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MOBILE TECHNOLOGIES FOR PUBLIC POLICE FORCE TASKS AND PROCESSES: A T-GOVERNMENT PERSPECTIVE

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Abstract

The research in this paper considers the adoption and diffusion of mobile technologies for t-Government transformation to police force tasks and processes. Specifically, it undertakes an analysis of the use and impact of two mobile technologies (Mobile Data Terminals and Tablet PCs) on three specialist groups of police in Victoria, Australia. Technology and task issues are identified that lead to performance effectiveness and virtualization of policing activities. The research extends the theory of task technology fit with the theory of virtualization to explain the transformation of police processes as an outcome of mobile technology applications.

The methodology for the research included a qualitative analysis of data gathered from informal interviews, observations and focus groups guided by initial conceptual observations from the literature. The findings emphasise that mobile technologies are important tools for police organizations as they implicitly support and enhance individual and group performance as well as transformed processes. However, specific mobile technology issues, network support for connections and a need for training would achieve greater adoption efficiencies.

Key words: mobile technology, theory of task technology fit, theory of virtualization, focus groups, public police
Introduction

Police forces, as with other public sector organizations, are becoming increasingly innovative and proactive in their operational activities. Their work is geographically distributed and requires access to dynamic information as well as communication with remote colleagues. Information and Communication Technologies (ICTs) are radically transforming these organizations through the adoption of mobile technologies in an attempt to enhance police tasks. Consequently, the research in this paper considers the application of Mobile Data Terminals (MDTs) in police vehicles and Tablet PCs (TPCs) used by Crime Investigators and Sexual Offences & Child Abuse Units with the police force in Victoria, Australia. Here the Police employ some 14,000 staff including police officers and public servants serving a community of over five million people. The organization is divided into a wide variety of specialised units such as Forensic Services Department; Homicide Squad; Licensing Services Division (LSD); Missing Persons Theme Desk; Organised Motor Vehicle Theft Squad (OMVTS); Research; Sexual Crimes Squad; the Sexual Offences & Child Abuse Units (SOCAU); The Organised Crime Theme Desk; Gaming and Crime Theme Desk; Drug and Alcohol Strategy Unit and Drug Task Force; Arson and Explosives Squad; and the Special Operations Group (SOG). These operations are supported by the Air Wing, Dog Squad, Mounted Branch and Search and Rescue Squad. These units deploy different types of technologies to better serve the community and for safety and security of the work force.

ICTs used by Victoria Police include laptop and desktop computers, personal digital assistants for senior officers, infrared helicopters, DNA sampling, robots and dogs with cameras, speed and infrared cameras, fingerprint analysis and technologies to put together images of face descriptions provided by witnesses. All of the technologies are used in conjunction with radio transmission, which remains the most important form of communication between the organization and its employees. These enable hands free access to information, to support officers working by themselves on incidents, and to raise alerts to allow the officers access to computer systems. More recently Victoria Police distributed to its employees Secure ID authentication tokens to log onto the organizational network from remote locations. Whilst some sections of the organization discussed above are using state of the art technologies, others are introducing new mobile technologies to specific tasks. Specifically, the paper undertakes to establish if the mobile technologies enhanced the tasks of crime investigators, sexual offences and child abuse units and field officers, to who tablet PCs and mobile data terminals were recently introduced to enhance their tasks. Earlier research on mobile technologies and police tasks (Sorensen and Pica, 2005; Ioimo and Aronson, 2004; Sorensen and Pica, 2005; Tapia and Sawyer, 2005; Colvin and Goh, 2005; Bouwman et al., 2008; and Bouwman and Wijngaert, 2009) explored the applications of mobile technologies in Europe and the USA. Research discussed in this paper is a first study conducted in Australia on the application of mobile data terminals and tablet PCs to police tasks of three specific groups.

The first section of this paper is a review of literature on mobile technologies and their applications to police operations. The second section describes the theory of task technology fit and how the constructs are related to literature analysis on mobile technology issues. The third section is a description of the research methodology followed by a discussion of the findings. The paper concludes with an extension of the theory of task technology fit with the theory of process virtualization to explain transformation of police processes as an outcome of mobile technology use for the tasks of three specialized groups of officers.

