LEARNING THROUGH NETWORKS WITHIN EMERGENCY MANAGEMENT RESPONSE
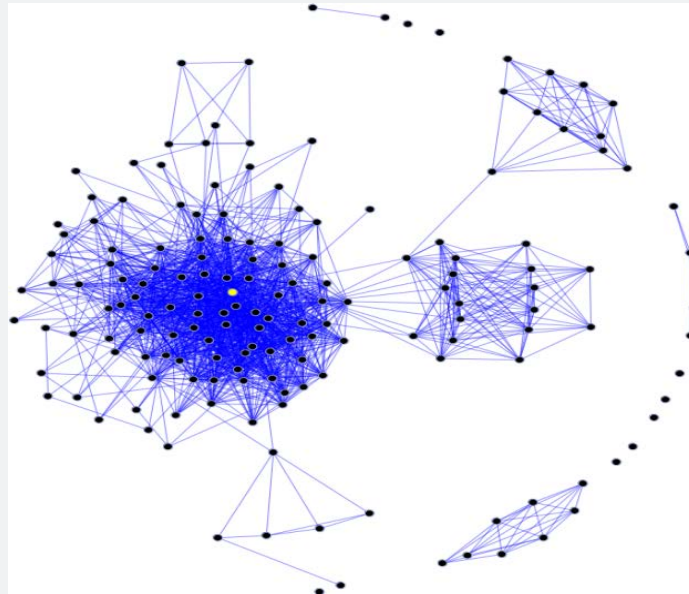
Jafar Hamra

Centre for Complex Systems Research, Faculty of Engineering and IT, The University of Sydney
Bushfire CRC

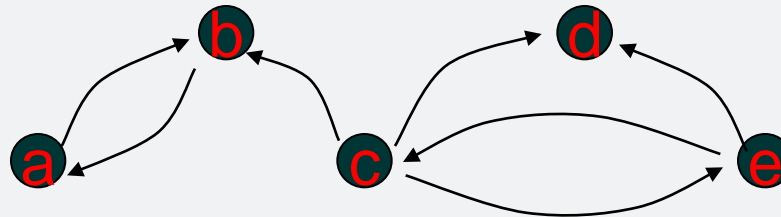Supervisors: Prof. Liaquat Hossain, Dr. Christine Owen

Project: Effective Incident Management Organising

RESEARCH PROBLEM

- In **dynamic** environments like bushfire, the largest problems for managers often derive from collaborative problem solving, learning and other problem of coordination between the different organisations

- **Failure** of **information sharing** or lack of will be the main reason for **coordination failure** during disasters

- The aim of my research is to use **Social Network Analysis** to identify if there are network patterns of people's interactions. The success or failure of the response to bushfires may depend on these patterns.

SOCIAL NETWORK

- **A Social network** is a social structure made of nodes (which are generally individuals or organizations) that are tied by one or more specific types of interdependency, such as values, visions, ideas, financial exchange, friendship, kinship, dislike, conflict or trade.

- The resulting graph-based structures are often very **complex**.

SOCIAL NETWORK

From Graph to matrices

	a	b	c	d	e
a		1			
b	1				
c		1		1	1
d					
e			1	1	

BENEFITS OF SOCIAL NETWORK ANALYSIS

- **Identification** and retention for **people** with vital **knowledge** and **connections**.

- Analysing social networks increases **innovation**, **productivity**, and **responsiveness** through plugging "know-who" gaps.

- It can also help us make **smarter decisions** about organizational changes and establishment of key knowledge roles.

- Social network analysis gives us insight into challenges of **knowledge transfer**.

SOCIAL NETWORK

SOURCES OF DATA:

1- Questionnaires

2- Direct Observation

3- Written Records: archival or diary

4- Experiments

5- Derivation

RESEARCH GAP

- Previous research has shown that **interactions** between **nodes** in the **network** resulted in important opportunities for **learning**.

