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The Incident Command System: a literature review

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Given the foundational and the fundamental role that the Incident Command System (ICS) is intended to play in on-scene response efforts across the United States, it is important to determine what is known about the system and how this is known. Accordingly, this study addresses the following research question: 'How has research explored the ICS?'. To probe this question, a methodological review of the scant, but widening, pool of research literature directly related to the ICS was conducted. This paper reports on the findings of the analysis related to the focus, theoretical frameworks, population and sampling, methods, results, and conclusions of the existing research literature. While undertaken using different methodological approaches, the ICS research suggests that the system may be limited in its usefulness. In addition, the paper discusses the implications of the research for the state of knowledge of the system and for the direction of future research.

Keywords: command and control, disaster preparedness, disaster response, incident command system, incident management

Introduction

Organisations involved in emergency management at the local, state, and federal level in the United States have been mandated since 2004 to use the National Incident Management System (NIMS) to structure emergency management activities related to preparedness, command and management, resource management, communication and information management, and maintenance. With respect to command and control, NIMS requires, among other things, that organisations (such as fire departments, emergency medical services, law-enforcement agencies, public-works departments, and voluntary agencies) responding on-scene to hazard events employ the Incident Command System (ICS) to structure their activities. According to the Department of Homeland Security (DHS, 2008, p. 45), the ICS is:

> *a widely applicable management system designed to enable effective, efficient incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure.*

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The ICS is mandated for use by all responding organisations to all hazard events regardless of their geographic scope, duration, or complexity. Thus, responders should employ the ICS on a daily basis in response to emergencies such as house fires, traffic accidents, and water-main breaks, and to non-routine hazard events such as earthquakes, hurricanes, and terrorist attacks.

The goal of NIMS is grand and far-reaching: to standardise emergency management structures, processes, and terminology for preparedness, response, recovery, and mitigation across all emergency management-relevant organisations in the US. The aim of the ICS mandate relative to the overall NIMS—to standardise the organisation and execution of on-scene response to all hazard events across all responding organisations—is significantly more limited but nonetheless ambitious. Given these objectives, one has to wonder if and how the systems are being used and the extent to which they are useful in facilitating response efforts.

In recent years, a small, but significant, body of literature related to NIMS has emerged. This pool includes the work of Anderson, Compton, and Mason (2004) on the history and components of the system and the discussion of leadership issues and NIMS in Lester and Krejci (2007). There have also been several publications based on empirical research (see, for example, Neal and Webb, 2006, 2008; Jensen, 2008, 2009, 2010; Clark, 2010; Dewalt, 2010; Wilson, 2010; Henkey, 2011; Jensen and Yoon, 2011; McCauley, 2011; Jensen and Youngs, 2012). Cumulatively, this research suggests that: NIMS is not being implemented in a standardised fashion; there is variation in the intent to do so; and there are a variety of variables that affect both actual implementation and implementation intent. While this research examines NIMS and not solely the ICS, it does imply that the NIMS mandate has not necessarily resulted in standardised use of the system and it highlights the need to study further all aspects of NIMS, including one of its key subcomponents: the ICS.

The purpose of this paper is to identify the literature on the ICS and from the writing on the topic isolate and review those scholarly, peer-reviewed publications that report the findings of empirical work. Specifically, this study reviews the research questions, theoretical frameworks, sampling, methods, and results and conclusions of ICS analysis. Based on this review, the implications for knowledge of the system and the direction of future ICS research are deliberated.

Background

The ICS was not new to much of the practitioner community associated with emergency management in the US when its employment was mandated through NIMS in 2004. Some observers have gone so far as to suggest that, by the time ICS was mandated for use through NIMS, the system had already become 'the de facto standard for firefighting and emergency management' (Harrald, 2006, p. 263). The ICS had been in existence for decades, having made its first appearance in the early 1970s in the State of California, US (Auf der Heide, 1989). Furthermore, prior to its

incorporation in NIMS, the system had been used during responses to events by many, if not most, fire departments across the country and by organisations such as the Environmental Protection Agency, the Occupational Health and Safety Administration, and the United States Coast Guard (Christen et al., 2001; Hannestad, 2005; Harrald, 2006).

From its inception, the ICS was designed to alleviate a variety of problems commonly observed in response to disasters, including:

> *failure to recognize the magnitude and seriousness of an event; delayed and insufficient responses; confusion regarding authorities and responsibilities, often resulting in major 'turf battles'; resource shortages and misdirection of existing resources; poor organizational, interorganizational, and public communications; failures in intergovernmental coordination; failures in leadership and vision; inequities in the provision of disaster assistance* (National Research Council, 2006, p. 141).

Specifically, the system is 'designed to clarify key response-related tasks and overcome the confusion that invariably develops when multiple agencies and jurisdictions mobilize during major disasters' (Tierney, Lindell, and Perry, 2001, p. 211). Should the ICS be used, the following scenario is possible:

> *When agencies involved in a major emergency use ICS . . . there are few, if any, differences in operations. In essence, they are 'one' organization, and can be managed as such. Instead of several command posts operating independently, the total operation can be directed from only one location. Instead of preparing several sets of plans (with no guarantee of coordination among them) only one set need be prepared to inform all participants. In place of several logistical and communications processes, only one system of collective and integrated procedures is used* (Auf der Heide, 1989, p. 157).

The potential of the ICS to create the aforementioned scenario has led many practitioners to become advocates of the system's widespread employment in emergency management (see, for example, Rubin, 1997; Mathis, 1988; Klassen, 2009).

Indeed, the emergency management practitioner community has widely heralded the potential benefits of the ICS (Wenger, Quarantelli, and Dynes, 1990; Tierney, Lindell, and Perry, 2001; Buck, Trainor, and Aguirre, 2006; Waugh, 2009). The advantages associated with the ICS include its foundation on management characteristics, such as common terminology, modular organisation, and management by objectives (DHS, 2008). The system also is said to be flexible, scalable, and applicable to all incidents regardless of complexity, duration, or size, making it useful in day-to-day operations as well as in emergency and disaster situations (DHS, 2008). The ICS is designed to facilitate standardised response and can be utilised by all levels of government and by all emergency management organisations (DHS, 2008). Use of the system has the potential to decrease the perception of chaos and confusion, communication problems, leadership issues, duplication of effort, and unnecessary

response-related expenditure when implemented correctly, as well as to increase the safety of responders (Perry, 2003, p. 407; Anderson, Compton, and Mason, 2004). These benefits, and others, have led certain responding organisations to support the system enthusiastically (Christen et al., 2001; Hannestad, 2005; Harrald, 2006).

