Common Topics in C2 Doctrine for Emergency Management

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ABSTRACT

A set of publications from the online, English-language, Emergency Management (EM) doctrine has been surveyed to identify common topics in Command & Control (C2) at the tactical and operational levels. Jackson's (2013) ontological and epistemological review of the evolution of military doctrine serves as the analytic lens, enabling a link to be made to resilience and agility. The topics identified were mapped to scientific disciplines in C2. The results could be used to draw up a recommended table of contents for comprehensive EM doctrine, to guide the development of curricula for training emergency managers, and to define the user requirements for supporting information systems. In further research, the results will be compared to a similar, ongoing survey of military C2 doctrine.

Keywords

Tempo, uncertainty, complexity, chaos, resilience, agility.

INTRODUCTION

One of the ways to encourage professionalization is to document experience and best practice as doctrine. Doctrine is defined as "*a belief or set of beliefs held and taught by a church, political party, or other group*" or "*a stated principle of government policy, mainly in foreign or military affairs*"[1]. This paper concerns doctrine in the field of Emergency Management (EM). More specifically, it focuses on the function that the military call Command & Control (C2), i.e. how emergency, disaster, and crisis operations are managed in real time both on-site and remotely. Following Pigeau and McCann (2002), command is defined as "*the creative expression of human will necessary to accomplish the mission*" and control as "*those structures and processes devised by command to enable it and to manage risk*". They point out that most acts, such as decision making, involve an amalgam of command and control, i.e. C2. C2 encompasses both the management process and the supporting socio-technical information system (Coakley, 1991).

Grant (2017) developed a meta-theory of C2 in EM by identifying entity- and relationship-classes from a simple example incident. The result was a list of scientific disciplines relevant to C2. An initial attempt was made to verify this list by comparing it with a set of C2 doctrine publications. However, this set was small and drawn exclusively from the military domain. By contrast, this paper reverses the approach. Existing C2-related doctrine publications from the EM literature are surveyed to identify common topics. For example, topics commonly encountered in the literature include leadership, organization structure, and decision making. Jackson's (2013) ontological and epistemological review of the evolution of military doctrine since the early 17th century serves as our analytic lens, enabling a link to be made to resilience and C2 agility. This approach has the advantage that the source material distills the actual knowledge of experienced emergency managers. Good doctrine publications evolve as new experience is gained, not infrequently triggered by unexpected events and adverse outcomes. The resulting list of topics could be used to draw up a recommended table of contents for comprehensive doctrine publications, to guide the development of the curricula for training prospective emergency managers, and to define the user requirements for supporting information systems.

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[1] From https://en.oxforddictionaries.com/definition/doctrine (accessed 24 May 2018).

The underlying motivation for this research is to scope the doctrine part of a forthcoming textbook on C2. As currently envisaged, the textbook will focus on military operations, on EM, and possibly on the operational management of utilities (e.g. water, gas, electrical power, sewage, telecommunications, and the like). A sister study of military C2 doctrine is in progress, and a similar study of C2 doctrine in utilities may be needed. When the studies are completed, the respective lists of common topics in C2 will be compared.

The purpose of this work-in-progress paper is to identify common topics found in the existing doctrine for crisis, disaster, and emergency C2. The survey is limited to English-language publications on EM at the tactical and operational levels that can be found in the open literature. The paper consists of six sections. Following this introduction, section 2 summarizes the relevant theory. Section 3 describes the sources and methodology used in surveying doctrine publications found in the on-line EM literature, and section 4 summarizes the survey results, linking common topics to scientific disciplines. Section 5 discusses the results, comparing them with a similar survey of military C2 doctrine and looking ahead to near-future operational and technological developments. Finally, section 6 draws conclusions and makes recommendations.

RELEVANT THEORY

Jackson (2013) examines the evolution and nature of the belief systems of western militaries through an analysis of their doctrine. This belief system determines the militaries' culture, how they fight, and their relationships with the state and society. An appropriate belief system results in organizational well-being, good strategy, stable civil-military relations, and victory, while getting it wrong means organizational disfunction, sub-optimal strategy, strained civil-military relationships, and poor operational outcomes and defeat. Lacking an equivalent study specific to EM, we apply Jackson's analysis to EM doctrine.

