Anticipation in context: Factors that support or hinder anticipation in Incident Management Teams

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Abstract

Large fires are suppressed through the deployment of extensive resources coordinated by Incident Management Teams (IMTs). A key element for success is the ability to identify the likely ways that an incident may unfold, and plan corresponding responses. The Australasian Inter-agency Incident Management System (AIIMS) provides a framework for managing large bushfires and other emergencies such as floods and pandemics. AIIMS notionally supports anticipation via its Planning function and the processes of incident prediction and option analyses whereby the safety and effectiveness of alternative responses is assessed. To be effective, IMT personnel must not only monitor *how* an incident is unfolding, but also engage in active *sensemaking* to develop a coherent forward-view of necessary strategic responses. In this paper we analyse the role of the AIIMS framework in supporting or hindering anticipatory thinking. We examine team member behaviours, and in particular consider the role that team member familiarity may play in IMT functioning. We propose that three familiarity-related variables - transactive memory, trust, and cohesion - are important enablers of anticipatory thinking. Finally, we draw on Klein, Snowden and Pin's (2007) research to outline potential interventions that may facilitate anticipatory thinking in IMTs, including training, and processes to improve team coordination.

Introduction

Anticipatory thinking has been described as "a critical macrocognitive function of individuals and teams … the ability to prepare in time for problems and opportunities" (p. 1; Klein et al., 2007). Clearly, anticipatory thinking is important for most organisations, and in the case of emergency service agencies it is essential.

Emergency service agencies have developed a number of systems and procedures to support rapid and effective responses to incidents. In the case of large scale natural, industrial or civil incidents, emergency service agencies deploy Incident Management Teams (IMTs) to coordinate the response. The IMTs use a standard system known as AIIMS, the Australasian Inter-agency Incident Management System to manage these events (AFAC, 2005). The AIIMS protocol outlines a standard structure for Incident Management Teams including member roles, responsibilities, and operational procedures.

In the case of bushfires, rather than managing the fire, the IMTs main role is in managing the firefight. On-scene divisional and sector commanders are primarily responsible for tactical firefighting decisions. The IMT's role is to coordinate the planning and the logistical resources required to contain and ultimately resolve the incident. In common with the management of many organisations, there is the inevitable tension between responding to the current situation, and developing the plans and strategy required to resolve the longer-term incident.

The AIIMS framework

The AIIMS framework embraces three principles that assist IMTs to focus on the management of the incident (AFAC, 2005). First, IMTs involve functional management, enabling particular individuals or sub-teams within the IMT to focus on specific tasks. The standard IMT structure involves an Incident Controller overseeing three functional sub-teams of Planning, Operations, and Logistics (see Figure 1). For a smaller incident the team may consist of only a few members. For larger incidents an IMT can be scaled up to a more extensive team with numerous specialist roles. In a later section, the lead role that the Planning section plays in anticipatory thinking is elaborated upon.
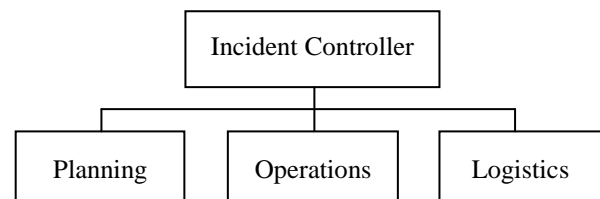
Figure 1. Incident Management Team (AFAC, 2005).

The scalability of IMTs is related to the second AIIMS principle of span of control. As an incident, and the corresponding IMT, becomes larger, position-holders are expected to delegate so that they do not manage more than five reporting groups or individuals. Similarly, as an incident de-escalates, responsibilities for IMT personnel are adjusted accordingly. A brief outline of the key IMT roles follows (AFAC, 2005).

The Incident Controller has overall responsibility for the management of the incident. The Incident Controller establishes incident objectives, and ensures that effective strategy is put in place to manage the incident in a safe, effective, and efficient manner.

The Operations Section is responsible for the control of all operations that are focused directly on resolving the incident. The Operations Section ensures that the strategies implemented to resolve the incident are in accordance with the Incident Action Plan (IAP). The IAP sets out the objectives for managing the incident and describes strategies and resources relevant for the control of an incident.