- Existing studies of **learning theory** in human networks have looked at learning problems requiring **stable** working relationships with no environmental uncertainties.

- However, **few** studies have been conducted in a **dynamic** environment context where agents must adapt to new situations and overcome possibly unpredictable obstacles (problems), such as disasters.

- This study adopts the view of **networks** of **learning** in a **dynamic** environment context

RESEARCH QUESTIONS

➢ Is there a relationship between the configuration of **social network structures** and **learning** in **dynamic** environment such as emergency management?

➢ How do the **network** relationships among emergency management groups affect their **learning**?

➢ Does the **change** to **interconnectedness** of actors (i.e., personnel involved in mitigating the emergency event) in the network have implications for the potential to **learn** as an event unfolds?

➢ How does a different pattern of actor **collaborations** affect **learning** and **adaptability**?

METHODOLOGY

➤ **Review literature** to determine **current** state of **knowledge** in the use of **SNA** and **learning** theory in emergency response, including bushfire-specific SNA work.

➤ The process of social network analysis typically involves the use of questionnaires and/or interviews to **gather information** about the relationships between a defined group and network of people.

➤ Determine/develop applicable social network analysis tools/techniques that can be employed to **analyse** and **answer** the research questions.

LITERATURE REVIEW

- ➢ Social Networks - Overview and Brief History

- ➢ Social Network Ties

  Granovetter's Theory on the Strength of Weak Ties
  Strength of Strong Ties
  Degree and Diversity of Ties

- ➢ Burt's Structural Holes Theory

  Network Efficiency and Effectiveness
  Network Constraint

- ➢ Social Exchange Theory

- ➢ Overview of Learning

- ➢ Network Affect on Learning

- ➢ Social Network and Learning in Dynamic Environment
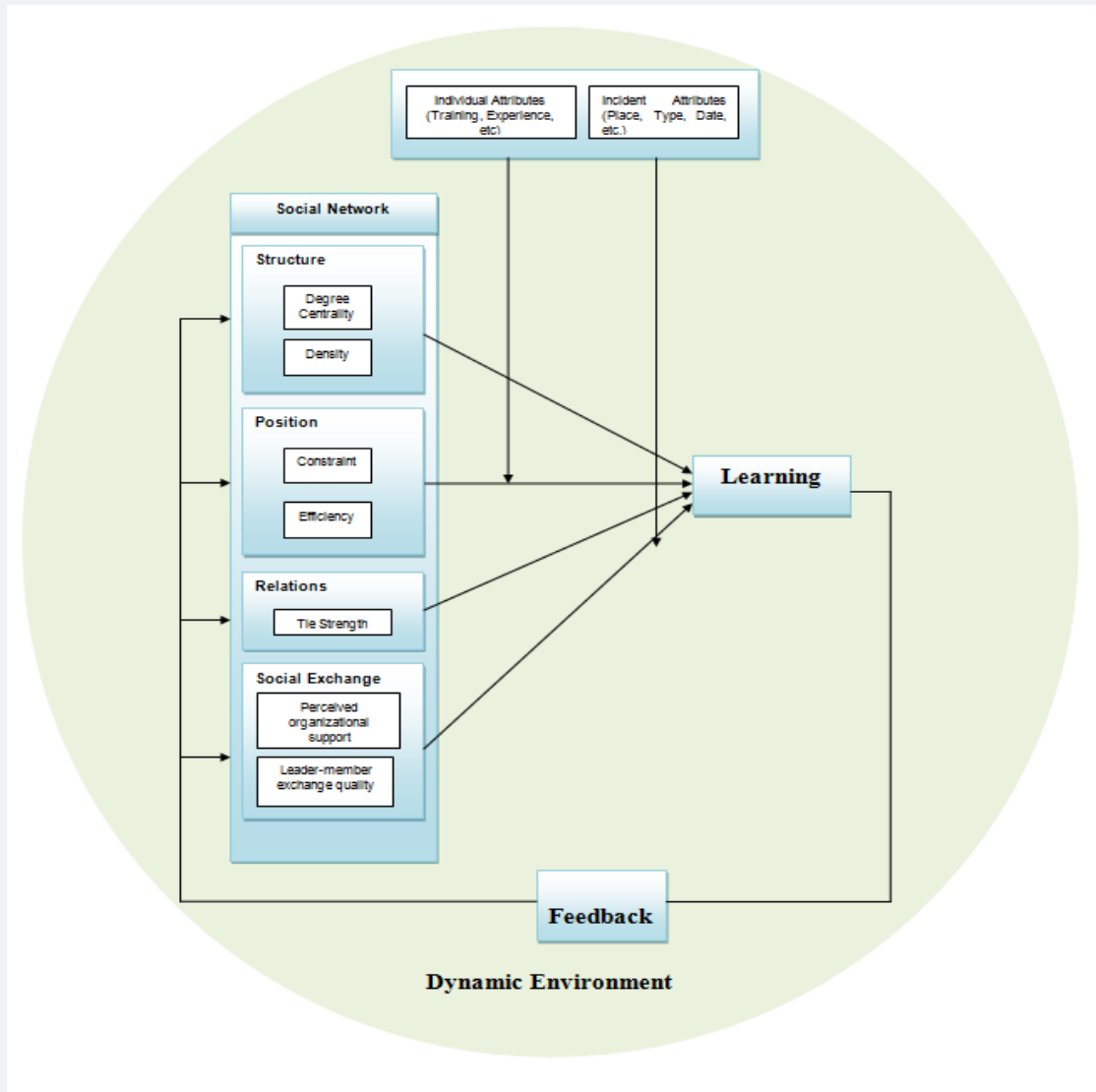
LITERATURE REVIEW: NETWORK EFFECT ON LEARNING