Jackson (2013) employs ontology and epistemology as the key tools for analysis. *Ontology* is the study of the nature of reality in terms of "a set of concepts and categories in a subject area or domain that shows their properties and the relations between them"[2]. For example, EM may categorize operations into the preparation, response, and recovery phases. *Epistemology* is a branch of philosophy concerned with "the theory of knowledge, especially with regard to its methods, validity, and scope, and the distinction between justified belief and opinion"[3]. It is used in evaluating an operation and assigning it to one of the ontological categories, e.g. to "response" or "recovery".

Epistemology and ontology are interrelated. If a doctrine publication asserts that there is a difference between the response and recovery phases, then this reveals (part of) the ontology in use (Jackson, 2013, p.8). If the organization determines that it is better to produce two separate doctrine manuals, one for response and the other for recovery, then this influences the epistemological process that determines exactly what kind of strategy will be established in each of the two manuals.

Jackson (2013) reviews the history of military doctrine from its emergence in the early 17th century to the end of the 20th. In his second chapter, Jackson identifies four schools of doctrinal ontology, which he labels *technical*, *tactical*, *operational*, and *military strategic*. Three factors distinguish these schools: the doctrine manual's intended audience and scope, the manner in which the manual is applied, and the relationship between the manual and the military's accepted institutional ontology; see Table 1.

Jackson's (2013) third chapter concludes that, despite the differences between the four doctrinal schools, doctrine has consistently employed ontological realism as the basis for discourse. *Realism* is an ontological perspective that emphasizes that the world is structured regardless of whether or not humans perceive and label it. This perspective is often contrasted with *nominalism*, which emphasizes that the identification and labelling of structures are prerequisites to establishing their existence. Militaries are prolific labellers, not aimed at creating reality per se, but more in an effort to understand how it works so as to manipulate it (cf. "shaping the battlefield"). Although not mentioned by Jackson, *critical realism* (Collier, 1994) may be better suited to military C2 and EM[4], because its objective is to actualize real, internal mechanisms to produce desired outcomes in the world, rather than just understanding or labelling structures.

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[2] From https://en.oxforddictionaries.com/definition/ontology (accessed 25 May 2018).

[3] From https://en.oxforddictionaries.com/definition/epistemology (accessed 25 May 2018).

[4] The author is indebted to an anonymous reviewer for this observation.

Table 1.   Four schools of doctrinal ontology (Jackson, 2013).

School	Period	Audience & scope	Application	Relationship to ontology
1st: Technical	1607 to 18th century	Users of technical systems	Instruction manual	(none)
2nd: Tactical	1779 to end Vietnam war	Student officers	Training aid	Implicit
3rd: Operational	1982 to end Cold war	Commanders & planning staffs	Guidance	Explicit
4th: Military strategic	1993 to present	Much broader: from single service, through other services & militaries, to general public	Instrument for analysis	Inquisitive

In his fourth chapter, Jackson (2013) determines that *positivism*, characterized by rationality and objectivity, has provided the epistemic foundation for the four doctrinal schools. Since the start of the 21st century, however, *anti-positivism*, emphasizing relativity and subjectivity, has begun to influence doctrine. Positivist doctrine failed in Iraq, Afghanistan, Libya, and Syria, in part because of the complexity of orchestrating international "coalitions of the willing". The traditional hierarchical organization lost relevance. New information technologies, such as social media, enabled front-line officers in Iraq and Afghanistan to bypass hierarchical processes by crowdsourcing their experiences. Moreover, operations began increasingly to appear chaotic. Repeating procedures, even when the circumstances appeared to be the same, did not yield the same outcomes. Events only seemed to be fully understandable to participants. Perception gains in importance, but is unlikely to be black-and-white and can change over time.

While there were already calls to apply chaos and complexity theory in the late 1980s, the first tentative steps were taken in US Marine Corps doctrine in 1996. Jackson (2013) draws on the work of Bousquet (2008) into *chaoplexity*, i.e. the combination of chaos and complexity. In consequence, military C2 doctrine manuals are starting to stress the role of intelligence and design thinking in inquiring into the nature of the problem, rather than in applying established procedures in solving it.

Jackson's (2013) fifth chapter considers the significance and implications of the emergence of this paradigm shift. Anti-positivist approaches have the potential to alter the way in which a responding organization perceives its relationships with others, enabling better inter-organizational communication. *Mutatis mutandis*, the same should be true for how EM organizations interact with one another. However, Jackson concludes that it is too early to say whether an enduring paradigm shift is underway or whether the anti-positivist approach is a chimera.

