Bright ICT: Social Media Analytics for Society and Crisis Management

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Abstract. Bright ICT promises a new era of IT adoption and use, however, in this current era of ubiquitous computing and social media platforms, we have witnessed IS users being rendered powerless in the information systems development process and professionally manipulated by large technology companies through the algorithmic structures of social networking platforms. In 1987 Markus & Bjorn-Andersen warned us of the potential of consequences of this situation which are now evident on a daily basis where data privacy is compromised, social media platform content is difficult if not impossible to manage and our political and economic systems are disrupted. This paper outlines an engaged research approach being taken by the RISE_SMA project to develop more innovative theoretical approaches and methods for analysing social media data for the assurance of social cohesion during times of crisis.

Keywords: ICT, Crisis Management, Social Media Analytics, Engaged Scholarship

1 Introduction

1.1 Eras of IT Adoption

In 2012, Hirschheim & Klein [1] wrote about the four eras of information technology (IT) adoption explaining the 40 year history of information systems and the possibility of sharing a history "that would be effective in helping to bridge the communications gap that exists between the different sub-communities that make up the discipline" [1 - p. 188]. Niederman et al. [2] further developed the ideas of Hirschheim & Klein [1] to relabel each IT adoption era to reflect the information systems development (ISD) skills orientation in each era from the "inner circle" of highly specialised IS expertise in the First Era right through to the Fourth Era "where people who previously had little engagement with information technology were suddenly power users" [2 - p 36].

Table 1 highlights the Eras of IT Adoption and the dominant technologies in use as outlined by Hirschheim and Klein [1] and Niederman et al. [2] but it also highlights the location of ISD expertise and power/control as well as the ISD trend for each adoption era. It is interesting to note that the First and Fourth Eras reflect much the same ISD expertise and power/control which is predominantly in the hands of technology companies. It appears we have come 'full circle'.

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Table 1. Eras of IT Adoption and Location of ISD Power – adapted from Hirschheim & Klein [1] and Niederman et al. [2]

IT Adoption ERA	Technology in Use	Location of IS Development Expertise and Power	IS Development Trend
First Era (mid 1960s to mid 1970s) *Computing Inner Circle*	Third generation mainframe (IBM 360); Languages (Assembler, Fortran, COBOL); Databases; Ethernet.	Tech companies – high Business – low Government – low End users - none	Outsourcing (bureaux); Insourcing (vendor controlled); Proprietary networks.
Second Era (mid-1970s-mid-1980s) *End User Revolution*	Minicomputers; Mid-range computers; PCs; Fifth generation computing project.	Tech companies - high Business – moderate Government – moderate End users – moderate	Insourcing (vendor and organisational partnerships) Proprietary networks; Personal computing.
Third Era (mid-1980's to mid/late-1990s) *E-Commerce Gold Rush*	Internetworking leading to the emergence of the internet.	Tech companies – low Business – high Government – high End users – moderate	Insourcing (in house developed); Proprietary networks; Early internet.
Fourth Era (2000 to now) *Ubiquitous Computing*	Internet age; Ubiquitous computing (laptops, netbooks, tablets, smartphones etc); Search engines; Social media.	Tech companies – high Business – low Government – low End users – low	Integrated (formal) enterprise systems; Outsourcing (cloud IT service commoditisation); Commercial internet; Social network (personal) computing.

1.2 IFIP WG8.6 and Information Systems Development (ISD) Research

IFIP WG8.6 has the brief to "foster understanding and improve research in practice, methods, and techniques in the transfer and diffusion of information technology within systems that are developed and in the development process"[1]. Over the years, since establishment in 1993 (during the Third Era of the E-commerce Gold Rush), IFIP WG8.6 scholars have critically researched ISD practice and how it relates to adoption, diffusion, transfer and implementation of IS within society, government, organisations

[1] http://ifipwg86.wikidot.com/about-us last access 5 April 2019

and on an individual level. In recent years membership of the group has been actively consolidating its scholarship in the current Fourth Era of Ubiquitous Computing.

