PAPERS

Virtual Team Concepts in Projects: A Case Study

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ABSTRACT

This article uses a case study to demonstrate the application of virtual team concepts in a virtual project team formed from existing personnel within an organization. The article is presented as a literature review followed by a case study of a virtual team project entitled the "Country Capital Works Program" undertaken within the New South Wales Police Force, Australia. The case confirms the appropriateness of existing virtual team concepts in a virtual project team formed from existing personnel for a specific purpose. The study has the inherent limitations of any case study in terms of the generalization of the findings.

KEYWORDS: project management; virtual project teams; leadership

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INTRODUCTION

The emergence of effective and relatively cheap information and communications technology (ICT), particularly web-based techniques, has led to the increased use of so-called "virtual teams." While almost all the challenges associated with traditional teams present for virtual teams, they also have additional challenges resulting from reduced face-to-face communication and lack of community among participants (Danton, 2006). Virtual teams can be assembled on a "need basis" to collaborate on projects (Andres, 2002; Jarvenpaa, Knoll, & Leidner, 1998), particularly utilizing the skills of the employees who are geographically dispersed.

In July 2001, a virtual team structure was formed within the New South Wales Police Force in Australia to undertake a project known as the Country Capital Works Program (CCWP). This was a 3-year project costing more than AUD $20.5 million. It was deployed in rural areas in the Australian state of New South Wales for the ongoing development and support of the New South Wales Police Force radio systems. A virtual team structure was formed to implement the project because the distances involved in rural New South Wales are vast, and this made it difficult for a colocated project team from police headquarters in metropolitan Sydney to implement the CCWP while maintaining effective liaison with, and involvement of, remote members of the project.

The author used the virtual team organization in implementing the CCWP project as a case study to demonstrate the virtual team concepts in projects. Virtual teams can work collaboratively and effectively in a project despite the additional challenges, if a skilled project manager leads the project in overcoming the problems associated with the lack of direct person-to-person contact and immediate managerial oversight. In particular, difficulties can arise if it has been necessary for an organization to form a virtual team from existing personnel who have had other responsibilities in their day-to-day work in the organization. The author acknowledges that an earlier version of the case study entitled "Managing Virtual Project Teams: How to Maximize Performance" (Kuruppuarachchi, 2006) was published in the *Handbook of Business Strategy.*

The remainder of the article is organized as follows. Following this introduction, the relevant literature is reviewed. In particular, the inherent problems that exist in virtual organizations or virtual teams are identified. The research question for the present study is then stated. A detailed case study of the CCWP project is then presented. This includes an analysis of the functions undertaken in each functional area of project management. The lessons learned from the case are then summarized. The article concludes with a brief discussion of the implications.

Literature Review

Projects and Project Management

A Guide to the Project Management Body of Knowledge (*PMBOK® Guide*) (Project Management Institute [PMI], 2004, p. 5) defines the term "project" as a "temporary endeavor undertaken to create a unique product, service, or result." The *PMBOK® Guide* (2004, p. 8) also defines "project management" as the "application of knowledge, skills, tools, and techniques to project activities to meet project requirements."

The *PMBOK® Guide* (PMI, 2004) further categorizes the knowledge required for project management into nine major areas: integration, scope, time, cost, quality, human resources, communication, risk, and procurement management. This schema is followed in the case study in this article.

The *PMBOK® Guide* (PMI, 2004) also observes that the use of virtual teams creates new possibilities for acquiring project team members. Finally, the *PMBOK® Guide* recognizes the significance of communication planning if a virtual team is to enjoy success; however, no details were provided.

Emergence of Virtual Teams

Virtual teams may exist across time, space, and cultural boundaries; these teams, while sharing a common purpose, use technologies to communicate and collaborate effectively (Johnson, Heimann, & O'Neill, 2001; Lipnack & Stamps, 2000). A virtual team can formally be defined as a group of geographically and/or organizationally dispersed coworkers assembled using a combination of information and communications technologies for accomplishing an organizational task (Malhotra, Majchrzak, & Rosen, 2007; Townsend, DeMarie, & Hendrickson, 1998).

It is the ability of advances in information and communications technologies (Jarvenpaa & Ives, 1994; Lipnack & Stamps, 2000), particularly web-based techniques (Danton, 2006), that facilitates the development of electronically integrated virtual organizations, offering organizations global reach and collaboration capabilities. It is not a methodically planned event (Bergiel, Bergiel, & Balsmeier, 2008). Moreover, relatively "flat" organizational structures are becoming increasingly common in an attempt to reduce costs, improve quality, compete globally, improve customer service, and accelerate the product-development cycle (Akkirman & Harris, 2005). This further supports the use of virtual organizations. However, flat organization structures disperse employees both geographically and organizationally (Townsend et al., 1998). Any team of a virtual organization is often a virtual team. Another aspect is that a combination of "business pull" and "technology push" is likely to promote the use of global virtual teams (Prasad & Akhilesh, 2002). The "business pull" is being produced by the expansion of global operations, as firms attempt to penetrate new markets, access scientific talent, and utilize the diverse human-resource capabilities of people from across the globe. The "technology push" is being produced by the advent of new electronic technologies in communications, ranging from simple e-mail to sophisticated groupware.

Drawbacks and Benefits of Virtual Teams

A number of potential drawbacks associated with virtual teams have been reported ("Nortel and BP Succeed," 2003). These include ineffective communication in the absence of nonverbal components of messages, lack of leisure time for team members because they tend to be overloaded with work, resistance to the unstructured nature of the team, loss of vision, security concerns in the online environment, lack of permanent records, too many members on some teams, and added pressure due to overemphasis on speed. Other reported obstacles that can hinder the performance of virtual teams are multiple time zones, different languages, and different approaches to conflict resolution (Bergiel et al., 2008). Regarding conflict resolution, group members have face-to-face opportunities to immediately and directly discuss conflicts and problems with each other (Andres, 2002), but virtual teams do not possess such opportunities. Furthermore, in virtual teams, lack of intimacy and the possibility of having site-specific cultures could lead to some conflicts (Hinds & Bailey, 2003).