The enthusiasm of the practitioner community contrasts dramatically with the concerns of academics. Many analysts associated with disaster research have produced considerable critiques of command-and-control models, of which the ICS is an example (Dynes, 1983, 1993, 2000; Walker et al., 1994; Neal and Phillips, 1995; Schroeder, Wamsley, and Ward, 2001; Tierney, Lindell, and Perry, 2001; Wise and Nader, 2002; Drabek, 2003; Waugh and Strieb, 2006). Despite the fact that the ICS is described as being flexible and facilitating efficiency, the disaster research suggests the opposite. As Waugh (2009, p. 172) remarks: 'such systems, by their very nature, are inflexible, slow, and cumbersome and would be much less adaptable in task environments characterized by uncertainty and rapid change'.

Examples of additional issues raised in the disaster literature include: whether such a model is needed to manage hazard events (Dynes, 1994; Drabek and McEntire, 2002); whether such a model fits with the organisational reality/realities associated with emergency management (Drabek, 1983, 1985; Wenger, Quarantelli, and Dynes, 1990; Neal and Phillips, 1995; Drabek and McEntire, 2002; Waugh and Streib, 2006; Waugh, 2009); whether such models address some of the issues critical to a successful response, such as information management (Comfort, 2007) or leadership (Waugh, 2009, p. 168); and whether the use of such a system actually accomplishes the opposite of that for which it is designed (McEntire, 2001, p. 8; Jensen, 2009, 2010, 2011). Concerns such as these led Drabek (2007, p. 228) to comment on the 'limited usefulness, indeed outright inappropriateness, of older managerial paradigms rooted with the rhetoric and orientation of "command and control"'.

Yet, many of the concerns of academics have been voiced in pieces not reporting the findings of empirical research; and command-and-control models—let alone the ICS—were not a focus of the majority of the works that were based on original research. Wenger, Quarantelli, and Dynes (1990), for instance, focus on the ICS specifically and offer one of the most stinging critiques of the system to date. However, their analysis is not based on findings of original research on the system but on their collective research experience. Concluding that the 'ICS does not appear to be a useful model that is readily transferable to broader communitywide planning and response efforts' (Wenger, Quarantelli, and Dynes, 1990, p. 12), they underline issues with variation in the meaning of the ICS, differences in its implementation, difficulties integrating non-traditional responding organisations and volunteers into the system, and the dependence of the system's success as a coordinating mechanism on all of the responding organisations' training and their knowledge and experience of the ICS and each other, inter alia (Wenger, Quarantelli, and Dynes, 1990, pp. 8–12).

The critique of Wenger, Quarantelli, and Dynes (1990), like those of most academics writing on the subject, suggests that there are a variety of reasons to question the usefulness of the ICS as an organising system for on-scene response to hazard

events. However, they do not offer empirical evidence to support their claims, also like most academics writing on the topic. The concerns of academics with respect to command-and-control systems, and the ICS specifically, may be warranted, but the findings of original research on the system must be provided to support any such assertions. Thus, empirical research on the ICS must be identified and analysed before any conclusions can be drawn regarding its usefulness during a response.

The ICS literature

Locating literature specifically on the topic of the ICS was not a challenge. Much has been written about the system by many and these writings have been disseminated in a variety of ways. For instance, countless practitioner assessments based on personal experiences and normative theory (such as 'best practices') have been published in professional magazines (see, for example, Goldfarb, 1997; Larson, 1998; Cardwell and Cooney, 2000; Parker, 2005; Dudfield, 2008; Bennett, 2011; Decker, 2011). In addition, there are dozens of papers based on applied research projects conducted through the National Fire Academy's Executive Fire Officer Program (EFOP) (see, for example, Webb, 1990; Brent, 1992; Nash, 1994; Berk, 2001; Cole, 2001; Juratovac, 2004; Bardwell, 2005). Students also have produced written work on the subject of the ICS: Naval Postgraduate School students have grappled with it in argumentative papers written to complete their programmes of study (see, for example, Favero, 1999; Templeton, 2005); and students at a variety of academic institutions have conducted original research on the theme for their dissertation or thesis (see, for example, Domorod, 1991; English, 1992; Arney, 1993; Szabo, 1993; Benson, 2004; Huang, C., 2004; Huang, J., 2004; Su, 2004; Chian-Cheng, 2005; Freeman, 2005; Williams, 2005; Mason, 2006; Cone, 2007; O'Neill, 2008; Schoen, 2008; Fakhoury, 2009; Hancock, 2010).

The concerns of academics, practitioners, students, and others have been helpful in sensitising readers both to the benefits of the ICS and to the obstacles to the implementation of the system. Yet, the interest of this research in empirical evidence related to the usefulness of the ICS led to a focus on identifying and reviewing articles that present the findings of original research on the ICS as a whole, or in general, that were peer-reviewed, and that were published in a scholarly journal.

Approach to the review

The process of searching for articles that met the aforementioned criteria began with a search of the EBSCO, Web of Science, and WorldCat library databases and Google Scholar, utilising the phrase 'incident command system'. This initial search yielded very few articles. The citations used in the articles were reviewed, concentrating on those references that referred to the ICS, and the articles identified were procured.

This 'snowball' citation search was continued until no new articles were found. This approach allowed for the amassing of most, if not all, existing works in peer-reviewed scholarly journals reporting the findings of empirical research, but it is quite possible that some were missed.