The Planning Section provides support for the management of the incident with specific responsibility for: collection, evaluation and dissemination of incident information; prediction of incident behaviour; preparation and dissemination of plans and strategies for the control of the incident; and the collection and maintenance of information as to the resources that are allocated to the incident. A key output from these activities is the formulation and updating of an IAP.

The Logistics Section's primary function is to support the incident through the provision of human and physical resources, facilities, services, and materials. The IAP assists the Logistics Section in estimating the requirements for the next operational period.

The third AIIMS principle employed in IMTs is management by objectives. The Incident Controller in consultation with the IMT sets the desired objectives for the incident. These objectives become the guiding principles for resolving the incident and form part of the incident action plan. Only one set of objectives and one incident action plan is in place at any time.

Anticipatory thinking

Effective anticipatory thinking involves three important elements (Klein et al., 2007). First, it entails looking ahead to identify the likely trajectory that an incident may follow. Secondly, it requires active attention management by the individuals and teams involved. When attempting to understand and predict the likely development of an evolving problem or opportunity, the often complex and uncertain nature of the situation means that decision makers need to be selective as to the information they consider and use. Effective anticipatory thinking involves identifying and attending to the most likely sources of critical information. The third feature of anticipatory thinking is its functional nature. Individuals and teams are not just predicting the likely future, but they are also preparing for these events.

Klein et al. (2007) propose that there are three common forms of anticipatory thinking: pattern matching; trajectory tracking; and convergent. Pattern matching involves matching the key characteristics of the current event with previously experienced incidents. In essence this is a form of recognition-primed decision making and suggests that the more expert an individual is, the greater the likelihood that they will be able to quickly match the situation to a previous event that they were involved in. An example of pattern matching for IMTs in south-eastern Australia is where strong nor-west wind conditions are forecast to be followed by a south-westerly change. This pattern of weather is recognised as classic conditions conducive for large and difficult bushfires.

Trajectory tracking involves noticing and extrapolating trends so that an individual or team can "get ahead of the curve" (p. 2; Klein et al., 2007). In other words, preparing for how the situation is likely to develop and taking account of the time it may take for an individual or organisation to respond. An example of trajectory tracking for IMTs is the 'warm start'. On days of extreme fire risk some IMTs may start operating prior to the outbreak of any incidents, enabling a more rapid response to any bushfires that may occur.

Convergent anticipatory thinking occurs where the connections between events and consequent implications are identified. This enables an individual or team to understand the significance of the different events and to recognise interdependencies among these. In some instances, convergent anticipatory thinking may be identified by inconsistencies in events. For example, effective convergent anticipatory thinking during the 2003 Californian bushfires (Cedar Fire) would have recognised that fire suppression activities were ultimately dependent on continuity of the supply of electrical power to pump reticulated water. Unfortunately this contingency was not recognised until too late and municipal reservoirs emptied because the pumps providing supply ceased working.

Anticipatory thinking in an IMT: the planning section

The planning section is primarily responsible for anticipating how an incident may develop and putting

in place an overall strategy to successfully contain, resolve, and mitigate its effects. The planning section follows standard procedures to prepare the Incident Action Plan for an incident. In simple terms this involves:

• developing an understanding of the current situation;
• predicting the likely trajectory of the incident;
• evaluating the possible options for the management of the incident; and
• formulating objectives and strategies.

Determining the current situation often provides considerable challenges for IMTs. Information relevant to the incident is usually held by people in a variety of roles and needs to be elicited from a number of sources (e.g. fireground personnel, communication logs, maps). Usually no single individual has a complete overview of the situation. This requires the planning section to integrate the various and possibly contradictory accounts of events in order to form a coherent understanding of the incident. In essence planning sections are required to undertake *sensemaking*, to understand the relationships between key elements of an unfolding bushfire so that they can then anticipate the likely trajectory for the incident. Sensemaking is the process that teams use to develop a strategic understanding of the incident, whereas, situation awareness, is the knowledge state that is achieved (Klein, Moon, & Hoffman, 2006).

An understanding of the current situation is important in anticipating the development of an incident. Planning Section personnel use AIIMS-based processes to anticipate the extent of the fire over several different time horizons (e.g. 6, 12, and 24 hours). However, anticipating the likely development of a fire is no easy task. Bushfires are dynamic and vary with topography and land use, whilst weather conditions influence both the fire behaviour and the assets that may be at risk.