Granovetter's (1973) theory on the **strength of weak ties**:

- A given **tie** is **strong, weak** or **absent**. The mark of strong ties is connections with high intensity of emotional closeness and frequent communication (Granovetter 1973; Burt 1992).

- Individuals obtain **new** and **novel information** from **weak ties** rather than strong ties within the individual's group structure.

- That is, networks, where **strong ties** tend to bond similar people to each other, are closed networks and are **not** well **receptive** of **new information**.

LITERATURE REVIEW: NETWORK EFFECT ON LEARNING

- However, other research work done by Kraatz (1998) shows that **stronger ties** between the **nodes** of the network will provide better opportunities to **learn** for those nodes.

- The view of learning presented by Granovetter (1973) and Kraatz (1998) is valid in **stable** environment, but this concept in studying and identifying social networks may not be adequate for research in **non-routine** situations, such as emergency incident management.
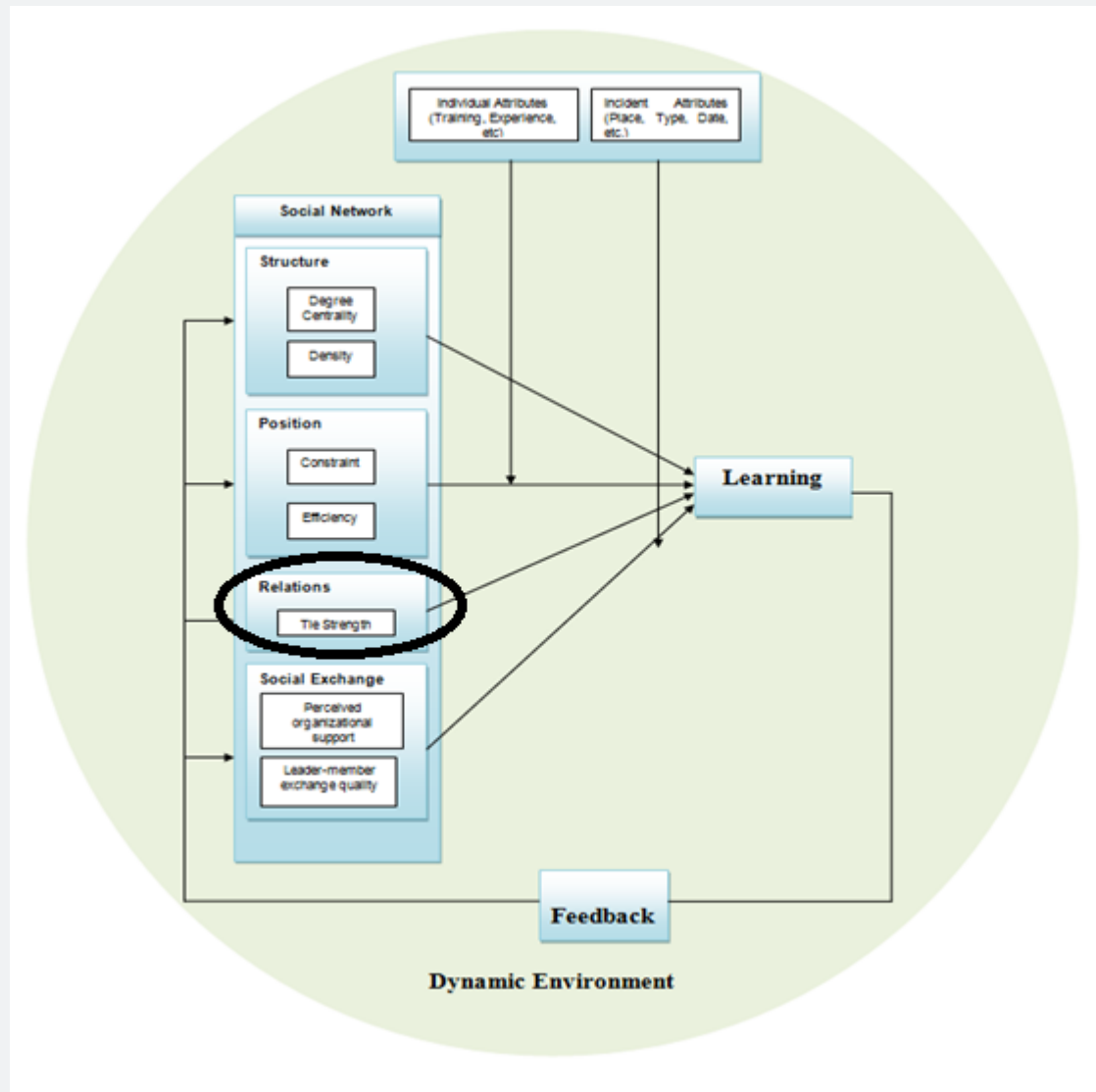
THE MODEL