Nevertheless, this process resulted in a total of 37 scholarly, peer-reviewed articles specifically on the topic of the ICS. Of the articles found, 18 did not report the findings of original research and hence were not included in the analysis (Wenger, Quarantelli, and Dynes, 1990; Stumph, 2001; Zane and Prestipino, 2004; Arnold, Paturas, and Rodoplu, 2005; Jacoby, 2005; Autry and Moss, 2006; Nicholson, 2006; Hansen, 2007; Moynihan, 2007, 2008b; Gyorfi et al., 2008; Nja and Rake, 2008; Madigan and Dacre, 2009; Adams et al., 2010; Phonburee et al., 2010; Andrew and Kendra, 2012; Fishbane, Kist, and Schieber, 2012; Tsai and Chi, 2012). Furthermore, eight reported the findings of original research related to specific aspects of, or issues pertaining to, the ICS but not to the overall system:

- Thomas et al. (2004) suggested and tested an evaluation method for the performance of the ICS in an exercise— Arnold, Paturas, and Rodoplu (2005) critiqued the piece;
- Crichton, Lauche, and Flin (2005) evaluated the skills needed by members of incident management teams;
- McLennan et al. (2006) studied decision-making in incident management teams;
- Wang et al. (2008) presented an approach to modelling workflow in incident command systems;
- Branum, Dietz, and Black (2010) assessed the personnel structures used in an ICS-based functional exercise;
- Granillo et al. (2010) examined a method of training individuals in the ICS;
- Stambler and Barbera (2011) attempted to document the historical development of the ICS; and
- Djalai et al. (2012) attempted to measure decision-making performance in an ICS-based table-top exercise.

Consequently, a total of 26 articles were not included for further analysis; the review centres on the other 11 articles (Arnold et al., 2001; Bigley and Roberts, 2001; Tsai et al., 2004; Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008; Moynihan, 2008a, 2009a, 2009b; Lam et al., 2010; Jensen and Yoon, 2011; Yarmohammadian et al., 2011).

The following dimensions of each of these 11 articles were appraised: research question(s); theoretical foundation; population and sampling; methods; and results and conclusions. Specifically, the article's research question was documented regardless of whether or not it was stated explicitly or was implicit in the introduction. In cases where no research question was expressed explicitly, this fact was noted and an attempt was made to induce the research question/purpose. With respect to theoretical foundation, the previous scholarly work and/or academic theories used in each

piece to form the basis for understanding the topic under investigation were noted, setting the stage for an understanding of the methodology. Typically, this information was found in a literature review section of an article. The methodological approach was recorded (that is, qualitative, quantitative, or mixed methods, method(s), unit of data collection, unit of data analysis, population, sampling frame, type of sampling, and sample). The results and the conclusions drawn were noted. An analysis was then conducted across the articles to identify findings related to this small body of literature's overall areas of focus, population and sampling, methods, results and conclusions. The following section contains the outcomes of this analysis along with the conceptualisations employed to frame the analysis.

Review of ICS-related research

Research focus

A study's research focus was conceptualised as a line of reasoning or specific statement that clearly identifies the starting point for data collection with respect to the topic of interest, unit of analysis, concepts, problem to solve, and/or the theoretical framework to build or test. The research focus is the 'intellectual stimulus' pinpointed by the author(s), calling 'for an answer in the form of scientific inquiry . . . problems amenable to research are empirically grounded, clear, and specific' (Frankfort-Nachmias and Nachmias, 1992, p. 69). As noted, articles that concentrated on the ICS overall, as opposed to specific aspects of the system or specific issues related to it, were purposively selected for inclusion in this review.

Three of the 11 articles reported findings related to the ICS in routine times:

- Arnold et al. (2001) looked at perceptions of the Hospital Emergency Incident Command System (HEICS) among attendees of a medical conference in Turkey;
- Jensen and Yoon (2011) explored how volunteer fire department chiefs and volunteer fire fighters in the State of North Dakota, US, perceived the usefulness of the ICS; and
- Yarmohammadian et al. (2011) examined implementation of the ICS in Iranian hospitals during routine times.

The remaining studies all looked at the ICS in the context of responding to hazard events:

- Bigley and Roberts (2001) explored the employment of the ICS as a high reliability system within a California county fire department's response to a wildland fire;
- Tsai et al. (2004) described the use of the HEICS in a hospital during an outbreak of severe acute respiratory syndrome (SARS) in 2003;
- Buck, Trainor, and Aguirre (2006) evaluated the use of the ICS by the Federal Emergency Management Agency (FEMA)'s Urban Search and Rescue Task Forces in nine hazard events;

- Lutz and Lindell (2008) examined the use of the ICS in Emergency Operations Centers (EOCs) during Hurricane Rita in 2005;
- Moynihan (2008a, 2009a) assessed the use of the ICS during the outbreak of Exotic Newcastle Disease (END) in 2002–03, as well as how it was used in seven hazard event case studies (Moynihan, 2009b); and
- Lam et al. (2010) gauged citizen perceptions of the ICS following a series of mudslides in Taiwan that occurred between 2000 and 2005.

One should note that all of the studies in routine times focused on perceptions of the ICS at only one point in time. Of those studies that evaluated the ICS during a response, only Buck, Trainor, and Aguirre (2006) and Moynihan (2009b) analysed it in more than one event. Six of the 11 articles (Arnold et al., 2001; Bigley and Roberts, 2001; Tsai et al., 2004; Lam et al., 2010; Jensen and Yoon, 2011; Yarmohammadian et al., 2011) centred their ICS research on or within one type of perspective, such as disaster-affected citizens, fires, and hospitals. In addition, seven of the articles concentrated on the ICS in the US context (Bigley and Roberts, 2001; Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008; Moynihan, 2008a, 2009a, 2009b; Jensen and Yoon, 2011), whereas four studied it in other national settings (Arnold et al., 2001; Tsai et al., 2004; Lam et al., 2010; Yarmohammadian et al., 2011).

Theoretical framework

A study's theoretical framework was understood to be a perspective, orientation, set of concepts, and/or group of specified variable relationships that explicitly serve to guide the research focus, methods, and subsequent data analysis. The framework might range from a synthesis of prior research efforts and the issues that they raise to widely accepted and detailed theoretical statements applicable to an assortment of phenomena. Eight of the 11 articles reviewed included a theoretical framework.