Similar to incident prediction, option analysis is supported with standard processes. IMT planning personnel are encouraged to consider at least three different approaches (options) to respond to a bushfire, considering the issues associated with each option, the wider impact of the approach, and each option's probability of success. The analysis of these options leads to the selection of the objectives and strategies the IMT use in their management of the incident and documented in the IAP. Incident Action Plans are developed for a defined period of time, usually the following 12 hour shift.

Factors that may hinder anticipatory thinking in IMTs

An important advantage of AIIMS is that it provides a standard system for managing a wide range of incidents. Since its inception thousands of incidents have been successfully managed using this framework. In simple terms AIIMS functionalises anticipatory thinking by identifying the IMT personnel responsible for this activity, providing standard processes to predict the incident's development, and devising appropriate responses for the anticipated events. AIIMS processes generally support anticipatory thinking; however, occasionally IMT personnel can also be captured by these processes and fail to critically examine information or adequately link anticipated events with their planning. AIIMS recognises that intra-team familiarity is desirable in IMTs, although may not always be possible. We suggest that greater intra-team familiarity of an IMT may assist anticipatory behaviours.

Some limitations of AIIMS

A potential risk associated with the structured option analysis prescribed in AIIMS is that IMT personnel may become formulaic in their approach and end up just 'going through the motions'. That lack of deep thinking about an incident may result in the IMT failing to identify possible worst case scenarios for an incident (c.f. Johnson, Cumming, & Omodei, 2007). The AIIMS convention of considering specific timeframes can also blind the IMT to possible consequences that might be several days away. For example, the IMTs controlling the various bushfires leading to the 2003 Canberra fires may have failed to identify the longer term risk to the city posed by the fire if suppression endeavors remained un-coordinated, or if the various fires combined into a large blaze (as, in fact, happened).

An IMT needs to ensure that their planning takes full account of what resources are actually available, or will be available given the forecast conditions. Although the Planning section of an IMT generally consults with the Operations and Logistics sections, failure to do so, especially regarding resourcing, can be problematic. For example, if the weather forecast predicts strong winds, then aircraft scheduled to assist in firefighting are likely to be grounded. Effective anticipatory thinking occurs when plans are in place for this contingency.

Familiarity and team member behaviour

So far the discussion has focused on the role that the AIIMS structure plays in supporting effective anticipatory thinking. In this section we consider the role that familiarity of IMT personnel may play. For the purposes of this paper, familiarity is defined as the knowledge of one another gained through having worked together previously.

Klein et al. (2007) observed that anticipatory thinking requires teams to be able to coordinate their response to

a situation. Effective teams need to have some degree of interpredictability, enabling members to take account of each other's expertise (or limitations) and to predict their colleagues' likely reactions to events. The dynamic nature of the incidents IMTs manage suggests that effective communication both within the team and with the wider world is important in supporting anticipatory processes.

An important influence on the ability of a team to coordinate their activity is familiarity (Reagans, Argote, & Brooks, 2005). Additional support for the role of familiarity in helping coordinate team performance comes from Weick and Roberts (1993) who propose that familiarity is important in enabling *heedful interrelating*, significant in explaining the almost faultless performance of an aircraft carrier flight deck. Team members interrelate heedfully when they consider the big picture and their contribution to the collective goals in a careful, critical, and purposeful manner. It takes time to develop the shared understanding, openness and disclosure require to heedfully interrelate, and as Weick and Roberts point out, these are indicators of a mature and well developed team.

We propose that the familiarity-related variables of transactive memory, trust and cohesion offer explanatory mechanisms through which improved team coordination may develop. Transactive memory (i.e. knowing who knows what in a team) provides a mechanism to coordinate knowledge in a team, enabling members to quickly locate the expertise required for a particular task (Moreland, 1999). Transactive memory aids coordination by helping ensure that the most appropriate team member is tasked for a job and helps avoid the assignment of personnel to roles where their limitations may handicap the team.