Resource: smh.com.au
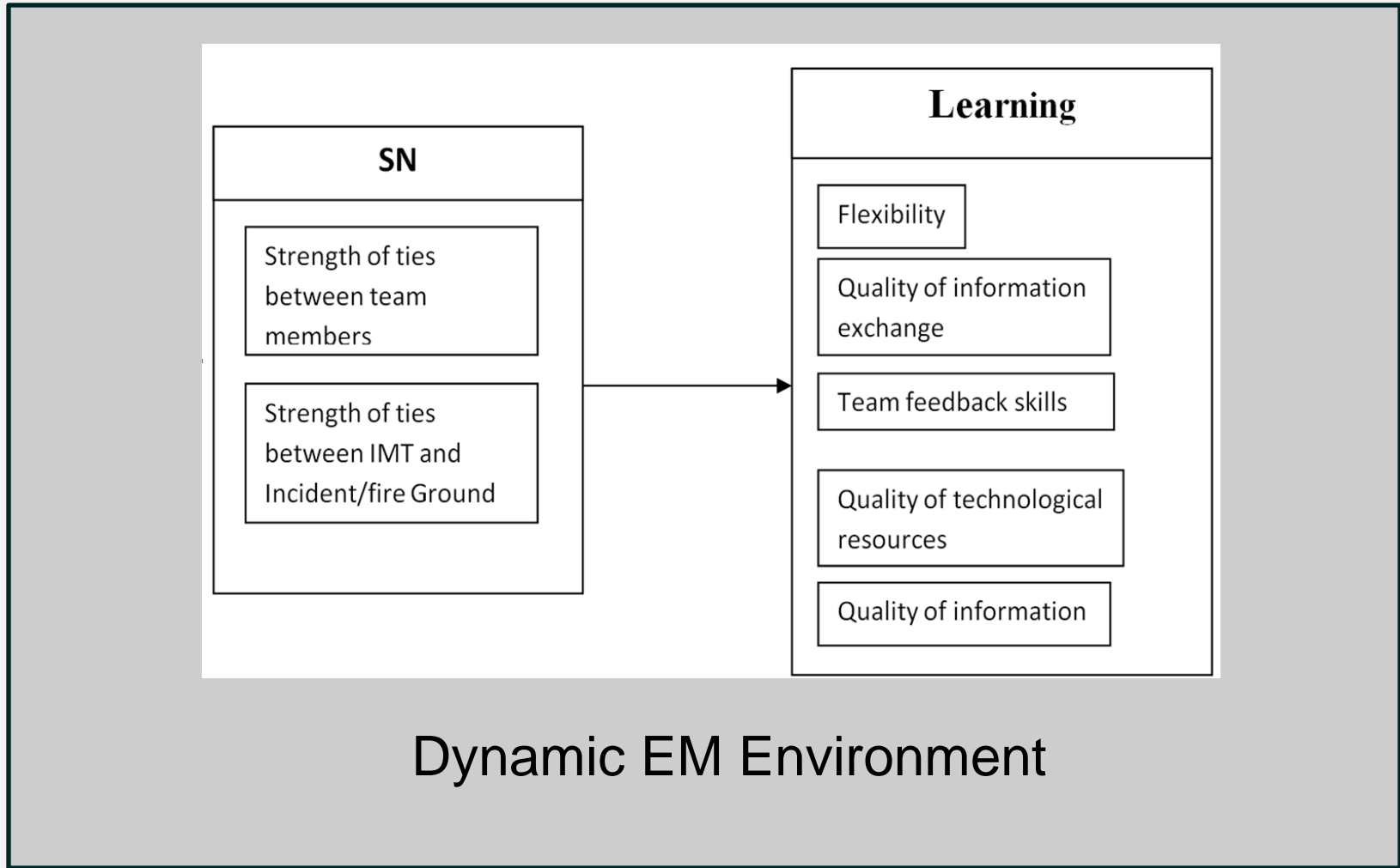
AIIMS DATA

- Worked on an existing data set which was a survey collected between 2008-2009

- AIIMS (Australasian Inter-service Incident Management System) National Questionnaire (A questionnaire was distributed to 25 agencies in Australia aiming to assess how information flowed between emergency incident management personnel)

- The survey was not originally intended for this purpose but nevertheless we could explore

- The questionnaire was completed by people in different layers within the AIIMS structure

- Respondents were asked to give their perceptions on a range of indicators of information flow and teamwork within the AIIMS system. They were asked to think about one incident and to identify:

  1- The characteristics of that incident
  2- Whether they received a briefing or incident action plan
  3- Whether particular risk management and assessment tools were in use
  4- Whether particular teamwork indicators were in use.

THE MODEL

Dynamic EM Environment

AIIMS PAPER

- The first stage of collecting the data required a thorough exploration of the survey instrument to identify **possible questions** that provide relational data to assess the respondents' **social network**, or questions relevant to **learning** measures as proposed in the model.

- For any Network or learning measure, the scores of the items are **combined** to form the respondent's degree of that measure. So for flexibility, the scores of the three questions are combined to form the respondent's degree of flexibility.