Seven of the nine articles referenced the ICS and/or disaster literature (Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008; Moynihan 2008a, 2009a, 2009b; Lam et al., 2010; Jensen and Yoon, 2011), and one (Yarmohammadian, 2011) referenced the hospital/medical disaster management literature. However, while the ICS and/or disaster literature was cited in the majority of the articles, this literature was used to justify the research focus of an article or was simply acknowledged more than it was used to frame the methodological approach of the studies.

Beyond citation of the ICS/disaster literature, there were no clear patterns in the theoretical frameworks employed to ground the studies. In addition to the ICS and/or disaster literature, Buck, Trainor, and Aguirre (2006) and Jensen and Yoon (2011) used literature related to firefighting, Lutz and Lindell (2008) used psychology literature related to team climate, and Moynihan used network theory (2008a, 2009b) and organisational learning theory (2009a), respectively. Bigley and Roberts (2001) relied exclusively on the high reliability organisation literature to frame their results. Of note is the fact that they did not use a theoretical framework initially to develop

their study, owing, perhaps, to the use of grounded theory as their model for analysis. Finally, three articles (Arnold et al., 2001; Tsai et al., 2005; Yarmohammadian et al., 2011) did not utilise a discernible framework.

Methods

Methods were viewed as a set of rules guiding the data-collection process that needs to be sufficiently explicit to shepherd partial or full replication of the study. Data collection in the social sciences generally is conducted via one of three approaches: quantitative; qualitative; or mixed methods. Quantitative methods are those systematic data-collection efforts (such as experiments and surveys) that rely primarily on numerical data (for instance, coded responses, counts, and scales) to pursue a study's research focus. Of the 11 articles that examined the ICS, four used quantitative methods (Arnold et al., 2001; Tsai et al., 2004; Lutz and Lindell, 2008; Jensen and Yoon, 2011). All of the quantitative studies employed a survey of some type—one delivered in person, one by mail, and one through a structured interview.

Despite the presence of quantitative work within the ICS literature reviewed, qualitative approaches were dominant. Qualitative methods are conceptualised as a systematic data-collection effort (such as field studies and semi-structured interviews) that relies principally on non-numerical data (including observations, visual images, and words) to pursue a study's research focus. Of the 11 articles that examined the ICS, six used qualitative methods (Bigley and Roberts, 2001; Buck, Trainor, and Aguirre, 2006; Moynihan 2008a, 2009a, 2009b; Yarmohammadian et al., 2011). The qualitative studies employed a variety of methods: observation was used in one article, interviews in five, content analysis in five, and focus groups in one. Four of the articles employing a qualitative methods approach used more than one process for data collection in the same study (Bigley and Roberts, 2001; Buck, Trainor, and Aguirre, 2006; Moynihan 2008a, 2009). To be clear, two of the articles reviewed were based on the same study (Moynihan 2008a, 2009a) and are counted twice in the two preceding sentences.

Mixed-methods approaches, meanwhile, are those that utilise a set of systematic, integrated data-collection efforts that rely on both qualitative and quantitative information to draw conclusions relevant to the study's research focus. One of the articles reviewed used a mixed-methods approach (Lam et al., 2010), combining the qualitative data-collection strategy of focus groups with the quantitative structured interview approach.

Population and sampling

It was difficult to ascertain the populations for many of the studies, or the 'theoretically specified aggregation of the elements in a study' (Babbie, 2008, p. 520). The number of units in the population was particularly hard to determine. It was difficult, therefore, to evaluate the study samples relative to the population from which they were drawn. For instance, the population in Arnold et al. (2001) was all

of the medical professionals attending a medical conference in Turkey. Arnold et al. (2001) employed a non-probability sampling technique (unclear whether they were attempting a census or convenience sample) that resulted in 33 completed surveys, but what portion of the conference attendees are represented in the sample is unclear. For their part, Jensen and Yoon (2011) attempted a census of 365 volunteer fire department chiefs but also sent surveys to two volunteers within each department—the total number of volunteer members in all 365 volunteer fire departments was not reported.

Despite the issues related to population, this research was able to examine the studies' sampling techniques. Sampling is taken to be a set of selection rules to identify elements (such as events, groups, or people) for data collection that may be guided by the laws of chance (probability sampling) or by concerns associated with the ongoing data-collection processes (nonprobability techniques such as purposive sampling). The majority of the ICS studies reviewed used small nonprobability samples, or 'any technique in which samples are selected in some way not suggested by probability theory' (Babbie, 2008, p. 519). Of the studies employing nonprobability samples, three used a purely purposive sampling technique (Moynihan, 2008a, 2009a, 2009b), one employed a census technique (Tsai et al., 2001), and the remaining studies used a combination of nonprobability sampling techniques: one a combination of purposive and snowball techniques (Yarmohammadian et al., 2011); two a combination of purposive and convenience (Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008); and one a combination of purposive, census, and convenience (Jensen and Yoon, 2011). The sampling techniques of Buck, Trainor, and Aguirre (2006), Moynihan (2008a, 2009a), and Tsai et al. (2001) were deduced as the authors did not specify them. The sampling techniques of Arnold et al. (2001) and Moynihan (2009b) could not be determined.

Only Lam et al. (2010) employed probability sampling techniques—'the general term for samples elected in accord with probability theory, typically involving some random-selection mechanism' (Babbie, 2008, p. 520)—but questions linger as to the execution of the sampling procedures. While Lam et al. (2010) drew on a random sample of the households in the two villages under review, the confidence interval and confidence level associated with their sample/results were not made clear.

As noted, the samples in the studies were predominantly nonprobability samples of small size. Consequently, there is no generalisability of findings from the individual studies reviewed or the body of work overall. The implications of this situation are discussed in more detail later.

Results and conclusions

Results were conceptualised as the conversion of raw data (qualitative, quantitative, and/or mixed) into a form (descriptive and/or explanatory) that addresses the research focus within the study's theoretical framework. Conclusions were viewed as the interpretations of the significance of a study's results provided, at a minimum, in relationship to the study's explicit research focus. During the examination of the

ICS literature, some continuities were discovered in the results and conclusions of the various authors.