In recent years, EM research has been focused on building resilience to cope better in the face of unexpected events. While much of this research has been directed at strengthening local communities during the mitigation and preparation phases, similar lessons could be applied to responding organizations to cope with organizational complexity and chaotic environments. In the military domain, by contrast, the emphasis has been on increasing the agility of the C2 system (Alberts, 2011), rather than on resilience. C2 agility is seen as altering the *C2 approach*, namely the combination of the allocation of decision rights, the distribution of information, and the pattern of interactions among partners to suit changing conditions (Alberts & Hayes, 2006).

SURVEY OF EM DOCTRINE

Sources

C2 doctrine publications were sought by searching the Internet and book suppliers' catalogues (e.g. Amazon.com) using the search phrase "command and control" and variants. This ensures that the publications found are open source. Publications not relating to the EM domain, not in English, or focusing on the political level were rejected. A set of eight EM doctrine publications remained; see

Table 2.

Table 2.   EM doctrine publications surveyed.

Year	Form	Nation	Domain	Reference	Short title
1996	Manual	USA	Disasters	LA EOB	Disaster Response – Command & Control
2001	Book	USA	Disasters	Green	Command and Control of Disaster Operations
2002	Book	SWE	Fire & rescue	MSB	The Elements of Command and Control: The general principles of C2 in fire and rescue operations
2006	Book	USA	Medical	Rüter et al	Medical Command and Control at Incidents and Disasters
2007	Manual	DE	Disasters	DV100	Leadership and Command in Emergency Operations
2008	Manual	UK	Fire	HMG FSO	Fire & Rescue Manual, Volume 2, Fire Service Operations – Incident Command (3rd ed)
2009	Manual	UK	Police	HMG NPIA	Guidance on Command and Control
2012	Manual	UK	Ambulance	HMG NARU	Command and Control Guidance

Methodology

A questionnaire was developed to analyze the EM doctrine publications found, based on Jackson (2013) and other relevant theory. The questionnaire template was as follows:

Reference:

Date:

Audience & scope: system users / student commanders / commanders & staffs / broader

Application: instruction manual / training aid / guidance / analysis instrument

Phase (FEMA):   mitigate / prepare / respond / recover

Level: technical / tactical / operational / strategic / political

Tech metaphor: (none) / clock / engine / computer / network / other (specify):

Ontology: (none) / implicit / explicit / inquisitive

Mentions:

- Tempo: Yes / no
- Uncertainty: Yes / no
- Complexity: Yes / no   (emergence, self-organization)
- Chaos: Yes / no   (non-linearity, positive feedback, feedforward)
- Resilience: Yes / no
- Agility: Yes / no

Decision making: (none) / cyclic / naturalistic / rational

- Cycle: OODA / HEAT / SHOR / PDCA / other (specify):

C2 definition:

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Topics:

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After reading each publication, the questionnaire was filled in. Following Jackson (2013), the publications were classified into one of the doctrinal schools on the basis of their audience and scope, application, and whether or not an ontology was detailed. The disaster phase(s) and management level(s) at which the publication was focused were determined from its stated purpose. To assess the philosophical stance of the publication, notes were made of whether the publication mentioned time pressure (or tempo), uncertainty, complexity, chaos, resilience, and agility. The decision process described in the publication (if any) was characterized and, if cyclic, the type of cycle identified. Following Bousquet (2008), an attempt was made to identify the metaphorical technology (if any) underlying the decision-making process. Definitions of C2, command, and control were noted, if provided. Finally, the common topics were identified by mapping the publication's contents to the scientific disciplines listed in Grant (2017).

SURVEY RESULTS

Doctrinal school

As Table 3 shows, all the publications surveyed fell clearly into the category of Jackson's (2013) third, "operational" school of doctrine. It would appear that, unlike military C2, EM doctrine has not progressed to the fourth school, in which doctrine is aimed at a broader audience at a strategic level. Several of the single-service publications did mention the need to partner with sister services, and two publications identified inter-organizational interfacing or interoperability as a C2 topic.

Table 3.   Results for doctrinal school.

Year	Reference	Audience	Application	Ontology	School
1996	LA EOB	Commanders & staffs	Guidance	Explicit	3rd: operational
2001	Green	Commanders & staffs	Training aid & guidance	Explicit	3rd: operational
2002	MSB	Commanders & staffs	Guidance	Explicit	3rd: operational
2006	Rüter et al	Commanders & staffs	Guidance	(none)	3rd: operational
2007	DV100	Commanders & staffs	Training aid & guidance	Explicit	3rd: operational
2008	HMG FSO	Commanders & staffs	Guidance	Explicit	3rd: operational
2009	HMG NPIA	Commanders & staffs	Guidance	Explicit	3rd: operational
2012	HMG NARU	Commanders & staffs	Guidance	Explicit	3rd: operational

Disaster phase and C2 level

All the publications surveyed focus primarily on the respond phase of a disaster, and cover the lowest-level, tactical level of C2; see Table 4. All but one also cover the operational level. Four publications cover the strategical level as well. One (Rüter et al, 2006) extends to the political level, but this is outside the scope of this paper.