Some of the downsides of virtual teams include the lack of knowledge and/or expertise among the employees about high-level applications related to virtual teaming, the possibility that the team structure may not fit the operational environment, and that some employees may be unfit for virtual teams psychologically (Bergiel et al., 2008). Virtual project team members rarely meet or sometimes never meet with each other or with the project manager (Das, Yaylacicegi, & Canel, 2008). This could also create a specific set of problems: people management is more difficult, there is an additional cost for supporting different locations, and all team members may not be operating on the same assumptions. Furthermore, quality management in virtual teams gives rise to a new set of challenges resulting from the practical problems of physically conducting the audit at various locations, and the difficulty of implementing a common set of standards in different cultural and linguistic environments (Das et al., 2008).

A summary of the drawbacks of virtual teams previously discussed is presented in Table 1.

However, a carefully designed and implemented virtual team can offer benefits. These benefits include improved productivity, reduced cost, increased competitive advantage, and improved customer service (Akkirman & Harris, 2005); and improved business process, flexible working hours for employees, elimination of time-consuming travel to a central office, support of cross-functional and cross-divisional interactions, potential for expanding labor force, flexibility in work scheduling,

Drawbacks
• Ineffective communication in the absence of face-to-face communication
• Loss of vision—members may not know the goals and objectives clearly
• Structure may not fit the organization or operational environment
• Resistance to unstructured nature of teams
• Additional cost for setting up remote offices
• Too many members are possible on a team
• Lack of permanent reports or reports are not available centrally
• Lack of visibility of the work of the team members, including their workload and progress
• Conflicts are often invisible and complex—they could even be site-specific
• Quality control is difficult
• Some members may not be psychologically fit for virtual teams
• Supervision and monitoring and performance management are difficult
• Require managing multiple time zones, different cultures, and languages
• Require developing skills of employees on special virtual teaming supporting applications
• Require developing skills of individual members to work in virtual teams

Table 1: Drawbacks of virtual teams.

speedy dissemination of information, and enhanced knowledge sharing within organizations (Johnson et al., 2001). Stevenson and McGrath (2004) presented evidence to confirm that major companies in the United States—Hewlett Packard, General Electric, IBM, and US West—have benefited through substantial productivity increases by using virtual teams.

Other benefits (Bergiel et al., 2008) are the possibility to recruit talented employees, stimulate creativity and originality among team members, create equal opportunity in the workplace, and discourage age and race discrimination. In particular, for software projects, advantages of virtual teams include the possibility of having a qualified labor force, speed in the product development cycle, having more flexibility in resource allocations, and taking advantage of the availability of a pool of expertise regardless of location (Das et al., 2008; Lipnack & Stamps, 2000). The *Human Resource Management International Digest* ("Nortel and BP Succeed," 2003) presented a similar set of benefits—phenomenal cost savings from not having face-to-face meetings, speedy dissemination of information, enhanced knowledge sharing within the agency, good customer relationships, flexibility on recruitment, talented workforce regardless of distance, and flexible scheduling.

A summary of the benefits of virtual teams discussed here is presented in Table 2.

Note that some of the benefits may have some negative effects, while some of the drawbacks may have some positive effects. For example, too many virtual team members may be a drawback for communication, but at the same time it could be a benefit to speed up product development. Similarly, diversity of the workforce facilitates creativity, while also having a negative effect on communication. Furthermore, this classification (advantages and disadvantages) is subjective. For example, "virtual teams can create equal opportunity in the workplace" is debatable, and "flexibility in work schedules" may be dependent upon the situation.

Teams in General

Design and support of teams are vital in leading any team (Hackman & Powell, 2004). According to Hackman and Powell (2004), three key considerations to decrease the adverse effects of teams are (1) the team has to be a clearly bounded group of people with a shared collective responsibility for the outcome, (2) the team leader has to establish basic norms of conduct and make these explicit, and (3) the reward systems of the organization have to recognize collective performance of the team. Other considerations are that team members need to have the required diversity of knowledge, skills, and experience; the team has to have the right mix of personalities or behavioral styles; and the team size is limited to less than 10. In a team, an individual who is not fit for the team could hinder the performance of the team. Furthermore, in contradiction to the normal belief, harmonious relationships are often not a facilitator of team performance.

Some literature on self-managed teams (SMTs) are also worth mentioning. Albert and Fetzer (2005) have considered team theories and summarized essential factors for team effectiveness:

- skills, accountability, and commitment;
- vision, creation of clear mission, development of goals, objectives, and action plans;
- roles and goals, feedback, structure, problem solving, and relationships; and
- team environment, team design, teaming process, and work process.

Teams in highly innovative and transformational environments often find difficulties (Albert & Fetzer, 2005) in managing feedback, establishing a good structure, solving problems, and managing relationships. Furthermore, SMT often leads to disappointment

Benefits
• Financial gains through improved productivity, reduced cost, reduced travel time, etc.
• Increased competitive advantages and improved customer satisfaction
• More flexibility on working hours for employees
• Improved business processes and cross-functional and cross-divisional interactions in the organizations
• Skilled, qualified, and talented workforce is possible regardless of the distance
• Availability of a pool of employees regardless of location, and possibility of easily expanding the workforce
• Enhanced information dissemination and knowledge sharing within the organization
• Stimulation of creativity and innovation most likely due to diversity of the workforce
• Creation of opportunities for employees in remote offices
• Flexibility in resource allocations and work scheduling
• Speed up product development and project management

Table 2: Benefits of virtual teams.

because the SMT concept was poorly implemented by managers who did not understand the process of shared meaning (Flory, 2005). That is, managers often implemented the SMT without having much-needed dialogue with the employees. These findings could also be applicable to virtual teams; particularly that poorly implemented virtual teams do not provide good results.

Virtual Teams Versus Colocated Teams

Many of the elements relevant to successful colocated teams, particularly high levels of trust, clear communication, strong leadership, and the appropriate level of technology, are also associated with successful virtual teams (Bergiel et al., 2008). Both types of teams, colocated and virtual, "require a clear, well-founded and convincing purpose"; however, virtual teams lack the communication that "appeals to the hearts and minds of potential team members" (Morris, 2008, p. 34), as explained next. Virtual teams are more dynamic than traditional teams, as their members are dispersed geographically in different locations with different functional roles.