For example, the recent working conferences 'Re-Imagining Diffusion of Information Technology and Systems: Opportunities and Risks' in 2017 at Guimaraes and 'Smart Working, Living and Organising' in 2018 in Portsmouth have taken the scholarship efforts of the group into areas such as social networks, social media, adaptive technologies, work systems, socio-technical approaches and perspectives, digital artifacts and boundaries, the colliding worlds of formal and self-organising systems, ICT4D, disruption and digital platforms, sharing economies, data and project governance, smart objects and systems, digital payments and security and privacy in the digital world. These new developments have reorientated our research agenda to more fulsomely consider the impact of IS and IT on society. The Working Conference to be held in June 2019 in Ghana is themed on 'Bright ICT' for societal benefit focussed on "development of relevant technologies, business models, public policies, social norms, international agreements, metrics for measuring national progress and preventing undesirable activities on the Internet".[2]

In this era of ubiquitous computing and digital disruption, however, large technology companies continue to abuse their ISD power [3] and this has an impact on Bright ICT potential. When looking at the ISD approaches to social media (SM) platforms issues such as data privacy, platform monitoring and surveillance, inability to manage platform content and disruption of political and economic systems are brought into sharp focus daily with a continuing stream of horror stories. Most recently a mass murder that occurred in Christchurch on 15th March 2019 was live streamed by the perpetrator of the murders on Facebook [4] and currently we see the Australian government is grappling with how to deal with the impact of such an action that is facilitated by a SM platform architecture [5]. SM platforms are often criticized more widely: fake news and social bots can manipulate and disturb public communication [6]. At the same time, they generate a large amount of data in real time during disasters – data that is important for the first response to such events. Also, the assurance of social cohesion during a disaster event becomes a problem when the sheer volume of messages generated means that SM messages are not able to be effectively analysed for essential information [7]. This is in part due to the communications architectures of these platforms and current limitations in the development of SM analytics software.

The development of an open and unmanaged communications platform has unforeseen consequences that are now difficult to overcome. The jinn, as they say, is out of the bottle.

On the other hand, we must acknowledge that SM channels have become important communications channels for society. Twitter, Instagram and Facebook have changed public social communication enormously. They are used by individuals as well as by political, economic and scientific players to disseminate information and messages or to find out what others think. It is imperative that we develop suitable analytics approaches that render the users of these systems more aware of their design

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[2] http://ugbs.ug.edu.gh/ifipwg86-2019/index.html last accessed 5 April 2019

consequences and give them the ability to develop more socially positive and "bright ICT" applications of them.

This paper discusses the outcomes of a research workshop held in Sydney on March 6th and 7th, 2019 as part of the research project "RISE_SMA – Social Media Analytics for Society and Crises". RISE_SMA is a multi-partner EU project which aims to improve data analytics methods and approaches to more effectively filter out and use relevant information in an ethical way. A key focus of the project is to involve practitioner stakeholders as research project co-creators and collaborators through the use of an engaged scholarship approach and research methods, so as to effectively shape analytics solutions to meet the expectations of society and crisis responders.

In this paper, we firstly discuss the awareness of power in the ISD process and what this means for SM platform providers and their users. We then go on to highlight the unforeseen consequences of SM platform developments that are a result of the professional manipulation of the ISD process by social media vendors and that result in mistrust of SM messages and information. Next, we discuss how we might overcome these limitations through the RISE_SMA[3] project and its objective of mutual negotiation of the IS development process (in this case SM analytics) describing the project's engaged scholarship approach and live research methods to achieve this outcome. We then outline the workshop findings and conclude the paper with contributions which highlight the beginning of the fifth era of IT adoption and location of ISD power, limitations and areas of future research.

2 Awareness of Power and the Information Systems Development Process

Do the IT power users of today, as described by Niederman et al. [2] have the knowledge and understanding of information systems development to allow them sufficient power and control over the systems that they adopt and use? We would contend that currently this isn't the case. By way of example, we have seen that the development activities behind platforms like Facebook and Twitter remain secretive due to their commercial value as well as a reluctance of SM platform providers to interfere with the structure and dynamics of their platform architectures. This problem will increase even more with the new developments in artificial intelligence and machine learning.