Positivistic stance

With the exception of the UK Ambulance Service (HMG NARU, 2012), all publications mentioned time pressure and the need for tempo in decision making and action; see

Table 5. The exception is perhaps surprising, given that both sister services in the UK do mention tempo in their doctrinal publications. The omission may simply be a case of time pressure being so obvious to the publication author that it does not need mentioning.

As might be expected, the great majority of publications mentioned uncertainty and the need to make decisions with incomplete information. Some publications mentioned information seeking or intelligence gathering as a measure for mitigating uncertainty. By contrast, few publications mentioned complexity or chaos as an influence in EM. None of publications that did provided a detailed description of chaos and complexity or prescribed counter-measures.

Table 4.   Results for disaster phase and C2 level.

Year	Reference	Disaster phase	C2 level
1996	LA EOB	Respond	Tactical
2001	Green	Respond	Tactical & operational
2002	MSB	Respond	Tactical, operational, & strategic
2006	Rüter et al	Respond	Tactical, operational, strategic, & political
2007	DV100	Prepare & respond	Tactical & operational
2008	HMG FSO	Prepare & respond	Tactical & operational
2009	HMG NPIA	Prepare & respond	Tactical, operational, & strategic
2012	HMG NARU	Prepare & respond	Tactical, operational, & strategic

Table 5.   Results for tempo, uncertainty, complexity, chaos, resilience, and agility.

Year	Reference	Tempo	Uncertainty	Complexity	Chaos	Resilience	Agility
1996	LA EOB	Yes	Yes	Yes	Yes		Yes
2001	Green	Yes	Yes				
2002	MSB	Yes	Yes			Yes	
2006	Rüter et al	Yes					
2007	DV100	Yes	Yes				
2008	HMG FSO	Yes	Yes	Yes			
2009	HMG NPIA	Yes	Yes			Yes	Yes
2012	HMG NARU				Yes	Yes	

A handful of publications mentioned resilience or C2 agility. Rather than referring to "resilience" or "agility", a synonym was often mentioned. For example, HMG NARU (2012) referred to resilience as "business continuity management", and MSB (2002) referred to the "principle of (organizational) vitality". Agility was referred to as "flexibility" in LA EOB (1996) and HMG NPIA (2009). However, flexibility typically meant the ability to scale up the initial response as the disaster developed, rather than changing the C2 approach (e.g. from centralized to decentralized decision making).

In summary, there is no evidence to suggest that any of the EM doctrine publications take on an anti-positivistic stance. This is consistent with the finding that all the publications surveyed fell into the third, "operational" doctrinal school.

Decision-making process

Almost   all   of   the   publications   detail   a   decision-making   process;   see

Table 6. Only Rüter et al (2006) failed to mention decision making at all, and Green (2001) referred implicitly to what was evidently a rational decision-making process, but without detailing it. In the majority of publications that detailed a decision-making process, it was invariably cyclic. There was no agreement on what that cyclic process should be. Only two publications referred to a decision cycle that can be found in the decision theory literature, namely Boyd's (1996) Observe-Orient-Decide-Act (OODA) loop in LA EOB (1996) and Deming's (1982) Plan-Do-Check-Act (PDCA) cycle in HMG FSO (2008). In other words, authors of EM doctrine seem to prefer to invent their own decision process.

Table 6.   Results for decision-making processes.

Year	Reference	Cyclic	Naturalistic	Rational
1996	LA EOB	Observe-Orient-Decide-Act (OODA)		
2001	Green			(implicit)
2002	MSB	"Planning cycle"		
2006	Rüter et al			
2007	DV100	Repeat (establish situation; planning; issue orders)		
2008	HMG FSO	Dynamic Risk Assessment (DRA)		
2009	HMG NPIA	Conflict Management Model (CMM)		
2012	HMG NARU	Dynamic Decision Making Cycle (DDMC)		

The cyclic processes consist of a continual repetition of the following (respective) processes:

- OODA: Observe – Orient – Decide – Act.

- MSB's planning cycle: planning – implementation – review.