In virtual teams, there is a lack of unplanned and informal social exchanges (Putnam, 2001). That is, team members "missed the office atmosphere and the opportunities presented by striking up a conversation in the cafeteria or hallway" (Oertig & Buergi, 2006, p. 25). Distant communication also prevents communication through body language (Stough, Eom, & Buckenmyer, 2000). In the absence of rich face-to-face communication, multiple means of communication should be used in virtual teams to facilitate information acquisition, sharing, and integration (Andres, 2002). Moreover, virtual teams rely on electronic communications technologies, and many conversations can be asynchronous, such as those that rely on e-mail; in contrast, only a minority of conversations are likely to be synchronous, such as those that use audio/video conferencing (Prasad & Akhilesh, 2002). Asynchronous communication in virtual teams can preclude informal expressions of appreciation for work that is well done (Lee-Kelley, Crossman, & Cannings, 2004). As DeLuca and Valacich (2006) explained, media with low synchronicity such as e-mail may be appropriate for conveyance of information in newly formed teams, while media with high synchronicity such as face-to-face meetings and telephone may be more desirable for convergence of shared meaning.

Furthermore, virtual teams are usually more diverse than traditional teams. Indeed, team membership can cross national boundaries and include people from a variety of cultural backgrounds (Johnson et al., 2001). This heterogeneous workgroup can hamper team integration and communication (Lau & Maurnighan, 1998; Oertig & Buergi, 2006). Thus, it is required to give careful attention to the pace of speech, slang, and different accents (Oertig & Buergi, 2006).

In addition, a lack of personal engagement in discussions limits the development of relationships among team members (Stough et al., 2000). In particular, if the team members are unknown to each other previously, there is unlikely to be trust among members because they do not feel at ease with each other ("Nortel and BP Succeed," 2003). However, trust is a prerequisite for virtual teams, because team members rely on the trust, judgment, and self-motivation of talented people working on a project, while their structures often contradict established command-and-control structures (Cascio, 2000; Shirley & Morton, 1998). Powell, Galvin, and Piccoli (2006) have explained this as virtual teams compared to colocated teams often showing strong relationships between work processes and trust, and between trust and effective commitment.

Human relationship breakdowns as well as lack of trust could lead to virtual team failures ("Nortel and BP Succeed," 2003; Pauleen, 2003). To avoid such failures, face-to-face meetings and video conferencing are essential components of virtual teams. In the absence of face-to-face interactions, managers should also create alternative strategies for developing mutual trust and reciprocal commitments in such areas as the supervision and coordination of project stages, the clarification of questions,

and the conduct of performance appraisals.

Lee-Kelley et al. (2004) used theories of social interaction to explain some of the relational issues created by the spatial and temporal separation characteristic of virtual teams. They grouped these issues into two categories:

- *"Hard" (visible) issues:* Operational structures, terms and conditions, processes, systems, and communication (methods, arrangements, and technology)
- *"Soft" (invisible) issues:* Trust and commitment, motivation, communication, role definition, and recognition

Piccoli, Powell, and Ives (2004) examined the effectiveness of virtual teams and advised to take considerable care in transforming colocated teams to virtual teams, because behavioral-related practices used in traditional teams—for example, motivation—cannot be used effectively in virtual teams, and could even be counterproductive. In virtual team dynamics, leadership is one of the most fundamental skills (Pauleen, 2003). According to Stevenson and McGrath (2004), managers are likely to incorporate intuitively the variables effective team leadership, commitment, and regular personal contact as very important for virtual teams, while they are likely to overlook the variables effective reporting procedures, solid work structures, team hierarchy, strict assessment processes, and greater likelihood of communication breakdown.

Barczak, McDonough, and Athanassiou (2006) presented factors essential for the formation of successful virtual teams as communication, trust, leadership, clear goals, and technology. Peters and Manz (2007) suggested that developed relationships, shared understanding, and trust are the important antecedents of virtual teams to collaborate effectively.

According to Peters and Manz (2007), the problems in virtual teams compared with traditional teams are mainly due to a lack of opportunities for team members to build relationships and trust, as well as to address issues caused by heterogeneous membership in terms of location and culture. Physical isolation and a lack of planned and unplanned face-to-face interactions among team members can thus have adverse effects. Members might have different habits and methods of working, few opportunities for informal information exchange, and so on. In addition, team members might have to deal with mistrust, unequal (or unknown) expectations, and different team dynamics. Furthermore, the suitability of conventional management styles and techniques in dealing with the issues encountered in virtual teams are questionable (Lee-Kelley et al., 2004). Considering the lack of face-to-face contact within teams, different skills are needed to interact in the global community and succeed in a virtual world. Part of the leadership functions such as monitoring team performance, implementation of solutions for problems, development of team members, and so forth are to be accomplished by leadership substitutes and/or distributing them to the team members themselves (Hunsaker & Hunsaker, 2008).

Based on literature (including the presented drawbacks and benefits), a summary comparison of virtual teams and colocated teams is presented in Table 3. The comparison is presented under the headings "communication" and "team structure and leadership."

Overcoming Inherent Problems

The initial effort required in designing, planning, and implementing virtual teams is enormous (Prasad & Akhilesh, 2002); the dimensions to be considered are team structure, strategic objectives, work characteristics, and situational constraints. It is also important to have a well-organized plan for success, particularly considering managerial support and establishing trust between managers and workers (Akkirman & Harris, 2005) are both dependent on effective communication. A variety of activities have been suggested to ameliorate difficult issues in virtual teams and to promote teamwork as follows.

Glacel (1998) stressed that a prerequisite for virtual teams is building a firm foundation; thus, face-to-face relationship building is essential. Oertig and Buergi (2006) presented the same conclusion: the first meeting should be a face-to-face meeting that facilitates team leaders to develop trust and respect at the onset of a project for successful interaction of team members. People will report problems early, prior to them becoming critical, when there is trust. It is also important to set clear roles for each team member by assigning formal individual responsibilities at the outset to avoid ambiguity and misunderstanding (Lee-Kelley et al., 2004).