Lutz and Lindell (2008) scrutinised a wide range of variables and their interrelationships; thus, the authors reported a wide range of findings. Some of their findings were not directly related to the ICS and are not reported here. Of those related to the ICS, Lutz and Lindell (2008) found that some EOCs used the ICS and some did not, and that there were inconsistencies in how the ICS was employed by those EOCs that did rely on it. Furthermore, they found that: there were differences between traditional first responders and representatives of emergency management-relevant organisations in their understanding of the ICS; prior experience of the ICS was positively related to understanding of the system; and the tasks that respondents were involved in during the response were similar even though they worked in different ICS sections. These results, among others, led Lutz and Lindell (2008, p. 132) to conclude that:

> *ICS implementation in Texas EOCs during Hurricane Rita left much to be desired. Thus this case study suggests that [the] ICS, as currently designed and trained, does not generalise well to all types of organizations.*

The results and conclusions of two of Moynihan's articles also questioned the generalisability of the ICS. Moynihan (2008a) found that the ICS was used extensively in the response to the END outbreak of 2002–03; yet, his analysis revealed that the system's usefulness was down to crisis variables (that is, extended duration, limited scope, and limited network diversity) and response network variables (that is, use of standard operating procedures, trust between responders, and shared understanding of the situation). The study led Moynihan (2008a, p. 224) to conclude that the influence of these variables on the manner in which the ICS was employed suggests 'shortcomings in the framing and underlying logic of the argumentation for the ICS', since it is assumed to be suitable for use in the response to every hazard event.

Using the lens of organisational learning to examine the END outbreak, Moynihan (2009a) found that certain aspects of the ICS (such as incident briefings and the tasking system) facilitated intra-crisis learning during the response. Specifically, Moynihan (2009a, p. 196) stated that the:

> *ICS fostered learning by establishing predictable flows of information and learning forums to consider this information . . . the adoption of [the] ICS also helped to curb strategic uncertainty by reducing the autonomy of member agencies and providing some basic guarantee that members were part of a collective effort.*

Moynihan (2009a, p. 196) highlighted again, though, the importance of the previously discussed event and response network characteristics to elucidate how the use of the ICS supported incident management and subsequently intra-crisis learning. He concluded that, although the ICS is based on the assumption that a hierarchical structure will facilitate inter-organisational coordination and learning, response

environment characteristics are important in understanding how the structure itself is used; and, hence, how useful the system is in facilitating inter-organisational coordination and learning. His discussion implies that, in a different event with different characteristics, the ICS may not be as useful to incident management and intra-crisis learning may not occur.

Moynihan's (2009b) results echo his earlier work. Specifically, he found that the ICS was implemented to varying degrees in his examination of seven hazard event case studies, and, moreover, that network characteristics (that is, network diversity, shared authority, and trust) influence use of the ICS. Moynihan (2009b, p. 912) concludes that the assumption underlying the ICS—that a hierarchical structure will facilitate inter-organisational coordination—is faulty since characteristics of the response environment similar to those identified through his earlier work were again found to influence the usefulness of the system in coordinating response efforts.

Buck, Trainor, and Aguirre (2006) also found that use of the ICS is shaped by a number of factors. They discovered that FEMA's Urban Search and Rescue Task Forces employed the ICS variously in response to the nine hazard events that they reviewed. They suggest that the ICS is most useful when a wide array of factors are present, including a shared vision for the response among responding organisations, working relationships among individual responders, the training of individual responders, and events limited in duration, objectives, and scope. Buck, Trainor, and Aguirre (2006, p. 14) concluded that the 'ICS is [not] useful . . . as a universal management system for responding to the entire spectrum of disaster-related processes and agency-generated demands' because it is likely to be successful only in very specific circumstances (that is, when all of the factors they identified are present simultaneously).

Yarmohammadian et al. (2011), in their examination of use of the ICS in Iranian hospitals, found that the system had not been institutionalised. They unearthed an assortment of internal (such as low motivation of hospital managers and staff and high cost of implementation) and external (such as changing nature of hospital regulations and inappropriate qualifications of managers) barriers to the system's implementation and made recommendations on how to enhance implementation of the ICS in Iranian hospitals, ranging from preparation of training materials and achieving 'buy-in' among staff and administration to fostering a crisis management culture.

While the research reviewed to this point suggests variation in how the ICS is used and the extent to which it is successful as an organising mechanism, Bigley and Roberts (2001) found that the system was successful as an organising mechanism in a California fire department's response to a wildfire. The authors pointed out that the system's success could be attributed to:

- timely and wise employment of ICS organisational structures and positions over the life of the incident;
- the appropriate use of improvisation; and
- understanding of the overall incident and operations during the course of the incident.

The findings of Bigley and Roberts (2001, p. 1296) led them to conclude that 'the ICS approach may represent an especially viable organizational solution' to a wide variety of hazard threats and events when it is employed this way. They underscored that the extent to which the system is used successfully probably will be influenced by the extent to which resources are available, as well as by the extent to which those involved are from traditional emergency services organisations, believe in the utility of the system as an organising mechanism, share response-related values and priorities, and 'buy-in' to the ICS authority system (Bigley and Roberts, 2001, pp. 1295–96).

The conclusions of Tsai et al. (2004) are somewhat similar to those of Bigley and Roberts (2001) in that they also determined that use of the ICS was successful. Specifically, they suggested that the HEICS provided a convenient, flexible, hierarchical, logical, and predictable command-and-control system that facilitated the response to an outbreak of SARS in 2003. They found that, during the response effort, new HEICS positions and units were created, some HEICS specified units were not activated, and that all of those participating in the study undertook unanticipated job actions in their HEICS positions. Unlike Bigley and Roberts (2001), however, Tsai et al. (2004) did not explore or suggest why the system was used as it was or provide evidence as to why they concluded that it was convenient, flexible, logical, or predictable.