Literature Review

Mobile and wireless devices enable organizations to conduct their operations more efficiently and effectively (Nah et al., 2005). These technologies are enabled through the collective use of various communication infrastructure and portable battery powered devices (Rao and Troshani, 2007). They support applications which deliver a complex range of services enhancing flexibility, mobility and efficiency for users in both public and private domains (Zimmerman, 1999), and are suitable for self-ascribed roles such as professional on duty, or private and off duty activities (Sarker and Wells, 2003). Factors which influence successful adoption of mobile technologies include prior knowledge and experience with technology (Rao and Troshani, 2007), perceived usefulness (Lu et al., 2003), perceived ease of use (Knutsen et al., 2005), social influence (Bhattacherjee, 2000) and demographic variables such as age and gender (Nysveen et al., 2005). In addition, technological characteristics such as interface and network capabilities, compatibility with existing network infrastructure, data
transmission speed, availability and reliability of wireless network and information confidentiality capabilities (Rao and Troshani, 2007; Sarker and Wells, 2003) are equally important. Although mobile technologies have received particular attention as rather unique phenomena that encapsulate the transformation of activities, they are not free from challenges. In particular, further adoption of mobile technologies relate to choices of appropriate medium of communication and the level of synchronicity, appropriate graphical user interface, communication frequency and volume, and network access and broadband issues in remote locations may impact data transmission and access (Rao and Troshani, 2007; de Reuver et al., 2008). Security of data transmitted and access of information or loss of data via damage to the device can also create problems. Ubiquity, personalisation and location specificity of mobile technologies make its implementation somewhat different from other ICTs.

Mobile technologies have been successfully used in business (Gebauer and Shaw, 2004; Nah, Siau and Sheng, 2005), health care (Burley et al., 2008), the construction industry (Deibert et al., 2008), education (Sarker and Wells, 2003; Divitini et al., 2002), real estate industries (Li et al., 2005), general workplace (Churchill and Monroe, 2001), outdoor recreation (Weilenmann, 2001), mobile information systems (Gabauer, Shaw and Gribbins, 2010), community organizations (Bingley et al, 2010) and mobile government (Kuschu and Kuscu, 2004). Although not extensive, mobile technologies are being extended to police operations in the United Kingdom (Sorensen and Pica, 2005), Europe (Bouwman and Wijngaert, 2009; Bouwman et al., 2008) and the USA (Colvin and Goh (2005); Tapia and Sawyer (2005); Ioimo and Aronson (2004). Other studies on police policies that highlighted the relevance of mobile technologies include that of Manning (2003) in the USA and Povey (2001) in the UK. Mobile technologies used by police highlighted in these studies include mobile data terminals, personal radio and mobile phones, PDA’s and 3G networks, intranets, automatic car location systems and laptops, etc.

The relevance of mobile technologies to police tasks relate to timely access to accurate information, reduced administrative work for police officers, improved communication and quick retrieval and transmission of relevant information. Information is crucial to police officers in carrying out their daily duties, and police organisations are ‘intelligence-led’ and information-intensive (Bouwman et al., 2008). Mobile technologies serve multiple purposes in police operations rendering the officers accountable through documentation and control of actions, provide a sense of security through connecting to control rooms and colleagues, support officers with awareness of current state of affairs, such as other incidents, the active queue of incidents and remote access to police databases as they innovate police operations (Sorensen and Pica, 2005; Bouwman, 2008). Mobile applications generally result in effectiveness and improved performance leading to an innovative image of the police service (Manning, 2003). Povey (2001) and Manning (2003) explain that benefits of mobile technologies are better informed police officers and improved coordination of limited resources at both individual and organisational levels. Other benefits from mobile technologies are efficiencies achieved from mobile technologies, improved data exchange, quality and frequency, and better management of information as well as staff effectiveness (Burley et al, 2008). Churchill and Munro (2001) suggest that wireless, portable communication technologies offer newer and better ways of being constantly available and in touch with information and with other people, improved management of processes and enhanced mobility, flexibility and information dissemination (Nah et al., 2005; Urbas and Krone, 2006).