The much-needed team cohesion for virtual teams can be encouraged if face-to-face meetings are held at three points in the life of a virtual team (Lee-Kelley et al., 2004):

- *At commencement:* When face-to-face contact can create social relationships, build mutual trust, establish reciprocal commitment, and establish a shared set of business goals and objectives
- *At an intermediate stage:* When workshops can influence relationships, resolve misunderstandings, and clarify task issues
- *At winding up:* When gatherings can finalize unresolved items, generate commitment to output, and celebrate success

According to Lee-Kelley et al. (2004), the key requirements are that regular face-to-face meetings should be scheduled (because there is evidence that virtual teams with such face-to-face contacts perform better than those with less contact, or those that are entirely virtual), that a structured formal approach be used in recognizing team members' efforts (to motivate them in the absence of immediate feedback from peers and supervisors), and that diversion of team members to

	Communication	Team Structures and Leadership
Colocated	• A rich form of communication face-to-face is always available • Regular personal interactions support building relationships and trust	• Well-developed traditional team leading concepts can be used • Monitoring of work of the team members is not difficult • Supervisor can motivate the members knowing their attitudes and requirements • Easy to implement effective reporting procedures • Easy to implement a common set of standards for various processes, including quality control
Virtual	• A heavy reliance on electronic forms of communication, often asynchronous media with several drawbacks • Lacks opportunities for building relationships and trust • Requires careful planning for team integration and communication • Requires clear and precise communication, as immediate feedback or clarification is difficult • Problems can go unnoticed	• Require skills to manage the diversity of the team membership, crossing national boundaries and different time zones • Require skills to supervise without having direct observation of team members' work and work progress • Self-motivation and self-judgment are often required from team members • Different reward systems may be required, as it is difficult to admire well-done work and motivate members • Establishment of standards for team processes, including quality control, is difficult • Different locations may have different habits (may be site-specific) and different methods of working • Different assessment systems may be required for work, work structures, and work processes

Table 3: Comparison of virtual and colocated teams.

other activities in the workplace be restricted (to reduce possible demotivating effects).

In the lack of face-to-face contacts in virtual teams, effectiveness of ongoing communication is very important. It is necessary to have a focus on simplicity and accuracy in communication to keep members informed of the work in progress (Townsend, DeMarie, & Hendrickson, 1996). Effective distance communication may include (Gould, 1997): having face-to-face time, if at all possible; giving team members a sense of how the overall project is going; establishing a code of conduct to avoid delays, maintaining team members' calendars; augmenting text-only communication; and developing trust. Efficient monitoring mechanisms are also important (Melymuka, 1998) to detect early signs of problems with the team or the schedules. The absence of contact or reduced contact between the manager and the team might create a situation whereby the manager does not know whether people are actually engaged in their allotted tasks.

It is also important for virtual team members to possess a number of qualities (Johnson et al., 2001): good self-starters having self-discipline, a sense of individual accountability, and flexibility within the virtual team. Furthermore, appropriate training for team members may assist virtual teams to improve group cohesiveness, perception of the team process, and satisfaction with the team's outcome (Beranek & Martz, 2005). Brake (2006) argued that two key challenges in leading virtual global teams are isolation and confusion; isolation can be beaten through building community, while confusion can be beaten by promoting clarity. Ten practical guidelines were presented: (1) be proactive (measures to be taken to meet the most likely challenges); (2) apply cultural intelligence (cultural differences could be either assets or potential liabilities); (3) build swift trust (connect first and then collaborate); (4) be a problem solver (problem solving should be pragmatic and not reactive); (5) stay person-centric (connect with feelings and not just with facts); (6) stay focused (everyone should understand the team's goals, objectives, strategies, and priorities the same way); (7) clarity of who and what (team members should know what is expected, by whom, and by when); (8) establish predictability (create common working grounds for key activities); (9) communicate context (provide all the contextual information

to develop a shared mental model); and (10) drive for precision (be specific with language and continuously probe for shared understandings).

Virtual team challenges may be complicated by organizational policies; organizational human resource policies, particularly concerning performance incentives, may negatively impact on a team leader's ability to manage a team (Pauleen, 2003). According to Johnson et al. (2001), the following factors lead to successful virtual teams:

- human resource policies that recognize, support, and reward virtual team members and leaders;
- an adaptable "flat" organizational structure, rather than a hierarchical, control-oriented organization;
- an organizational culture that values communication, learning, teamwork, and the need for diversity;
- people who possess good verbal, listening, and writing skills; and
- a technologically advanced organization and people trained in using technologies.

Hunsaker and Hunsaker (2008) provided detailed guides for project leaders who manage virtual projects, categorized into pre-project, project-initiation, midstream, and wrap-up. It seems that the suggested guidelines are not unique to virtual teams, but are also applicable to colocated teams:

- Pre-project: Establish and communicate project mission, priority and success criteria, select team members, define roles, and determine technology requirements.
- Project initiation: Establish and manage team boundaries, develop a shared mental model, create and maintain awareness, and manage communication processes.
- Midstream: Steps taken in initiation continue through managing team boundaries and establishing working conventions and norms.
- Wrap-up: Go over lessons learned and annotated successes.

Beal (2006) referred to the conclusion of the previously published article on the case study presented in this article and highlighted challenges for human resource teams for managing virtual projects. In that article, Kuruppuarachchi (2006) found the following:

> Virtual project teams are cost effective, but management of virtual teams requires skills over and above the management of co-located project teams . . . the organization should have high level project management expertise and systems prior to establishing virtual project teams. In addition, the most appropriate methods of managing virtual teams may not be fully complied within the existing policies and procedures of the organization. Teams should be empowered to own and commit to the purpose, and shape it if it is required. It may demand organizations to relinquish old style command and control base management and to provide freedom to teams. The team should work as a real virtual team rather than a dispersed fragmented team. (p. 78)

Referring to an international cross-cultural virtual team in a matrix organization, Oertig and Buergi (2006) outlined major challenges reported by project leaders. Factors identified as important for virtual teams are selecting creative leaders with a collaborative leadership style and excellent communication skills, top management support for continuing face-to-face communication and relationship building, and ongoing investment in language and intercultural communication training. Management of project tasks can be facilitated by defining team operating guidelines, setting up simple and workable processes, explaining the rationale when collecting information, having agreement for written communication, doing follow-up, and keeping everyone well informed of the status (Oertig & Buergi, 2006).