Three studies focused on perceptions of the ICS. Arnold et al. (2001) surveyed attendees at a medical conference in Turkey and found that 97 per cent of those responding thought that the HEICS would be useful for hospital response. Lam et al. (2010) also found that the usefulness of the ICS was perceived positively. The authors argued both that the response systems utilised must fit with citizen expectations of a response and that expectations may vary across cultures and socioeconomic conditions. Against this backdrop, Lam et al. (2010) discovered that Taiwanese citizens' perceptions of the core principles of the ICS (that is, modular organisation, integrated communications, manageable span of control, transfer of command, and an incident action plan) were positive. They concluded that 'further assessment of the residents' opinions will not only improve our understanding of attitudes towards the ICS in societies with different characteristics, but also will help facilitate implementation of the ICS at the basic community level' (Lam et al., 2010, p. 461). In contrast to Arnold et al. (2001) and Lam et al. (2010), Jensen and Yoon (2011) reported that those whom they sampled—volunteer fire department chiefs and volunteer firefighters in North Dakota—did not have particularly positive perceptions of the usefulness of the ICS for daily activities or disaster situations. They suggested that volunteer status and participating in response activities in a rural area could be factors that explain the perceptions observed. Jensen and Yoon (2011, p. 13) state that 'the findings of this research do not allow us to draw any definitive conclusions; rather, the findings have led us to ask some important questions' about the relevance of voluntary status and serving in a rural area to perceptions of the ICS.

Discussion

The ICS is mandated for use in response to day-to-day and large-scale hazard events by all responding organisations in the US. But the degree to which the system actually is being used and is useful is not known. Ideally, research on these matters would have been conducted prior to the inclusion of the ICS within NIMS and the creation of its subsequent mandate. Disaster scholars have noted, though, that there was very little empirical support for the ICS in general, much less its mandate for employment across the country by all responding organisations to all hazard events regardless of complexity, duration, or size, even though various organisations had utilised it to varying degrees since the 1970s (see, for example, Auf der Heide, 1989; Neal and Webb, 2006, 2008; Jensen, 2008, 2009; Moynihan, 2008a, 2009a, 2009b; Sylves, 2008; Waugh, 2009).

It is critical that research examine the ICS because of the role it is intended to play in response efforts across the US, the advocacy for its use worldwide, and the lack of empirical support for the system's usefulness in eliminating or reducing common response shortcomings. This paper makes a significant contribution in this respect by identifying much of the existing writing on the ICS, differentiating the writing on the topic from the empirical research on the subject, and reporting what the existing research has determined about the system. The body of research reviewed is small and has its weaknesses. However, it also provides a foundation from which to pursue future, much needed, research on the system (as discussed below).

Several limitations were observed in the body of literature reviewed. First, and foremost, owing to the sampling techniques employed, none of the work done on the ICS to date is generalisable to any population, all of the US (or even entire geographic regions within the country), all nations, or all hazard events (regardless of complexity, duration, geographic scope, and type, for instance). The ICS is purported to be useful in the response to every hazard event, everywhere in the US, and in all nations. Any empirically-based suggestion that it is not challenges the very assumption upon which the system is based. That issues were discovered related to the ICS among some populations, in parts of the US, in some other nations, and in the response to some hazard events necessitates further research on how the system is used and towards what end in any and every setting possible. Thus, while the lack of generalisability of the ICS literature reviewed is a methodological limitation that must be noted, it does not eliminate the contribution of the work to understanding of the system.

Second, the methodological design of the articles was not well articulated in some cases. An example of this observation, the population issue, was highlighted earlier, as was the lack of clarity regarding the type of sampling performed in several of the studies. Reporting methods are understood here in a manner sufficient to allow partial/full replication of a study to be a generally accepted social-science research standard. That a number of articles did not offer much information on the data that was analysed and/or how it was analysed is problematic (see, for example, Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008; Moynihan 2008a; 2009a, 2009b).

Examples of additional methodological issues observed include: incomplete reporting of the study data without rationale for data exclusion (Buck, Trainor, and Aguirre, 2006; Yarmohammadian et al., 2011); poorly developed survey instruments (Tsai et al., 2005; Lam et al., 2010); no inclusion of the survey instrument or description of survey questions (Lutz and Lindell, 2008; Jensen and Yoon, 2011) or interview questions asked (Yarmohammadian et al., 2011); study conclusions that did not flow from the study results as presented in the article (Buck, Trainor, and Aguirre, 2006); and, no, or poor, specification of the study's limitations (Buck, Trainor, and Aguirre, 2006; Moynihan, 2008a; 2009a, 2009b; Lam et al., 2010; Yarmohammadian et al., 2011). The lack of methodological clarity does not necessarily mean that the studies were not well done, but rather that their quality vis-à-vis accepted scientific standards could not be assessed in all cases.

In addition, an opportunity appeared to be missed with respect to methodology, as some of the articles did not have a sufficient narrative to establish clear linkages between their theoretical framework and methods, methods and results, methods and conclusions, and/or theoretical framework and conclusions. For instance, Moynihan (2008a, 2009a) employed network theory as the theoretical framework but did not discuss how it informed content analysis and coding of the data. It remains unclear if network theory provided the categories in which findings were presented or if these codes emerged out of the data analysis alone. Furthermore, a lack of connection between the theoretical framework and methods was particularly noticeable in one of the quantitative studies (Lam et al., 2010). While Lutz and Lindell (2008) and Jensen and Yoon (2011) discussed explicitly how their theoretical frameworks informed the development of their studies, Lam et al. (2010) did not. Such linkages are vital if the intention is for a study's results to enhance core scientific theory.

Another limitation of this research on the ICS is that the method for the assessment of outcome variables often was unclear. For instance, Moynihan (2008a, 2009a) reports on the successful utilisation of the ICS in the END outbreak and presents some reasons why this was the case, but he does not describe how he assessed use of the ICS, much less how he determined that it had been used *successfully*. Moreover, Moynihan (2009b) describes seven case studies that involved use of the ICS and discusses his finding that there was variation in its employment and effectiveness; yet, he does not define either term or how they were appraised. Furthermore, Buck, Trainor, and Aguirre (2006) also report on case studies of ICS use, but again it is not clear how use was evaluated across the case studies.