Police tasks have been described by Sorensen and Pica (2005) and Bouwman et al (2008) as operational which entail groups of people coordinating and sharing information across space and time. The physical context of police tasks can vary from on foot, driving a car, working behind a desk or even riding a horse. Police work may take place in a quiet environment or in a chaotic situation. Thus, the context of a police task is defined by the physical environment in which the police officer is operating. This could be at the precinct (the office) or on the beat (mobile). The nature of these tasks could be structured (predictable and routine) or non-structured (unpredictable and ad hoc) with information received from multiple sources. Therefore, whether a police officer uses mobile devices, systems and applications, to a large extent depends on the tasks at hand and the context in which it takes place. Although searching for and retrieving information is not a police officer’s core activity, it is a critical aspect of their job (Tapia and Sawyer, 2005). In addition to the location, nature and initiator of the task, the direction of information flow and its impact on performance is critical (Sorensen and Pica, 2005). It is clear that mobile technologies have certain characteristics that are suitable for certain roles and support flexibility,
mobility and efficiency. Literature also highlights the unique context in which police tasks are performed, and the importance of quick retrieval of information for operational police officers. Mobile technologies are appropriate technologies for certain police tasks improving performance and transforming processes.

Research on technology innovation and diffusion clearly highlights the importance of matching information systems with organizational tasks to be supported (Gebauer & Shaw, 2004). Theories used to explain mobile technology applications in earlier police studies include theory of task technology fit (Ioimo and Aronson, 2004); theory of virtualization (Sorensen and Pica, 2005); technology acceptance model (Colvin and Goh, 2005) and technology acceptance model with the theory of task technology fit (Bouwman and Wijngaert, 2009). Although the theory of task technology fit (TTF) has been used to explain the use of information systems on individual performance (Goodhue and Thomson, 1995), Zigurs and Buckland (1998) extended its application to group goals, performance and impact by matching capabilities of technology to the demands of group tasks. TTF has the ability to explain that mobile technology is more likely to have a positive impact on performance and be used if the capabilities of technology match the tasks of the user/s. In lieu of this readily available approach that explicitly measure the fit between tasks and technology for assessing group performance outcomes, this research is based on the theory of TTF. This research extends the theory of TTF to a specific application of assessing the fit between mobile data terminals and tablet PCs to police tasks of specific groups working in different contexts as it establishes performance outcomes.

**Research Methodology**

Given the relative novelty of mobile technologies in the police force, especially in Australia, this research was exploratory (Saunders et al, 2009) guided by interpretive research paradigm. It attempted to understand phenomena through the meanings researchers assigned to them (Walsham, 1993), focusing on human sense making of emerging situations (Kaplan and Maxwell, 1994). To provide corroborative evidence, a triangulation of methods including document analysis, observations, interviews and focus groups were used to understand and collect data. The interpretive approach to data analysis enabled the focus to be on emerging patterns in assessing mobile technology characteristics, police task characteristics, performance outcomes and transformation of police processes. A combination of methods and analysis supporting a sound generalisability of theory within a setting (Lee and Baskerville, 2003) is presented in the discussion section of this paper. Data collection methods used in this research are briefly described in the following sections.

A number of documents regarding mobile technology roll out policies, technology manuals, organisation structure, descriptions of positions and roles were analysed to gain a good grasp of the organisation, police work, security policies and the technologies used. This was followed by a number of interviews with senior officers to further understand police work and context, technologies used, a police officer’s responsibilities, attire and equipment to be carried, innovation plans, technology applications to police tasks, database and police network security issues. Notes were taken to record the information provided by the interviewees and later written up as the background information essential for the analysis of mobile technology issues in relation to police work. To understand the context in which mobile technologies were applied to tasks, observations with the users of mobile data terminal and crime scene investigation were completed.

Although observations provided a good understanding of the application of mobile technologies to tasks characteristics, focus group research with crime investigators and sex offences and child abuse units from different regions in Victoria were completed to understand the relevance of tablet PC’s to their tasks. A set of issues on police tasks, technologies used, performance outcomes and problems were prepared by the moderator from a review of literature and presented to the group for comments. The number of participants in each focus group was in the order of 7 for the crime desk and 4 for the two SOCAU groups. These groups comprised of the number of officers available at the time. Focus group research provides insights into the sources of complex behaviors and motivations from the interactions that are a group effort (Hesse-Biber and Leavy, 2004), offering valuable data on the extent of consensus and diversity among the participants (Morgan and Krueger, 1993). Digitally recorded and transcribed data from focus groups were qualitatively analysed by summarising, categorising and structuring interpreted meanings (Saunders et al, 2009) on issues discussed by research
participants. The following sections briefly discuss the issues established from interviews and observations, followed by an analysis of findings from focus groups.