- DV100's unnamed process: establish situation – planning – issue orders.

- DRA: evaluate situation – tactical mode – select systems of work – risks proportional to benefits? (if not, loop back to select systems of work) – tactical control – additional / alternative measures – review.

- CMM: information / intelligence received – threat assessment – powers & policy – tactical options – actions & contingencies.

- DDMC: information received – risk assessment – policy & procedures – options – action – review.

Metaphorical technology

It proved impossible to assess what metaphorical technology (i.e. clock, engine, computer, or network) underlay the C2 process in all but one of the publications. A handful of the publications pointed implicitly to organization as the underlying "technology". This was especially notable for HMG FSO (2008). The nearest equivalent in Bousquet's (2008) scheme would be the network.

C2 definitions

All but one of the publications gave definitions, either for C2 of for command and control; see Table 7. Most of the definitions emphasized the authority given to the commander over personnel and other resources. While the three UK doctrine publications gave similar definitions, all definitions differed. None of the definitions was drawn either from influential references, such as Pigeau & McCann (2002), or from the military literature (e.g. the NATO Glossary or the US DOD Dictionary of Terms and Abbreviations). Like the decision-making process, EM doctrine authors appear to prefer to invent their own C2 definition. As other researchers have observed, the lack of standardization on definitions, terms, and models hampers interoperability and cooperation between organizations.

C2 topics

The C2 topics were extracted from the doctrine publications by mapping the publications' contents to the C2-related entity-classes and scientific disciplines listed in Grant (2017); see

Comparison with Grant (2017) shows that some topics appear to be missing from EM doctrine. Three key topics that doctrine authors seem to overlook are followership, sociology, and situation awareness. While leadership scores high on the list of topics, careful reading of the EM publications shows that the material on leadership all centres on the commander, and not on his/her subordinates. Modern research into leadership places equal emphasis on the characteristics of the followers (Grant, 2016). Moreover, EM involves interacting with large groups of people, often drawn from a variety of cultures. This calls for knowledge to be applied from the social sciences, e.g. on inter-cultural communication. However, this is not yet reflected in EM doctrine. Finally,

military C2 doctrine places strong emphasis on how incoming information is analysed to build up an up-to-date picture of the area of operations. Known as (gaining and maintaining) "situation awareness", this has been shown to be essential to effective decision making. While threat or risk assessment processes are mentioned in the EM doctrine, the importance of acquiring the "big picture" or a "helicopter view" is absent.

Table 8.

It is possible to score topics by the number of publications referring to them. Ranking the topics in descending score order and choosing a cut-off point (e.g. when at least half of the publications refer to the topic) enables the common topics to be identified, as follows[5]:

- Organization theory. More specifically, organization design and organizational structure (often termed "command structure") is common to every doctrine publication.

- Leadership theory. Leadership is central to C2.

- Decision theory. Almost all doctrine publications detail the decision-making process at the heart of C2.

- Psychology. EM involves directing people – first responders, victims, and volunteers – and to do so successfully requires knowledge and experience of psychology. Human factors become important when technological resources (especially information systems) are used.

- Communication theory. Commanders and their staffs cannot accomplish their mission without communication. Situation reports must be communicated to the control room, and orders must be issued from the control room. Moreover, first responders must communicate with one another to deconflict or synchronize their actions.

- Management theory. C2 involves many aspects of management theory and management science. Key aspects in EM include managing risk, planning, developing and using procedures, compliance with legal and ethical demands, and documentation management.

Table 7. Results for C2 definitions.

Year	Reference	Defines	Definition given	Page(s)
1996	LA EOB	Command	"exercise of complete authority to direct the actions of others"	1
2001	Green	C2	"a process of exercising command and planning and directing operations towards a successful conclusion"	6-7
2002	MSB	C2	"a conscious influence on a system of humans and methods through planning, implementation, and review"	8 & 33
2006	Rüter et al	(none)	(none)	(none)
2007	DV100	Commanding	"a target-oriented process of thinking and acting that is continuously repeated"	19
		Control	"the verification of the decision implementation"	21
2008	HMG FSO	Command	"the authority for an agency to direct the actions of its own resources (both personnel and equipment)"	Glossary (p.141)
		Control	"the authority to direct strategic and tactical operations to complete an assigned function, including (where agreed) other agencies"	
2009	HMG NPIA	C2	"the authority and capability of an organization to direct the actions of its own personnel and the use of its equipment"	6
2012	HMG NARU	C2	"the principles adopted by an organization acting with full authority for the deployment and utilization of its resources"	10

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[5] The author accepts that this procedure is simplistic.