Based on the literature, activities for overcoming the possible problems of virtual teams are suggested in Table 4.

Case Study

Research Question

The research question addressed in the study can be expressed as follows:

- To maximize performance, what specific undertakings are required in virtual project teams, compared with traditional project teams?

This research question was addressed in this article by means of a case study of a 3-year police communications project in rural New South Wales (NSW), Australia, which was known as the Country Capital Works Program (CCWP). The CCWP commenced in July 2001 and cost more than AUD$20.5 million.

Background to Case Study

In rural NSW, five communications centers—Tamworth, Wagga Wagga, Newcastle, Wollongong, and Penrith—provide radio dispatch services to police in various cities, townships, and rural areas. Country radio communications systems in the rural NSW are linked to these five centers. A center manager controls each center with support from maintenance centers, which are known as "Radio Network Service" (RNS) units. Five of these RNS units are colocated with center managers; a further three RNS units are located remotely.

NSW has an area of 801,600 square kilometers. The distance from Sydney to the remote city of Broken Hill is approximately 1,200 kilometers. A virtual project team was formed to undertake the CCWP because the distance from Sydney to the country centers and the distances from country centers to remote radio sites made it difficult for a colocated project team in Sydney to carry out the project. The project management structure of the CCWP is shown in Figure 1.

Human Resources of Project Team

A project manager who was responsible for the day-to-day management of the project was assigned to the CCWP on a full-time basis. Under this person's management, the CCWP was undertaken as

Area	Suggested Undertakings
Communication	• Have face-to-face meetings at commencement, intermediate stages as required, and at close • Use multiple channels of rich media for precise and effective ongoing communication to avoid miscommunication • Provide feedback to members of the work progress, status of the project, and the overall team environment • Seek top management support to facilitate (to have additional) face-to-face meetings • Use face-to-face meetings for problem solving whenever possible
Team Structures and Leading Teams	• Establish team operational guidelines or code of conduct, particularly aiming to establish appropriate habitual routines, standard operating procedures, and regulation of team performance • Set clear roles and responsibilities for individuals (i.e., clear engaging direction along with specific goals) as opportunities to resolve ambiguities and misunderstandings are greatly reduced in virtual teams • At the onset of the project, develop individuals into a sound and well-integrated work unit through the development of trust and respect, and cooperative relationships • Use efficient structured formal approach to collect information in the absence of immediate feedback • Establish efficient mechanisms for dissemination of information and collecting feedback, as well as effective monitoring mechanisms to detect problems early • Maintain a snapshot of the members' availability and work progress • Carefully select members (if possible) who have qualities for self-management and motivation • Select skilled leaders with a collaborative leadership style and excellent communication • Establish a supportive work climate, examine the existing policies and procedures of the organization, and augment them if they are not supporting virtual teams • Provide the necessary training to team members on the use of technology and project management

Table 4: Overcoming problems in virtual teams.

a series of subprojects. The center managers and RNS units were responsible for the implementation of subprojects in their respective areas. In each RNS unit, five to seven members actively participated in the subprojects; all were full-time employees of the New South Wales Police (NSWP) who worked on the CCWP on a part-time basis. In addition, six members from Sydney (also on a part-time basis) were included in the project to provide technical and financial (accounting) support. In all, approximately 45 members took part in the CCWP. It was not possible for the project manager to choose who should be on the team.

Because all team members were full-time employees of the NSWP, they already knew each other when the project team was established. However, this acquaintance across the organization was mostly limited to the familiarity of names of members and where they were located rather than well-developed relationships. Members at each individual RNS unit worked together on a daily basis, having autonomy within their areas of responsibility—that is, RNS units did not work together. As such, even though within each RNS unit, the team members were colocated and had long-standing working relationships with each other, when crossing the RNS unit boundaries, relationships, and attitudes toward each other were more problematical. The development of trusting relationships between the project manager and individual RNS units was recognized as a key success factor for the project.

The project sponsor, who acted as the "corporate champion," chaired the steering committee that was responsible for providing overall project direction and approval of key milestones. As previously noted, the project manager was responsible for the day-to-day management of the project and the country teams were responsible for the delivery of assigned subprojects. The technical support teams reviewed specifications and requests for tenders/quotations, and were responsible for recommending selection of vendors. The financial support team administered other financial matters,

