualitative analysis of worker viewpoints and social positions (Fischer, 1998; Johnson and Onwuegbuzie 2004; Prasad, 2005; Teddlie and Tashakkori 2009). The use of the case study technique enabled the inquiry to rigorously focus on the organisational aspects (workers, tasks and relationships) of the research model, rather than the VCS technology (Benbasat et al. 1987; Gibbert et al. 2008). In addition, the use of in-firm ethnography supports the development and analysis of task delivery, service line working arrangements (including work group culture), worker relationships, and VCS usage patterns and metrics (i.e. close proximity to reliable data) (Anderson et al. 2007; Atkinson 2005; Denzin and Lincoln 2011; Fetterman 2009; Schwartzman 1993). As the research progresses, examination of the work tasks, including the task-VCS fit, and the outturn worker productivity should support the creation of emergent insights and confirm the appropriateness of MRT and TTF theory lens (Eisenhardt and Graebner 2007). Importantly, the application of directed graph and adjacency matrix algebra to Likert-scale rated responses, taken during the worker interview segment of the case study, enables a complementary quantitative analysis of worker social networks and task work group relationships (Leonardi 2007). In sum, the ensemble of research methods are used to deliver a rigorous and instructive study in the tradition of VCS research (Anderson et al. 2007; Ferran and Watts, 2008).

Research Process

We have commenced research using a two part (pilot and main) process. A pilot study was conducted using unstructured interview techniques (Eisenhardt 1989), and was used to evaluate our research model, identify potential constructs that were not apparent in the early research design, observe task-VCS fit, and assess the

applicability of TTF theory and MRT. The pilot study interviews were conducted at FourStars ACT office-building and lasted 20-60 minutes. Subjects in this study were working on IT advisory, financial management, internal audit, and external audit engagements. Participation in this study was voluntary, with commentaries recorded and transcribed to the case study database.

A detailed ethnographic case study of FourStars Australian operations in the ACT office commenced in May 2013. Importantly, the majority of ACT office resources are allocated to the RR, BPS, and GRC service lines. Accordingly, we will only look at these three service lines (i.e. three cases) in our study. Given that the chances of identifying patterns, continuities, and discontinuities will be higher as the period of investigation gets longer (Dube and Pare 2003), the research will be conducted for a minimum period of twelve months. This will include analysing corporate and archival data (i.e. standard operating procedures, key productivity indicators, quality assurance standards, travel policy, VCS manual, VCS cost table, news releases, various engagement reports, time and expense reports), collecting and analysing VCS usage data from the EMS (i.e. employee level, purpose of usage, task and event type, VCS-task period, client type, task processes, worker interactions, distance to client location), and conducting and processing interview data.

In phase 1, we have commenced meeting with a number of highly knowledgeable informants (i.e. approximately 3 subjects in each service line), who can provide rich descriptions of the service line work, group work types (e.g. internal audit, external audit business case) and tasks (e.g. scoping meeting, development of assignment plan, data testing, report writing). In phase 2, we will continue with a series of in-depth interviews, commencing with open-ended and semi-structured question formats, moving on to more direct, structured and closed questions. The stratified sample will take in employees across all levels (i.e. Consultant, Senior Consultant, Manager, Associate Director, Director and Partner), consistent with the work group membership and task work profile. While interviews are a direct and effective method for gathering rich data, bias can emerge due to informants' unintentional retrospective sense making or impression management (Denzin and Lincoln 2011; Eisenhardt and Graebner 2007). To mitigate this data bias, we start each follow-on interview with questions and issues generated by, and related to, another informant (Corley and Gioia 2004). To assure the accuracy of the interview data, interviews will be recorded (subject to informant consent), and copies of the verbatim transcripts given back to the informant to agree the content and context (Dube and Pare 2003; Denzin and Lincoln 2005; Eisenhardt 1989; Gibbert et al. 2008; Yin 1994).

During both phases, a data collection hierarchy will be instituted with lower level collected data and themes aggregated and summarised into the key dimension or construct (Corley and Gioia 2004). This strengthens our collectivist approach to construct validity. Also, the collection of data from multiple sources (and points in the hierarchy) supports the triangulation process and provides scaffolding for our claims of stronger internal validity and construct precision (Dube and Pare 2003; Denzin and Lincoln 2011; Gibbert et al. 2008; Yin 1994). Chaining of evidence should assist with the establishment of tight linearity between the proposed constructs, data collections and analysis, and the findings (Gibbert et al. 2008).