A limitation of the ICS research is its reliance on perception-based data. Perception-based data is of value in understanding what people think, particularly because, as W.I. Thomas is so famous for articulating, perceptions have consequences (Thomas and Thomas, 1970). But, objective measures of usefulness, such as those that assess what is actually happening during a response as a result of using the system, whether the system is performing as it is designed, and whether the system leads to common response goals such as coordination, communication, and collaboration across the

organisations involved in the response, are also important. Research must measure objectively the usefulness of the ICS so that its value as an organising mechanism in response efforts can be gauged more comprehensively.

Despite its limitations, the body of literature related to the ICS has expanded the knowledge available on the topic and set the stage for future research. The US has made a significant investment in the ICS with the expectation that its use will facilitate a predictable, standardised on-scene response to all incidents regardless of complexity, scope, or severity—as noted, its use has been mandated through the NIMS since 2004. In addition, the federal government has provided training and funding to support exercises to help responders in jurisdictions across the country develop the experience, knowledge, and skills needed to implement the system. Theoretically, responders have been developing proficiency in implementing the system for nearly a decade. At this stage, it would seem reasonable to expect that the ICS is being used consistently and making positive impacts in response efforts.

The ICS also has been advocated for use worldwide. The assumption underlying this push to see it employed around the globe is the same as the one underlying the mandate for its use in the US: that the system can facilitate a standardised response across all responding organisations in all incidents. Unfortunately, the existing research suggests that this assumption is a faulty one—the ICS may not work as designed all of the time. More than one study identified variation in the degree to which the ICS was used, if it was used at all, in incident response, as well as a lack of use on a daily basis. And, within the limited research from countries other than the US specifically, the findings are mixed, suggesting that, perhaps, the system is not used equally or is helpful in avoiding common response problems in other national contexts either.

There appear to be a variety of potential explanations as to why this variation exists. In fact, the research suggests that the extent to which a diverse range of variables (see Tables 1 and 2 for a list of these variables) is present will influence the degree to which the ICS is used by responding entities and/or is useful in organising the response effort overall. These variables seem to be related to each of the individuals and each of the organisations that take part in a response, the leaders within the ICS, the response network as a whole, the local area, the incident itself, and how the system is implemented. Some of them seem to need to be present before a disaster and some of them seem to need to be present during the response effort. The effectiveness of the system seems to be vulnerable to the absence of any one variable or a combination of them. Whether many of the variables are present is not controlled by one entity but rather is distributed across a number of entities. The specific characteristics of the event also seem to be highly influential. For these reasons, it seems unlikely that all of these variables will be present consistently in disasters and equally unlikely that the system will ever be immune to individual or combined effects. Thus, the ICS may not be as useful an organising mechanism for all on-scene response efforts nationwide as its proponents suggest.

Table 1. Factors related to ICS use during a response

Factors related to the local area pre disaster
• Extent to which local culture has an emergency management orientation (Yarmohammadian et al., 2011). • Extent to which authorities/officials support use of the system (Yarmohammadian et al., 2011). • Extent to which emergency management regulations are stable (Yarmohammadian et al., 2011). • Existence of a legal mandate to implement the ICS (Yarmohammadian et al., 2011).
Factors related to the hazard event
• Duration of response (Buck, Trainor, and Aguirre, 2006; Moynihan, 2008, 2009a). • Geographic scope of impact (Buck, Trainor, and Aguirre, 2006; Moynihan, 2008). • Number of response tasks (Moynihan, 2009a, p. 903). • Extent to which responding entities have prepared for the response tasks confronted (Buck, Trainor, and Aguirre, 2006). • Extent to which convergence has occurred (Buck, Trainor, and Aguirre, 2006; Moynihan, 2009a, p. 903). • Extent of volunteer involvement in response (Buck, Trainor, and Aguirre, 2006; Moynihan, 2009a, p. 903).
Factors related to individuals participating in the ICS
• Type of organisation that participants represent (traditional first responder versus other) (Lutz and Lindell, 2008). • Extent to which participating individuals accept the ICS (Buck, Trainor, and Aguirre, 2006; Yarmohammadian et al., 2011). • Extent to which participating individuals understand the ICS (Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008; Moynihan, 2009a, p. 904). • Extent to which participating individuals have been trained in the ICS (Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008; Moynihan, 2009a, p. 903). • Extent to which participating individuals have trained with one another pre disaster (Buck, Trainor, and Aguirre, 2006). • Extent of individual participant experience in using the ICS (Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008; Moynihan, 2009a, p. 903). • Time between training and use (Lutz and Lindell, 2008).
Factors related to individual organisations

• Pre-disaster administrator/management factors (Yarmohammadian et al., 2011), including the extent to which:
  ◦ they perceive a need for emergency management;
  ◦ they accept the ICS as a means to meet that need;
  ◦ they are knowledgeable about the system;
  ◦ they make resources (in the form of facilities and money) available to support the system's implementation;
  ◦ they are involved in the organisation's daily activities;
  ◦ they speak the same language as employees; and
  ◦ they empower employees to implement the ICS.
• Extent to which training is available for employees prior to a disaster (Buck, Trainor, and Aguirre, 2006; Lutz and Lindell, 2008; Moynihan, 2009a; Yarmohammadian et al., 2011).
• Extent to which employees accept the system before a disaster (Yarmohammadian et al., 2011).

Factors related to the pre-disaster response network

• Number of entities involved in the network (Moynihan, 2008, 2009a).
• Extent of network stability over the life of the response (Moynihan, 2009a, p. 904).
• Pre-disaster working relationships across entities in the network, including:
  ◦ duration of relationships;
  ◦ trust among entities; and,
  ◦ frequency of contact (Buck, Trainor, and Aguirre, 2006; Moynihan, 2008, 2009a; Yarmohammadian et al., 2011).
• Understanding of response situation throughout the network (Moynihan, 2008, 2009a).
• Factors related to leadership, including the extent to which:
  ◦ it is known who is in charge throughout the system; and
  ◦ the person in charge is perceived as legitimate throughout the system(Buck, Trainor, and Aguirre, 2006; Moynihan, 2009a, p. 907).

Source: authors.