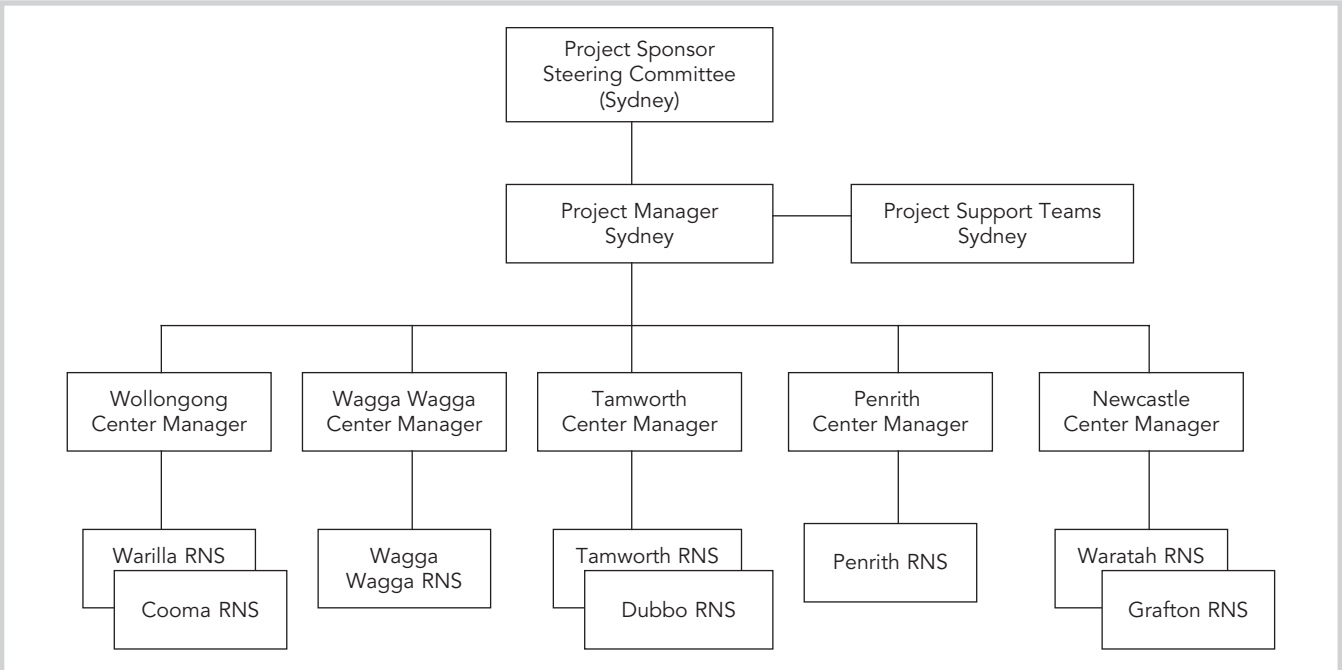

Figure 1: CCWP virtual team structure.

such as processing orders and payments.

Project Integration and Scope Management

The CCWP proceeded according to an approved business case, which described a set of identified subprojects for each area. In accordance with the business case, the "Project Execution Plan" (PEP) was developed to guide the planning, execution, and control of the project.

Each subproject was planned to run for a year, and the various subprojects ran concurrently. In general, the implementation of the subprojects was conducted independently in various RNS areas; however, certain subprojects were combined across RNS units to gain value for money and/or to execute certain subprojects efficiently.

At the beginning of the CCWP, a workshop for center managers was conducted to ensure a shared understanding of the overall project, and to inform center managers of individual and group responsibilities. At the commencement of each year of the CCWP, remote teams (headed by center managers) were empowered to refine the list of subprojects in consultation with users, with whom center managers had relatively closer contact than did central management. Consideration was then given to budgetary allocations and time constraints before the steering committee formally accepted the various subprojects. In formally accepting the subprojects, each was reviewed against corporate requirements in consultation with country teams.

Planning responsibility for subprojects, including the development of the work breakdown structure (WBS), was assigned to remote teams. An analysis of the WBS at the subproject level assisted team members in defining a cluster of activities for each subproject. To ensure that they were formulated in a consistent manner across all RNS units, guidelines and appropriate templates were provided to team members. Thereafter, the project was presented as a whole; this included (1) project integration activities, (2) refining subprojects, (3) combining appropriate subprojects, (4) defining milestones, and (5) predicting cash flow. Milestones and cash flow established the basis for project decisions and cost baselines (budgets) for measuring project performance. The progress of the project was continually monitored against targets using periodical e-mail reports and discussions with team members.

During the course of the CCWP, changes occurred in several areas—including technology, the government's radio strategy, and policing requirements. These changes caused a few key corrections to the scope of the overall project. However, in many instances, virtual team members failed to follow the agreed procedures to initiate changes in the scope of the allotted subprojects.

A benefits-management process was a formal part of the project. A "Benefit Management Plan" (BMP) provided a structured process whereby the project team could demonstrate the business benefits. As part of developing the BMP, a series of workshops was conducted, and business processes were documented. This process of benefit management was undertaken at country centers, where the benefits of the project were measured, recorded, and verified according to the BMP.

Before commencing BMP measurements, team members needed skills in gathering data (or deriving necessary data from existing information), validating data, and documenting data as baseline measures. They also needed to liaise with local business managers and other relevant stakeholders to determine the realized benefits. Local staff members were very useful in this process—an advantage of the use of virtual teams.

Time Management

All the constituent subprojects of the CCWP were carefully analyzed when planning project schedules and milestones. Schedules were specifically designed to facilitate concurrent subprojects and empower country teams. The overall project management plan was presented in the PEP.

The scheduling of projects and setting of milestones were both found to be difficult in the virtual team environment. This was complicated by the large number of subprojects (more than 230) and certain engineering constraints, which required some subprojects to be completed within certain critical time periods. In responding to the latter problem, it was decided that time-critical activities could be initiated: (1) before the completion of formal reviews of preceding activities, and/or (2) without waiting for design approvals, and/or (3) without waiting for full details.

Although the overall CCWP was a 3-year project, certain subprojects were to be initiated and completed during each year. In the initial months of each year of the project, project milestones were used to monitor the commencements of critical activities, and toward the end of each year the milestones were used to monitor the completion of work. Some activities also had intermediate monitoring points at which their progress was reviewed. In addition, all subprojects that had encountered problems were monitored continuously to detect and resolve difficulties promptly.

The project schedules and milestones presented at the project level guided the RNS units in their scheduling of subproject activities, and also synchronized project activities across RNS units. However, country teams took ownership of the work and planned and implemented their subprojects with minimal control. This involvement of country teams accelerated the granting of required planning approvals with regard to certain site development activities because members of the country teams had good relationships with local government agencies in their areas.

Cost Management

As explained previously, the implementation of the subprojects was conducted independently in various RNS areas; however, certain subprojects were combined across RNS units to gain value for money and/or to execute certain subprojects efficiently. Furthermore, budgetary allocations and time constraints were considered before the steering committee formally accepted the various subprojects. Milestones and cash flow established the basis for project decisions and cost baselines for measuring project performance.

The budget of the CCWP was controlled centrally, and this was found to be an extremely efficient and useful control mechanism. The budget was monitored against time using simple means such as Excel worksheets and graphs showing cumulative values. Rather than using special project management tools, it was decided to use Excel worksheets, because all team members were familiar with information being provided in this format.

Quality Management

Quality-control initiatives for the CCWP were included in the PEP by identifying applicable quality standards and the means of satisfying them. It was consciously decided not to employ centralized resources for quality review and/or inspections at subproject levels, because it was difficult for quality reviewers to visit diverse locations throughout rural NSW.