Flexibility Measure

- Strategies were adjusted in a timely manner as the incident unfolded

- Roles were effectively re-allocated as the situation changed

- When problems occurred the team was able to recover quickly and get on with the job

- We **validated** our measures using the literature as discussed before and by using a confirmatory factor analysis which showed that the measures were valid.

- Also, **Cronbach**'s alpha Coefficient was computed to test the **reliabilities** of these measures.

- **Statistical** tests were done to see if there is a **correlation** between **Network** Measures and **Learning** Measures

RESULTS

	Strength Of Ties Team	Strength Of Ties IMT Ground	flexibility	Information exchange	Team Feedback skills	Preoccupation with failure	Quality Of Information	Quality Of Plan	Quality Of Tech Resources
Strength Of Ties Team	1	x	x	x	x	x	x	x	x
Strength Of Ties IMT Ground	x	1	x	x	x	x	x	x	x
flexibility	.810**	.689**	1	x	x	x	x	x	x
Information exchange	.945**	.691**	x	1	x	x	x	x	x
Team Feedback skills	.938**	.691**	x	x	1	x	x	x	x
Preoccupation with failure	.182**	.213**	x	x	x	1	x	x	x
Quality Of Information	.540**	.641**	x	x	x	x	1	x	x
Quality Of Plan	.486**	.589**	x	x	x	x	x	1	x
Quality Of Tech Resources	.368**	.494**	x	x	x	x	x	x	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

RESULTS

- Under the framework of the research study, it may be said that when individuals and teams in an emergency network **invest** in existing relationships to strengthen the bond, the **relationships** between individuals and teams becomes more **efficient** as **trust** is developed and collective sensemaking can be enhanced.

- In turn, this may mean that after establishing better network relationships, an individual or team is more likely to have access to **information** that is of better **quality**.

RESULTS

• This improved working relationship may then have a positive effect on **sharing**, which may facilitate **learning** and the perceived state of **readiness** to interact with other individuals and teams in an emergency.

• We also conclude that successful learning depends not only on formal, planned, organizational implementation activities but also on the capabilities of the existing and emergent social networks.

CONCLUSION

- ❑ **Improved communication within teams** enhances effectiveness of perceived emergency management performance.

- ❑ the **communication across teams** is as important as **communication within teams**.

- ❑ Emergency managers should invest in existing relationships across teams to strengthen the bonds.

- ❑ Investing in existing social relationships can build **trust** and **common shared knowledge** which support learning-related work activity.

IMPLICATIONS

- By presenting a model of learning-related work activity, based on network connectedness, **personnel** within emergency services organizations can **strengthen** their **capacity** to be **flexible** and **adaptable**.

- This study can also assist to examine closely the **flow** of **information** within organizations responding to bushfire and understand information flow in order to make **improved decisions**.

FUTURE WORK

- Test the remaining hypotheses within my model in order to answer the remaining research questions.

- Further whole network analysis conceptual tools such as centrality, cliques and structural equivalence analyses can then be conducted which would provide a **richer** picture in terms of understanding network, learning and performance patterns.

- Another extremely valuable task for further research would be to apply the existing theoretical model to the context of **another** domain (e.g. floods) to understand what factors of social network may affect learning and performance.

FUTURE WORK

1- Analysis of secondary data sources

The transcripts from the Royal Commission will be used as a secondary source and analysed to identify what mental models can be inferred and what inter- and intra-organisational breakdowns can be identified.

2- Semi-structured and critical method interviews

The initial secondary sources will then be used as a template for further elaboration in field interviews with subject matter experts.