**Findings**

Findings from interviews revealed that while on duty, a police officer carries on his/her belt or tactical vests a firearm, handcuffs, pepper spray, a portable radio, gloves, spare ammunition and personal mobile phones. Although most are okay with the weight on their belts, a few, generally the overweight and the underweight are a little uncomfortable at times. The tactical vest is a satisfactory alternative, however, it can be uncomfortable during summer months.

Technologies used by Victoria Police include office technology (desktops) and laptops which are a shared resource. Tablet PCs were a recent addition due to a government grant to enhance the work of specific groups. All laptops and tablet PCs were configured to include logins and connections to the main police databases such as LEAP (Law Enforcement Assistant Program) and the intranet (Interpose). Two mobile phones per unit were provided and PDA’s were trialed with two groups. A RSA Secure ID (Token) was provided to all officers to enable email access from any remote location. Mobile Data Terminals in police vehicles is on a private network supporting 700 terminals in Melbourne metropolitan areas linked to a number of databases. MDT’s access jobs dispatched by the CAD (Computer Aided Dispatch) which include jobs created from 000 calls. This information is also relayed via police radio to alert the officers. Technology use is self taught from a CD which provides training on how to use the technology. Although some tend to pick up technology quicker than others, advanced applications are generally under utilised. Police in all states in Australia use mobile data terminals and have their own databases, however, they all have access to a common national database for vehicle registrations.

Observations revealed the following information about technology characteristics, tasks they supported and context in which used.

Mobile Data Terminals in marked police cars, unmarked cars and other police vehicles provide two way communication between dispatch office and field units. The terminal is mounted on the dashboard of the vehicle with a keyboard tucked away at the side of the driver’s seat. The terminal has a touch screen to support drop down menus and requires login with user passwords. The keyboard is rugged, described by the officer as ‘copper proof’ meaning the keys will not fall out even if used quickly and strongly and illuminate when used, supporting discreet access. The CPU supporting the MDT is stored in the boot of the car. The MDT includes USB ports for access to information such as policies stored on USBs. To support MDTs the cars have 4 antennas and an emergency button to alert the dispatch office if the officer is in danger and needs backup support. The MDT can access the LEAP database for additional information about the perpetrators before attending incidents. They can also access databases for vehicle registrations, prior incidents and status of driver license. MDT also supports car to car messaging. CAD (Computer Aided Dispatch) system which is able to identify police vehicles in all known locations transmits information to the vehicles and raises an alert via radio. The job dispatched entails an event number, location of the incident, details of what happened and a priority category, such as 1 for lights and sirens. While understanding the characteristics of the MDT in a static car with a senior police officer who had logged onto the system, an announcement came through on the radio for an emergency situation in the vicinity. The officer logged on and was able to show the case to be priority 1, the vehicle attending and the two backup vehicles rushing to the scene. This observation helped establish the characteristics of MDTs, the context in which patrol officer tasks are performed, the benefits of MDT for quick access of information about the case and backup support for the safety of officers.

A Tablet PC (TPC) is a mobile computer similar to a laptop with a slate-shaped device that has a touch screen and graphics tablet interface. Instead of the traditional keyboard or mouse the computer can also be operated using a stylus (digital pen) or fingertip on the screen. The Tablet PC is portable, flexible and useable. It can be used when space is tight or when using a keyboard may be awkward or difficult. The stylus can make some work ‘virtually paperless’ as it can be used to fill out forms, add drawing to digital photographs, make appointments,
send and receive information, store, search, and review handwritten notes, convert handwritten notes into text to use in other applications, or annotate documents imported from any application. A tablet PC used for crime investigation took place at a car impound centre for stolen cars although crime investigators attend to break-ins, assaults, stabbings, shootings and other incidents as well. They have to go to the scene, take fingerprints, get blood, semen and other evidence for DNA where relevant, and collect swabs and record any other evidences. Information on crime scenes to be investigated are sent to the unit via the police Intranet and sometimes via phone, which is first entered into a book (old way of doing thing) and then into a desktop PC (transforming the process). An officer is then assigned to the jobs for investigation. The police officer investigating the cars took with him a tablet PC. He remarked that,

‘A lot of officers still kept handwritten records since they were more comfortable doing that and long recordings required re-charging the batteries which slowed their work’.