The quality-assurance activities that were found to be efficient in the project were as follows:

- provision of necessary skills to country teams through appropriate training programs;
- review of specifications, request for tender/quotations, and evaluation methodologies developed by country teams before their release;
- inclusion of product quality and relevant national and international standards and accepted safety practices in the PEP as references; and
- giving high priority to quality-management experience of suppliers when selecting contractors.

As it was difficult for quality reviewers to visit diverse locations throughout rural NSW, the remote team members were trusted to deliver quality products without inspecting the intermediary and final products by a nominated central team. As such, it was found that the quality assurance and quality control at the product level was more difficult in virtual project teams.

Human Resource Management

The virtual team structure is presented in Figure 1. As a mature organization, the NSWP has a well-developed human resource management framework (systems, structures, and guidelines), including policies and procedures. Virtual team concepts were used within the project structure, particularly for project communication as described in the "Communication Management" section, however without contradicting the organizational human resource management framework. The center managers, as line managers, managed the team members.

Communication Management

The NSWP already had systems, structures, and guidelines in place to handle routine information and the communication needs of the CCWP, and all members had access to individual e-mail

and telephone facilities, and shared information repositories. Although the team members of the CCWP knew each other (by name and location) at the beginning of the project in their capacities as full-time employees of the NSWP, this did not necessarily mean that they had good working relationships. In general, team members interacted electronically; however, they had occasional face-to-face interactions when attending meetings and training programs.

At the beginning of the project, formal procedures were developed for gathering information from country teams. This was conducted on a needs basis with the aim of ensuring that required information was available for project monitoring and control, as well as for the provision of information to stakeholders. These formal procedures were revised several times as the project proceeded. The progress of the project was reported monthly; however, it was necessary to collect information more frequently to ensure that a snapshot of the project was always available. Formal reporting of the project took place in two broad forms: (1) project-specific reporting within the project team (for information sharing and to assist in project execution) and (2) project status reporting (for provision of selected information to various stakeholders). For the latter, the existing systems and structures of the NSWP were used to provide formal reports through the project manager. Within the project team, informal communication was encouraged on the basis that project implementation in a virtual team environment is dependent on trust, cooperation, and teamwork.

There were formal reviews of the project by the steering committee at the beginning, midpoint, and end of each year of the project. These reviews were carried out in face-to-face meetings with country members. In some cases, the country teams visited Sydney; in other cases, personnel from Sydney visited country centers. In addition, video-conferencing facilities were used as required—for example, in resolving critical issues and/or formalizing procedures.

The monitoring and reporting mechanisms of the project supported trusting relationships. These mechanisms included the following:

- Project activities, major milestones, and other relevant information were reviewed and agreed to at the beginning of the project.
- Mechanisms, formats, and frequency of reporting for monitoring of timelines and budgets were agreed.
- Team members were consulted as required for progress reviews, and team members were provided with feedback when summary reports were presented to stakeholders.

Three major problems were experienced that might be considered common to all virtual teams:

- At the beginning of the project, a considerable effort was required for full engagement of team members in accepting the project management framework and its monitoring and controlling mechanisms.
- To initiate appropriate corrective action, an efficient project-monitoring mechanism was required to identify issues, problems, risks, scope creep, and so on.
- As some team members might not appreciate the importance of documentation, more attention was required in maintaining comprehensive project documentation at the central office.

In addition, certain other problems were experienced that might be attributed to limitations of virtual teams, skill limitations, or the culture of the particular organization involved:

- The project manager needed support from the sponsor to implement some procedures and to resolve a number of problems.
- Some team members were deficient with respect to experience in project management.
- Resource limitations were experienced in critical times because team members were also responsible for other activities.
- Decisions made at remote centers (and the results generated) were not structurally captured and documented centrally in certain situations.
- Resolution of certain problems did not follow the documented path (for example, project manager to steering committee to project sponsor).

Risk Management

At the time of defining subprojects, guidelines were provided to country team members to assist them in risk identification, risk quantification, and response development for each subproject. Thereafter, based on the information provided by country teams, an overall risk management plan was developed for the project.

Preplanned risk responses worked effectively in the project; for example:

- The project was planned as a series of locally managed subprojects, with only weak links existing among the majority of subprojects; this allowed unsatisfactory subprojects to be terminated in isolation if necessary.
- Certain activities (such as site-development works, installation of towers, construction of huts, and so on) were not combined across subprojects; this minimized the formation of links among subprojects, even though it was possible to gain some value for money.

Similarly to quality assurance and quality control at the product level, responding to changes in risk over the course of the project and updating the risk management plans was found to be difficult. There was often a time gap between an event happening and the project manager noticing if there was an associated risk. This happened because the remote team members were either unable to identify risky events promptly or did not consider

that it should be reported to the project manager.

Procurement Management

Procurement activities of the CCWP were planned carefully to satisfy two key objectives: (1) to gain value for money and (2) to adhere to NSW government purchasing guidelines and policies.

Procurement guidelines were included in the PEP to provide guidance to country teams in all procurement undertakings—from decisions on what to procure through to the completion and settlement of contracts. In addition, the project manager was readily available to provide advice to team members whenever it was required.

An analysis of work structures at the subproject level assisted team members in defining a cluster of activities for each subproject. Thereafter, they identified the project-delivery methods and documented each procurement requirement—such as obtaining off-the-shelf equipment, leasing arrangements with service providers, use of contractors, and use of in-house resources. These activities were included in the initial scope definition of each subproject.

The proposed procurement activities of each subproject, as provided by country teams, were reviewed at the central office. Thereafter, an integrated procurement plan was prepared to cover procurement activities across RNS units, including the monitoring of progress milestones. Certain procurement activities were combined to gain value for money; others were not combined as part of a risk-reduction strategy of minimizing linkages among subprojects. Thereafter, country teams were allowed to initiate purchase requisitions, and these requisitions were reviewed at the central office as part of the approval process. High-level centralized control on procurement assisted budgetary control and cash-flow management of the project.

In addition, agreements with suppliers helped to procure equipment as needed for subprojects without compromising quantity discounts. This enabled delivery of equipment in several consignments, which assisted in satisfying procurement requirements on a needs basis for subprojects.