A second way that familiarity may influence team coordination is through trust. Shared experience can lead to trust, an important factor influencing the sharing of information within a team (McEvily, Perrone, & Zaheer, 2003). Liang, Moreland and Argote (1995) found that teams who have trained together were more likely to trust one another's expertise. In considering the role of trust in team functioning it is important to take account of the appropriate level of trust required for a given situation - more trust isn't necessarily better (McEvily et al., 2003). An important judgment that IMT members need to make is who, when and where do they trust the recommendations of colleagues and personnel outside the team and when do they ask for more information from them? Trust has been found to be critical in a range of emergency situations, especially where time is critical and the response requires good coordination (Omodei, Wearing, & McLennan, 2000).

The third familiarity-related variable is cohesion, the sense of "we-ness" that develops within a team

(Wheelan, 2004). Task cohesion, which taps into the shared commitment to the tasks and activities of a team, is associated with a variety of coordination behaviours. Carless and De Paola's (2000) research on naturally occurring teams found that task cohesion was related to team member communication, cooperation, workload sharing, and participation. The importance of task cohesion is further underlined by Zaccaro, Gaultieri and Minionis's (1995) research on team decision making under temporal urgency. Teams low in task cohesion tended to show a lack of persistence in undertaking the task whilst teams high in task cohesion were not only more persistent, but also demonstrated superior pre-planning and intra-team communication.

A potential threat to anticipatory thinking is groupthink, where the expectation of unanimity can limit the discussion of alternative approaches (Janis, 1992). However, the more likely form of cohesion to be associated with groupthink is social cohesion (i.e. interpersonal attraction) which is less likely to occur in task-oriented teams such as IMTs (Mullen, Anthony, Salas, & Driskell, 1994).

The implication for IMTs composed of unfamiliar personnel is that lower levels of transactive memory, trust, and cohesion may in some circumstances hinder their ability to coordinate their activities and exercise the openness and disclosure required for heedful interrelating.

Improving anticipatory thinking in IMTs

A number of factors may undermine anticipatory thinking at the individual, team, and organisational level (Klein et al., 2007). In this section we discuss two potential interventions that may potentially reduce organisational barriers and improve team coordination.

Pre-season and inter-agency training

Although AIIMS supports interoperability, it does not address the social and cultural aspects important in helping coordinate an IMT's performance. Typically, several agencies work together in an IMT and each organisation has its own distinct culture and values. The IMTs managing bushfires usually consist of fire and land management agency personnel and although united in their aim of containing the fire, each has differing additional objectives (e.g. property vs. ecosystem protection). The regular exercise of incident management personnel in inter-agency training can improve staff understanding of how their own agency's approach to incident management may differ from other agencies and assist in developing greater interpredictability.

Linked to the successful cooperation of personnel from different agencies is the importance of team coordination, and in particular the role of intra-team

familiarity. The research outlined on the familiarity-related variables of transactive memory, trust, and cohesion suggests that there may be benefit from providing IMT personnel the opportunity to exercise and train together prior to deployment into active duty. Effective training and exercises are likely to include elements that specifically target the building of team transactive memory, trust, and task cohesion.

Introductory processes for personnel

For a number of operational reasons fire agencies deploy IMTs whose personnel are unfamiliar with each other. A challenge for these personnel is determining the respective expertise and skills of their colleagues and the level of trust they should place in them. Experienced Incident Controllers describe various shortcuts they use to size-up their team so that they can appropriately allocate specific tasks and responsibilities. An additional mechanism that may speed the size-up of an IMT would be the use of short specifically designed résumés. These résumés would emphasize information relevant for assessing key experience and skills, enabling Incident Controllers and section leaders to quickly familiarise themselves with the capabilities of their colleagues. This idea builds on Klein et al.'s (2007) observation that weak mental models can inhibit anticipatory thinking. In essence, transactive memory is a team mental model of expertise and the use of short résumés may hasten its development.

Conclusion

The AIIMS framework provides an important script to help coordinate IMTs and support anticipatory thinking, especially where personnel may be unfamiliar with one another. Personnel who understand the strengths and limitations of AIIMS are likely to be best placed to use this framework appropriately. Although AIIMS is an important part of an IMT's toolbox, a number of other factors also influence their anticipatory thinking. Training and introductory interventions that enhance team member familiarity and thereby team transactive memory, trust, and cohesion, are likely to be particularly important in enabling IMTs to engage in effective anticipatory thinking.

Acknowledgments

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