The officer went to the cars to collect fingerprints. He then returned to his tablet PC to record the information, The tablet PC was left switched on in one corner of the building to avoid the sun on the screen and to keep it in the laptop position. At the end of the investigation the officer checked on the tablet PC for more incidents to be investigated in the vicinity before returning to the station. This observation exposed the characteristics of a TPC relevant to the tasks of criminal investigators in a context that was responsive and low risk. Electronic recording as well as accessing information on new crimes illustrated some of the transformed police processes and efficiencies in time saved from having to return to the station for next job.

Information was gathered from focus groups with three special units that used TPCs to complete their tasks. Focus Group 1 (FG1) comprised 7 participants, each representing a different crime desk; Focus Groups 2 (FG2) and 3 (FG3) comprised of 4 participants each from two Sex Offences and Child Abuse Units (SOCAU). FG1 was made up of crime desk officers who were all male, in the age group ranging from mid 20s to 40 years old. FG2 and FG3 included all female officers from similar age groups.

**Task Characteristics**

Tasks for the FG1 participants included attendance at all reported crimes. FG1 took fingerprints, photos and collected all evidences at a crime scene and recorded it. Focus group discussions indicated this group was keen to apply technology to their tasks and found it convenient as it helped transmit fingerprints and photos electronically for assessment. FG2 and FG3 investigated criminal offences regarding sexual assaults and child abuse. The tasks performed by participants of FG2 and FG3 included taking statements from victims and witnesses, completing reports on sexual assault and child abuse, taking victims to hospitals for medical examinations, video recording incidents, and liaising with the Department of Human Services (DHS) for removing victims from their current environments. They generated reports of incidents as well as completed a running log at the end of their shifts, a requirement for all officers. Task context for all three groups was responsive. Crime desk investigators (FG1) dealt with incidents that are generally high volume, low value crimes although it could also be in crowded or emergency situations, and in a range of environmental conditions such fire, flood, natural disasters and traffic accidents. This is a support group that processes the scene once a crime is reported. As described by a crime desk officer,

‘A crime desk officer investigating a shooting would go to the site, collect fingerprints, look for DNA, and collect swabs and other evidence for processing’.

The context in which FG2 and FG3 participants perform tasks is generally in victims’ residences, police stations, prisons and hospitals. It is with the victim on the scene and generally low risk. Frequency of tasks for FG1 participants on an average was between 100 and 150 crimes per week. This compares with 2 per week by FG2 and 1 per week by FG3. By frequency we mean ‘instance’ of crime rather than the length of time spent on each task.

**Technology Characteristics**
Although a range of technologies were used by all three focus groups to support their tasks, common technologies included Tablet PCs, which were recently introduced to these groups to enhance their tasks, improve performance and innovate police processes. FG1 participants, due to the context of their tasks, used RSA Secure ID for accessing emails, Mobile Data Terminals in vehicles, FIMS Polilight, Google Earth for maps, iFace and LEDR for recording information in conjunction with TPCs. FG2 and FG3 participants depended a lot on the use of LEAP and Interpose databases to access information via TPCs, and video recorders with children and old people. The three groups used different technologies for different activities in conjunction with TPCs. Some officers indicated that although TPCs were helping accomplish a lot more while away from the station, they have not performed to the level of officer expectations due to slow connectivity, no formal training, or having to duplicate work due to secure police databases. More capability and battery power was suggested would be helpful. One officer from FG2 commented that

‘If the officers found it easy to use they would use it more’.

All three groups indicated that they were self-taught in the use of TPC. TPCs were distributed with login instructions and officers were expected to either know how to use TPCs, or learn from each other. Documentation was provided (the example given being login instructions) however officers found the instructions difficult to comprehend and follow. Another officer from FG1 commented,

‘Not having a technology background or formal training, I have not had the slightest idea of the possibility of downloading video recordings on Tablet PCs and converting them to DVDs’.