Research Precision and Rigour

We are using five techniques to assure analytical rigour and precision (Denzin and Lincoln 2011; Siggelkow 2007). The study is using a combination of peer research briefings and research audits to assure the data collection, processing and analysis quality (Corley and Gioia 2004; Dube and Pare 2003); process analysis techniques in the form of sequence and time scale diagrams, and swim-lane based object-action diagrams will be created to determine process differences and temporal variations for the measurement and analysis of work tasks productivity (Darnton and Darnton 1997; Melao and Pidd 2000); fully audited data (i.e. charge-out rates, realisation, VCS usage data) from FourStar's Enterprise Resource Planning (ERP) system to measure any flow on financial savings for VCS enabled tasks; content analysis and coding using automated software tools (e.g. QSR NVivo, Leximancer), with coding rechecked during the research audits (Miles and Huberman 1994); and, social network and worker interaction analyses executed using mathematical directed graph and adjacency matrix techniques and software (Leonardi 2007).

SOME EARLY RESULTS

Based on the pilot study, some early observations are apparent. VCS used in government advisory work broadly supports client facing (i.e. management consulting, financial management, tax advisory, internal and external audit) and internal (i.e. committees' meetings, business development, and service line meetings) work tasks. However, our first observation suggests that VCS fits better with internal work tasks, rather than external work. As a result, senior staff members, who are allocated with more internal responsibility, have high VCS utilisation compared to junior staff members.

Second, there was some evidence that supports our argument that TTF theory provides a suitable foundation in order to understand which types of tasks work well (productively) with VCS. As an example, when executives needed to make a national announcement, or address a group (i.e. Chartered Accountant candidates, project

team), VCS was used rather than interstate travel. In other tasks, executives combined internal and external parties using VCS in order to release and discuss the results of analyses and client studies. Most subjects described: *'that the amount of time and cost which may have been spent on travelling could be spent on other work activities that could be recognised as highly valued billable hours'* (more output and higher productivity) (John Smith, Manager, 13 October 2010). However, it was also observed that some tasks involving more complex issues did not fit well with VCS due to different levels of staff engagement. As an example, an associate director participating in a complex risk assessment workshop using the VCS observed non-collaborative and disruptive behaviours with participants engaging in irrelevant and time-wasting activities (less output and lower productivity) (Paul Jones, Associate Director, 21 October 2010). Hence, TTF theory may assist us in explaining these observed variations.

Third, there were some specific cases where VCS was purposefully not used. Where clients expected physical meetings, were in close locational proximity, and/or did not possess the technical systems to support VCS-enabled working arrangements, VCS was not deployed. This shows that some business environment factors (e.g. client preferences in the task performance layer) will influence and impact the use of video technologies in different and dramatic ways. Accordingly, we expect that some of these factors will impact the frequency and scope of VCS usage, and consequently will have some influence on worker level productivity.

Fourth, the interviews did not query whether social structures, used to facilitate task delivery, moderated perceptions of productivity. However, an early phase 1 analysis of VCS usage patterns shows that most tasks are internal in nature; require some degree of decision making or judgment; typically possess moderate to high levels of uncertainty and equivocality; and, would benefit from sound social structures and worker relationships (see Table 1). While the follow-on interviews and EMS data analysis will tell us more about productivity perceptions, a recent firm-wide Microsoft SharePoint system implementation for knowledge sharing showed that social networks and informal worker relationships played a key part in enhancing FourStars worker productivity.

Table 1. FourStars VCS Work Tasks (2010-2012)

VCS Work Task	No	Ext./Int.	Type	Uncertainty	Equivocality	Social Structures
Client engagement meeting	46	Ext.	Problem/Decision	High-Mod	Mod-Low	Very important
Cross-service line engagement meeting	79	Int.	Problem/Decision	High-Mod	High-Mod	Very important
Executive meeting	185	Int.	Judgment	High	Mod	Very important
Service line engagement meeting	173	Int.	Problem/Decision	High-Mod	Mod	Important
Knowledge sharing / discussion	120	Int.	Simple	Low	Low	Less important

CONCLUDING STATEMENT

The follow-on phases of this study are yet to be completed, but some early phase 1 results already look promising. We expect that a fully audited set of results should be available by end 2014.

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