Review of Project Closure

Following completion of the second year of the project, a structured study was undertaken as part of the development of project closure report. This study included an appraisal of the views of participants in the project. Center managers, RNS staff, members of the steering committee, and supporting staff all participated in the development of the project closure report. A particular focus was to propose improvements to project management practices that had been deployed in the project.

The process was guided. In providing the information, participants were to consider the learning requirements: what went right and why, what went wrong and why, what could be done better with hindsight, and any ideas that might help on another project. A table was provided, and participants were asked to fill it in by providing information under nine major knowledge areas of project management and four learning requirements. The lessons learned from the case are presented in the following section.

In addition, the internal Audit Group of the NSWP conducted an audit review on the second year of the project. The audit report made specific findings related to some aspects of project planning, implementation, execution, and finance.

Lessons Learned From the Case

Critical factors in maximizing the performance of virtual project teams were derived by combining information from three sources: the project closure report, the audit report from NSWP, and the experience of the project manager. These factors have been published in a previous paper (Kuruppuarachchi, 2006). The factors can be categorized into three major areas:

- establishment of supportive systems for virtual teams;
- carefully planned launch of virtual projects; and
- efficient ongoing monitoring and controlling.

The first of these, *supportive systems for virtual teams,* can be provided by taking initiatives to improve the day-to-day activities of the organization. Possible initiatives include the following:

- adherence to well-proven project-management practices;
- enhancement of project management skills of staff members (without limiting their skills for day-to-day operational activities);
- engagement of engineering teams (if available) to develop standards and/or specifications for technical products for forthcoming projects without waiting for project initiation;
- capture and storage of current information on user needs and available technologies on a continuous basis;
- developing relationships among members of the organization and with relevant external agencies (government, power utilities, and carriers);
- minimization of delays in certain project activities—for example, utilization of memoranda of understanding, agreements with land owners, and so on;
- establishment of knowledge management systems—especially with respect to abstract information and valuable documentary information from experienced people (such as technical problems of products, local conditions, and so on); and
- establishment of planning groups to plan for forthcoming projects—including groups to take action on time-critical project activities, even before initiating a project (considering lengthy procedures and associated long delays).

The second factor, a *carefully planned launch,* is vital for the success of any project. The following elements need attention in virtual teams:

- identification at the central project office of resource requirements for managing the project—including detailed planning, handling procurement, budget control, and documentation;
- establishment of methodology and mechanisms for project control, risk management, and quality control;
- agreement on the working responsibilities of the project office and the virtual team, and agreement on procedures for work coordination;
- holding of workshops to facilitate the establishment of trust and achievement of a common understanding regarding work responsibilities at the beginning of a project;
- recognition of formal and informal communication needs, and agreement on formal communication mechanisms for status reporting, monitoring, and controlling; and
- establishment of procedures for undertaking project activities (such as capturing user requirements, undertaking procurements, and so on).

The third factor, *ongoing management including monitoring and controlling of virtual teams,* is more difficult with virtual teams than with traditional colocated teams. Attention should be given to the following elements:

- listening actively to virtual team members and being sensitive to their feelings in the absence of face-to-face communication;
- using telephone, e-mail, video conferencing, and so on (as appropriate for a given situation);
- adherence to a code of conduct—especially with respect to requests for information, checking e-mail frequently, time limits, project scope, and work responsibilities;
- establishment of procedures to capture useful information from informal communication and to document decision-making activities and results of decisions;
- having a snapshot of availability of team members (including absences, vacations, travel, or leave);
- recognition of differences in teams and individuals, respect for diversity, facilitation of relationships, fostering of motivation among team members, and so on;
- holding of regular meetings at two levels—(1) at the project level (convened by the project manager), and (2) at the subproject level (convened by remote team leaders);
- maintenance of trust and relationships;
- careful monitoring (including cross checks) of accuracy of information;
- updating of schedules and provision of feedback to team members using e-mail, organization's intranet, and so on;
- recognition of any mismatch between corporate culture and team culture (and perhaps between policies and procedures); and
- maintenance of documentation in a "lean" framework (but with cross-reference to detailed information satisfying corporate requirements).

Conclusion

Virtual teams offer cost savings, flexibility and many other benefits, but they also create various challenges, particularly associated with communication and leadership. Lack of project visibility, failure to see emotional aspects of members, difficulty in contacts, technology constraints, and so forth are all associated with communication. Problems resulting from miscommunication should be avoided through precise and effective communication; this can be facilitated by more complex and interactive communications technologies that are growing in popularity. It is also apparent that the management of virtual teams requires skills that differ from those required for the management of colocated project teams. That is, it is a challenge for leaders who are more comfortable and familiar with traditional face-to-face interactions to manage virtual team projects. In the virtual environment, it is difficult to monitor performance of team members and implement solutions, as well as develop team members through mentoring and coaching. Furthermore, team members are remote from other team members and colocated supervisors. In this environment, trust, shared understanding, and depth of relationships among team members serve as important antecedents for virtual collaboration (Peters & Manz, 2007, p. 124).

The findings of the present study are generally in accordance with the academic literature on the subject. The study also shows that virtual teams for projects can be established using the existing personnel of an organization, even though project-specific activities often require skills that differ from those required of personnel in undertaking their ordinary day-to-day activities. However, the leadership of such teams requires high-level communication and coordination skills if the work of team members is to be harmonized effectively. Furthermore, well-planned monitoring mechanisms are required to detect and resolve emerging problems that are not immediately apparent as a result of the lack of direct managerial oversight of work undertaken in remote areas. It is also apparent that quality management and risk management are more difficult in the virtual environment.

The establishment of effective virtual teams is facilitated if employees have well-developed self-discipline and a clear understanding of project management concepts from their other day-to-day work experiences—for example, they are well trained in quality reviews and risk management. However, it is problematic to apply existing centralized systems for quality management, risk management, and performance appraisal to virtual project teams in the same organization. These matters require further research.

Even though the case is not fully virtual (for example, the team did not exist

across different time zones or use different languages), the present case study confirms the applicability of virtual team concepts in projects. As Hunsaker and Hunsaker (2008) note, "While there may be pitfalls that virtual teams have relative to colocated teams, these drawbacks can be addressed by developing effective virtual team leadership" (p. 99).

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