Most respondents indicated that connection to databases from remote locations was slow and at times made the TPC not so useful. Sometimes loss of data was experienced due to lost connections. Since TPC’s were newly introduced, a lot of work was duplicated which took up time that could have been easily saved if technology integration and convergence were possible. All focus group participants indicated they were satisfied with the security of the systems used at Victoria Police. Security of police databases is good, although it is also restrictive to police tasks since it does not allow direct entry of information and update of already entered information. The TPCs entailed a double login system from remote locations and lock-in windows which saved data and blocked access to other users. TPCs and laptops were cared for by officers in the same way they cared for firearms so no loss or damage of equipment was recorded with any of the three groups. Officers had realised that digital information was more secure than paper-based documents, and had started converting documents such as medical reports and DHS reports into pdf format and storing them on TPC’s. With regards to reliability, different views were expressed amongst the focus group participants. FG1 participants believed a more rugged technology was required for use by officers in the field while FG2 and FG3 participants believed the technology was reliable albeit slow for FG3 participants who were from an outer metropolitan area.

Performance Outcomes

Three main categories of efficiencies identified across all focus groups included time, resources and workflows. Fewer officers are required to perform tasks as a result of the use of technology (FG1) since a lot more is accomplished with TPCs. Time spent waiting with victims at hospitals and other venues is now utilised preparing and compiling statements and reports and not having to wait and complete these until officers returned to their stations (FG2). This has also resulted in huge savings on overtime payments (FG2) to officers. Access to resources such as other police databases (databases for criminal identification, Vic Roads) in the field has improved the efficiency of officers in performing their tasks (FG3). One officer from FG1 noted,

‘I will never go back to the old way’.

More staff are needed which will never happen, so technology enables accomplish a lot more than without technology.” Workflows have been streamlined with the ability to transfer information electronically between other operational units such as detectives. Technology has improved recording and entering data. One participant from FG2 stated,
‘Working with TPCs is better than completing tasks the traditional way. A lot of the work is completed and entered into the system on the spot. Before technology the officers had to spend another 6 to 8 hours at the station recording information’.

However, efficiencies for regional users (FG3) were affected by slow access to police network and databases. An officer from FG2 noted,

‘Although technology is a positive, only the basic functions are used. There is not enough time to explore any additional features and its use at the present time is only needs based’.

Better information management was reported to have been achieved by all focus group participants who concurred that greater amounts of information could be processed, managed and shared with the utilisation of TPCs. FG1 participants indicated that with tablet PC’s one officer can perform multiple tasks. Participants in FG2 and FG3 shared thoughts on continuity of workflows as an example of better information management and transformed processes enabling officers taking over a shift commence with up to date data which had been recorded by the officer/s on duty before them. This also enhanced the work of detectives, the legal teams and others with reports compiled a lot faster. Urgent cases were easily handled with TPCs. Staff effectiveness was achieved by members of all three focus groups with the ability to complete more tasks and reduce traveling times between crime scenes and police stations. A better quality of life by going home earlier (FG2) had been enabled by technology. Officers felt more professional which improved their self image. FG3 participants recognised time savings but believed training for the full utilisation of TPC’s would result in greater improvements. All focus group participants indicated access to police databases, completion of tasks at remote sites, informing each other with attached documents and accessing the next set of tasks from remote sites to be very effective.

FG1, ‘I am serving the community better with quick responses”. FG2, ‘Every day is a busy day, so technology has supported managing a lot more work’.

**Transformed Police Processes**

Officers are able to access information from remote locations and are more informed about victims, situations and backup before they attend to reported cases. Officers from all focus groups reported that data loaded onto databases using TPCs resulted in improved and streamlined processes for other units needing the information to act upon. Information exchanged electronically between crime investigators and different entities working on crimes (forensics, fingerprints, detectives, others) was recognised as the main example of improved communication through the use of technology. Replacing paper-based information recording with technology promoted a sense of professionalism (FG1). The level of transformation was dependent upon reliable access to data with a modem connection and training to use the TPC to its full capacity (FG3). A new culture with electronic access, transmission and recording of information was noted by all three focus groups. The rate of change is however limited since focus group participants were uncertain if they were using the technology to its full potential. Officers felt safer due to technology that was connected to the stations and main systems. With access to LEAP database, officers were informed about victims before they dealt with them. FG1 and FG2 participants agreed that the use of TPCs in public places improved the professional image of police and portrayed Victoria Police as a technology-oriented and innovative police force.