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Table 8.   Results for C2 topics, indexed by scientific discipline.

Entity-class	Discipline	LA	Green	MSB	Rüter et al	DV100	FSO	NPIA	NARU
Person	Psychology	Yes		Yes		Yes	Yes		Yes
	Leadership	Yes		Yes	Yes	Yes	Yes	Yes	Yes
	Decision theory	Yes		Yes		Yes	Yes	Yes	Yes
Technology	Engineering	Yes	Yes		Yes			Yes	
	ICT	Yes		Yes				Yes	
Information	Information theory			Yes			Yes		Yes
	Knowledge management			Yes					
Message	Communication			Yes	Yes		Yes	Yes	Yes
Organization	Org theory	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Management	Yes	(risk)	Yes	Yes	Yes	Yes	(protocols)	(risk)
	Law & ethics		Yes		Yes	Yes			
	Political science				Yes				
State (-change)	Cybernetics / control theory	Yes		Yes		Yes			
	Geography & navigation			Yes					
	Time			Yes					
Relation	Network theory	Yes							

DISCUSSION

Comparison with military C2 doctrine

At the time of writing, a similar study of 13 military C2 doctrine publications is in progress, using the same methodology as described in this paper. While the study is not yet complete, the C2 topics in the publications have been extracted. Using the same ranking scheme and cut-off point, the common topics in military C2 are as follows:

- Organization theory.

- Socio-technical C2 system.

- Leadership.

- Spectrum of C2 approaches.

- Mission & (commander's) intent.

- Technology (and ICT in particular).

- Decision theory.

The top three topics extracted from the EM literature – organization, leadership, and decision theory – also appear in the common topics found in the military C2 literature.

Table of contents and curricula

Based on the common topics found in the EM doctrine publications, the table of contents for a comprehensive doctrine publication could be structured as follows:

1. Introduction

2. Definitions

3. C2 process, including control theory, decision cycles, and naturalistic versus rational decision making.

4. C2 system, including basic systems theory and network theory, personnel, social networks (formal and informal), organization, DIKW (data, information, knowledge, wisdom), information systems, communications networks.

5. Leadership & followership, including social science, psychology and cognitive science, leader-follower relationship, negotiation and conflict resolution, human factors (i.e. man-machine).

6. Organization & management, including organization structures, management (as opposed to leadership), roles and responsibilities, risk management, knowledge management.

7. Norms, procedures, and constraints, including legal and ethical considerations, norms, procedures, doctrine and rules of engagement, and other constraints.

Operational and Technological Developments

There are several foreseeable operational and technological developments that EM doctrine may need to take into account, as follows:

- Operational developments: joint operations (collaborative working with sister services and other partners), collaboration with military forces and with local communities, and the involvement of volunteers.

- Technological developments: autonomous vehicles and robots, information from social media, information from big data and analytics, and the near-term "tsunami of smallsats" for both telecommunication and remote sensing (Klotz, 2018).

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this work-in-progress paper has been to identify common topics in existing C2 doctrine for managing crises, disasters, and emergencies, to scope the doctrine part of a forthcoming textbook on C2. Eight English-language doctrine publications on EM at the tactical and operational levels have been found in the open literature. Using Jackson's (2013) review of the evolution of military doctrine as an analytic lens, common topics have been extracted. The topics mentioned by at least half of the publications include organization theory, leadership theory, decision theory, psychology and human factors, communication theory, and management theory. These topics have been compared with a similar study of military C2 doctrine publications, and both domains share a focus on organization, leadership, and decision theory. To show the potential value of the list of common items, a table of contents has been proposed for a comprehensive doctrine publication. Other possible benefits could be to use the list of common items in guiding the development of curricula for training emergency managers and in defining the user requirements for information systems.

The main contribution of this paper has been to identify a list of common topics in EM doctrine from a variety

of emergency services and countries. The key limitation of this research is that only a limited set of EM doctrine publications are available in the open literature. A larger number could be obtained if access could be gained to a range of EM organizations, improving the accuracy of the study.

Recommendations for further work include increasing the number of doctrine publications studied, extending the study to military C2 doctrine (currently in progress), studying the topics in greater depth, contributing to the standardization of C2-related definitions and of cyclic decision processes, and extending doctrine to take into account foreseeable operational and technological developments. Other researchers may wish to widen the study to business and supply chain management and to extend Jackson's (2013) framework to critical realism and its associated methodology.

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