Table 2. Factors related to ICS usefulness

Factors related to the local area pre disaster
• Extent to which local culture is compatible with the ICS (Lam et al., 2010). • Extent to which citizenry perceive the system positively (Lam et al., 2010). • The socioeconomic conditions of the local area (Lam et al., 2010).
Factors related to individuals participating in the ICS
• Extent to which participating individuals are paid, career employees of their organisations (Jensen and Yoon, 2011). • Type of organisation participants represent (traditional first responder versus other) (Bigley and Roberts, 2001, p. 1296). • Extent to which participating individuals accept the ICS (Bigley and Roberts, 2001, p. 1295; Buck, Trainor, and Aguirre, 2006).
Factors related to the hazard event
• Extent to which the affected area is considered urban (Jensen and Yoon, 2011). • Duration of the response (Buck, Trainor, and Aguirre 2006). • Geographic scope of the impact (Buck, Trainor, and Aguirre 2006). • Extent to which responding entities have prepared for the response tasks confronted (Buck, Trainor, and Aguirre, 2006). • Extent to which the resources needed are available (Bigley and Roberts, 2001, p. 1296). • Extent to which convergence has occurred (Buck, Trainor, and Aguirre, 2006). • Extent of volunteer involvement in the response (Buck, Trainor, and Aguirre, 2006).
Factors related to pre-disaster command and control

• Factors related to leadership, including the extent to which:
  ◦ authority system built into the ICS is perceived as legitimate throughout the system (Bigley and Roberts, 2001, p. 1296); and
  ◦ entities throughout the system are willing to accept tasks assigned by the person in charge (Bigley and Roberts, 2001, p. 1296).

Factors related to use of the system

• Extent to which system components are added/eliminated appropriately (Bigley and Roberts, 2001, pp. 1286–87).
• Extent to which system components are added/eliminated quickly (Bigley and Roberts, 2001, pp. 1286–87).
• Extent to which positions are added/eliminated appropriately (Bigley and Roberts, 2001, p. 1287).
• Extent to which positions are added/eliminated quickly (Bigley and Roberts, 2001, p. 1287).
• Extent to which individuals are integrated into the response environment at all times (Bigley and Roberts, 2001, p. 1292).
• Power of individuals in the system, including the extent to which:
  ◦ individuals are able to make decisions based on their technical expertise (Bigley and Roberts, 2001, p. 1288); and
  ◦ individuals are able to improvise solutions to new problems (Bigley and Roberts, 2001, p. 1289).
• Understanding of response situation throughout the network, including:
  ◦ regularity with which response is evaluated by entities in the network (Bigley and Roberts, 2001, pp. 1290–91);
  ◦ extent to which leadership in the network understands the response situation overall (Bigley and Roberts, 2001, p. 1292);
  ◦ extent to which information communicated throughout the network is accurate (Bigley and Roberts, 2001, p. 1291); and
  ◦ extent to which information communicated throughout the network is timely (Bigley and Roberts, 2001, p. 1291).
• Extent to which operating procedures are adhered to during the response, including those related to:
  ◦ resource use (Bigley and Roberts, 2001, p. 1289);
  ◦ performance of tasks (Bigley and Roberts, 2001, p. 1289); and
  ◦ operational routines (Bigley and Roberts, 2001, p. 1289).

Source: authors.

Certainly, more quality research is required before any sweeping conclusions regarding the potential of the ICS to facilitate effective response efforts can be reasonably made. The research conducted to date has raised questions about the ICS and suggested what future research might confirm the answers. An effort should be made soon to explore the relationship of the variables suggested in the existing research (see Tables 1 and 2) that may influence: (i) how the system is used, and (ii) towards what ends. This paper has initiated this exercise, but it falls to other scholars to complete it and to disseminate it so that others interested in the ICS throughout the disaster research community might explore the matter further. If scholars were to investigate the influence of the same set of variables on the ICS in many contexts over time, share their results with one another, and integrate the results of each other's work into their own future research, then a point could be reached at which there is some confidence in the identification of the key factors that are related to, explain, or cause variation in the ICS.

It is important that future research operationalise carefully the independent variables measured; and it is equally important that future researchers operationalise carefully and purposefully ICS-related dependent variables, particularly the use of the system as a dependent variable. This will be no small or easy task as the ICS could be operationalised in more than one way, including the number of structures used versus the total if the system were fully implemented (incident command post, joint information centre, multi-agency coordination centre, for instance) or the number of organisational units (such as command staff, branches, task forces, units) used versus the total if the system were fully implemented. Furthermore, ICS use could be measured in more than one way regardless of the operationalisation of the dependent variable—at a minimum, subjectively or objectively.

The ends that the ICS helps to achieve will be a potentially more difficult dependent variable to develop and to test. This issue could be probed by assessing the perceptions of individuals regarding ICS usefulness day-to-day and/or in a response to hazard events or by examining the system objectively (such as outputs related to the system, its performance, or the degree to which its use pertains to the fulfilment of aims). Collecting perception-based data will be far easier for future researchers, and it is for this reason that the existing literature on ICS usefulness probably pursued this approach to data gathering. Yet, perceived value and actual value relative to outputs, performance, and goal attainment are two different and equally important ways of evaluating usefulness. Most of the disaster literature critiques command-and-control models on the basis of their inability to yield positive outputs, to perform well, or to help to meet response objectives. It is in the light of their critiques and the complete absence of research in this area that this study recommends that it be pursued. Regardless of the methods employed or the variables reviewed, future research must be careful to establish clear linkages between the various study elements. It is important that readers be able to assess fully the quality of the work conducted and the significance of the results reported.

Conclusion

This paper has identified the range of written work on the ICS and reviewed the articles published in scholarly peer-reviewed journals that report the findings of empirical research on the system. The research suggests that, despite its allure, the ICS will not fulfil its promise in all response efforts, and that a diverse and complex array of conditions have to be in place pre-disaster and during a response for the system to work as designed. Yet, given the small body of work on the system, the varying design of the studies, and their differing quality, the extent to which the system actually is being used and is helpful in eliminating or reducing common response problems cannot be concluded. Consequently, it is important that future research explore these topics, building on the strength of existing work while avoiding its weaknesses.

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