FG2, ‘Sitting at hospitals waiting for victims’ medical examinations and reports, we look very professional working on TPCs completing our reports’.

Efficiencies achieved from TPCs leave officers with more time to attend to other matters for public safety and go home at the end of their shift rather than sit at the stations and complete reports. During a recent fire in regional Victoria officers used TPCs to find people from addresses affected by fire and alert a search for those not found. Being better informed enabled better decision making and increased police safety being able to check any recorded history of suspects prior to approaching them.
Discussion

The findings clearly indicate that the mobile data terminals in police vehicles and tablet PCs used by crime investigators and sexual offences and child abuse investigators satisfied all the characteristics of mobile technologies (Sarker and Wells, 2003; Rao and Troshani, 2007). Mobile Data Terminals (MDT) in police vehicles are especially useful for patrol officers in regards to improved communication between officers in other cars in the region, with dispatch office, access to databases for informed arrests and investigations. Additional information regarding victims and cases is easily retrieved via MDTs which was previously available only through the dispatcher which entailed time delay depending on the dispatcher’s load. It enables the stations to monitor the car locations leading to safety and security of officers as well as the community. MDT is an important innovation in police operations for Victoria Police, and it is of international standard (Meehan, 1998). However, at this stage information exchange supported on MDTs is in text format only rendering radio communication important for alerting officers to access information on MDTs.

The Tablet PCs used by the groups investigated has enhanced police tasks. The TPCs are portable and support mobility, flexibility and efficiency as suggested by Zimmerman (1999), Nah et al, (2005) and Urbas and Krone (2006). They supported better task management with retrieval of information from police databases and reduced paper-based documents such as reports and hospital reports. Security of information transmitted via TPCs is supported with a number of levels of password access and window lock-in. Although sometimes slow to connect from certain areas, especially for FG3, TPCs are reliable technologies which officers found easy to use and were proud to carry. All groups indicated TPCs were useful, however crime investigators indicated the need for longer battery life or replacement batteries to complete investigations without having to recharge between jobs. A key feature of TPC is the ability to write on the screen which was not used by any of the officers although some found the small keyboard of TPCs cumbersome to use. TPCs can be integrated with other technologies for better outcomes and a reduction in duplication of work, for example video recordings for SOCAU were transferred to desktops at stations and then saved on DVDs. Officers using TPCs spelt out very clearly that they were using only basic functions that were either self-taught or learnt from others. Knowledge and experience with mobile technology (Rao and Troshani, 2007) is an essential factor contributing to the successful use of TPCs. All mobile technologies were on private police networks supporting secure data transmission and could connect to relevant databases for the required information. The findings also supported the views of Lu et al (2003); Knutsen et al (2005) and Bhattacherjee (2000) that perceived usefulness and ease of use as well as peer support encouraged and enhanced mobile technology use. Although TPCs were not used to their full capacities, they helped officers achieve a lot more than what they did without technologies, supported flexibility and ability to complete tasks while being mobile. This research clearly indicates that mobile technology characteristics of functionality, portability and reliability are especially useful for police tasks, however, user issues of training and knowledge is an essential requirement for more effective applications.

Police tasks identified in this research are similar to those reported by Sorensen and Pica (2005) and Bouwman et al (2008) to be information intensive whether an officer is investigating a low risk crime or attending to an emergency situation. Police tasks were either structured (predictable and routine), or unstructured and ad hoc. However, for all tasks information was very important, confirming Tapia and Sawyer’s (2005) suggestion that although searching and retrieving information is not a police officer’s core duty it is a very important aspect of his or her job. TPCs helped with documentation and coordinating activities as well as with reporting and sharing information with other units working on the same case. This research indicates that TPCs are relevant to the tasks performed by crime investigators and sex offenders and child abuse units, and MDTs are useful for field officers because of the context in which they have to perform their tasks. It highlights that police task characteristics and context are well supported by mobile technologies.