3- Scenario/role play simulation studies

Simulation training using the developed models will then be undertaken and performance evaluated.
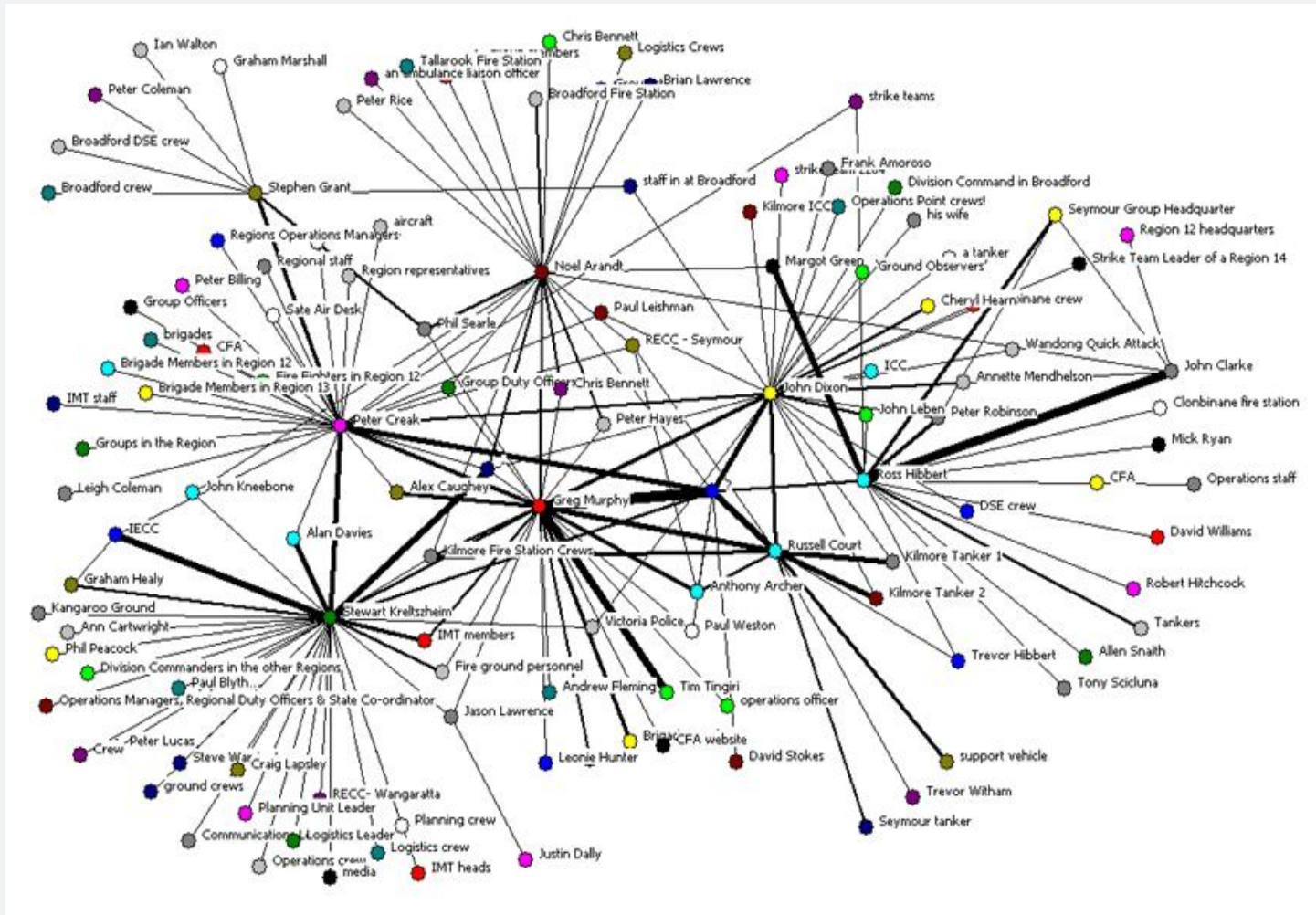
4- Observations/Cognitive ethnography

Observations will be conducted of both real-time and event simulations.

5- Follow up interviews will occur with personnel

6- Organisational survey

7- White paper and National Workshop

Thank you