Although no formal evaluation of TPC and MDT outcomes were recorded, cost reduction in overtime payments, fewer officers required to complete a task, less paper due to electronic records, accuracy of information, informed investigations, and improved workflows between all stakeholders were noted. Staff effectiveness was also noted with more accomplished by each officer using TPCs and less travel time required for additional and new information. Other findings indicate that use of technology has drastically reduced the time officers spent at stations at the end of their shifts completing reports. This supports work/life balance with officers getting more
time at home. TPCs and MDTs support flexibility and mobility of officers which are essential for a safer community. This research clearly indicates that better information management, coordination of responsibilities, accuracy in decisions and actions as well as efficiencies are achieved from mobile technologies in police operations.

Although some of the findings of this research are similar to mobile technology use by police in the UK (Sorensen and Pica, 2005), USA (Tapia and Sawyer, 2005) and Europe (Bouwman et al., 2008), this research highlights a new finding that that mobile technologies lead to transformed (virtual) police processes. It illustrates digitised data records, technology based reporting and seamless transfer of information between all stakeholders. It demonstrates officers making informed decisions and investigations with direct connections to relevant databases, with other officers, the station and dispatch office via mobile technologies. This is also resulting in greater accuracy and a safer work environment for officers. Work is now completed by officers on TPCs from remote locations which has enhanced ubiquity and innovation of police processes leading to a new culture and a professional image. These transformation of processes are best described with Overby’s (2008) theory of virtualisation which holds that due to advancements in the power and accessibility of information technology virtualisation of processes take place. A process (Overby, 2008) is a set of steps to achieve an objective, and applies to activities engaged in by organisations, individuals, and society in general. The transition from a physical process to a virtual process is referred to as process virtualisation.

The theory of task technology fit (Teo and Men, 2008) advocates that a fit between task requirements and technology functionality influence utilisation of technology and performance of users. This research findings suggest that mobile technology functionality, portability, user support, security, and network access relevant to police tasks in emergency, ad hoc, high or low risk contexts lead to improved performance outcomes of reduced costs, reduced paper work, reduced work load, officer effectiveness and improved information management. It also highlights that by combining these artefacts of task technology fit virtualisation of police processes is achieved. The theory of virtualisation (Overby, 2008) holds that information technology, in this case mobile technologies have a significant effect on virtualisation of processes with three important constructs of representation, reach and monitoring. Representation refers to mobile technology’s capacity to present information relevant to a process, their properties and characteristics and the interaction between actors and objects. Research findings discussed above indicate that information transmitted from dispatch office to patrol officers via mobile data terminals to attend emergency cases is now virtual with the ability to determine which officers would be attending, who would provide back up support and what the location of the incident is. For crime investigators and sex offenders and child abuse investigators, who is to act on the report next (detectives, legal teams, fingerprint and DNA experts, and others) is clearly represented with reports, fingerprints and other evidences. Reach refers to the technology’s capacity to allow process participation across time and space. This research clearly shows that with mobile technologies investigations and reports were compiled from remote locations and at different times of the day and night. The monitoring capability is the technology’s capacity to authenticate process participants and track activity. The investigation report, officer who compiled the report and who would be using the report is transparent and traceable as well as easily accessible on police databases. This research has extended the theory of task technology fit to include transformation of processes as an outcome of the fit between mobile technology characteristics and police tasks which take place in diverse contexts. It combines the theory of task technology fit with the theory of virtualisation to describe the transformation of police processes as an outcome of mobile technology applications to police tasks. However, our findings are from one state in Australia and outcomes are based on two mobile technologies with three specific groups. Further research to evaluate other mobile technologies used by other police organizations and validation of findings with a wider group is now warranted.

Conclusion

Police establishments are important government organizations that are resorting to mobile technologies to transform processes and enhance performance. Our research has established that mobile technologies enhanced the tasks of three specific groups of police officers. Although earlier research mentioned above addressed some aspects of mobile technology use with police in Europe, U.K. and USA, this study was a first to explore police
use of mobile technologies in Australia. It identified important issues in relation to the context of police tasks and technology, as well as extended the theory of task technology fit with the theory of virtualization to explain that mobile technology applications not only lead to improved effectiveness, it explicated how virtualization of processes take place. Findings discussed above clearly highlighted the importance of technological characteristics of interface and networks, and factors leading to successful adoption such as prior training and social influence to be important issues for mobile technology use in police operations as well. This research is one of the first to extend the theory of task technology fit with the theory of virtualization to illustrate transformation of processes in a unique government setting, the police department.

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