In 1987 Markus & Bjorn-Andersen [8] wrote "The potential of consequences of IS professional power for users is simply too significant to remain unexplored" (p. 498). This statement is still as relevant now as it was in 1987. "Awareness and the perceived legitimacy of power exercise will affect users' responses to [ISD] professionals and their acceptance of the solutions they propose. Furthermore, we believe that interventions that increase this awareness will pave the way to compromises by opening up previously covert issues. This would help prevent negative consequences from power use and help achieve solutions that are acceptable to both parties" (p. 502). When both

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[3] RISE_SMA is funded by the European Union from 2019-2022, https://social-media-analytics.org/ last accessed 5 April 2019

system designers and system users are aware of their power in the ISD process then *mutual negotiation* over the design and use of the system takes place. When designers are unaware, but users are aware of their power then *user resistance* to systems design and deployment occurs. When designers are aware, but users are unaware then *professional manipulation* of users by IS designers can happen but when both are unaware of power then *unintended influence* (lack of successfully negotiated systems outcomes and opportunistic exercise of power) takes place (see Table 2).

Table 2. Awareness of the Exercise of ISD Power – reproduced from Markus & Bjorn-Andersen [7]

		User Awareness	
		Aware	*Unaware*
Designer Awareness	*Aware*	Mutual negotiation	Professional manipulation
	Unaware	User resistance	Unintended influence

In this era of ubiquitous computing and social media we see companies like Facebook and Twitter who are aware of their power over the ISD process and users who have been rendered unaware of this by the algorithmic structures of these platforms. This gives rise to *professional manipulation* of users by technology companies and the development of data analytics approaches which are biased towards producing profits for them and their commercial partners. But are we now seeing a shift towards a new era of ICT adoption and use? Have technology designers been largely unaware of the power of their system designs and are the general users of these systems largely unaware of their social impact?

3 The Unforeseen Consequences of Social Media Design

The unforeseen consequences (*unintended influence*) of SM platforms limit their scope for Bright ICT outcomes for society. Unforeseen consequences include: system personalisation (not mass systematisation) and the difficulty in using SM information and messages for decision making; haphazard facilitation of convergence behaviour; and enablement of anti-social behaviour. We will now discuss each of these consequences in turn.

3.1 Platforms for System Personalization Not Mass Systematization

We know that SM platforms facilitate communication, collaboration and coordination of social networks when information is input to, processed by and output from a SM platform [9]. We also know that information is input and output from these platforms in many different formats, such as tweets, micro-blog posts, wiki posts, maps, etc. While these formats can work very well for personal decision-making, enhancement of

social interactions, and are easily accessible on personal devices (mobile phones, pads and laptops) SM platforms and the information generated by them lack mass 'systematization' i.e. the ability to derive an optimal understanding of the 'facts at hand' for a systemic approach to decision making - such as that found in proprietary business software systems.

So, on one hand the lack of systematization is a major strength of SM platforms as they allow a relatively novice user to propagate, access, use and communicate information in a personal and relevant way. Lack of systematization does, however, also represent a major weakness of SM platforms to address common problems, as the multiple personal 'representations' of information are difficult to combine, interpret and apply to derive common analytical solutions [10]. In many instances the volume of SM information and communications often gets out of hand during a major organisational or societal event, adding further to the difficulty that organisations and governments have in interpreting and using information that is generated in this way [11].

In order for decision-making to be effectively underpinned by the use of SM, these efforts would require a minimum level of systematization of SM platforms that enables and supports the interpretation, combination and application of multiple personal 'representations' into synthesized information and processes. SM has not been designed for mass systemization and decision-making activities, however, and attempts to use it in this way can seriously backfire.

For example, enabling a SM user to upload an image of a flood can greatly enhance the effectiveness of the information they are making available to other SM users; while on the other hand, by adding the GPS coordinates of the user to the message they are uploading, (in order to systematize the information) makes the information take on extra characteristics that once interpreted by an agency may assist in rescuing the user (if they are in imminent danger) or breaching their privacy (if they are not).

3.2 Platforms Which Haphazardly Facilitate Convergence Behavior

Convergence behavior is a phenomenon that occurs during mass events like crises or protests i.e. the spontaneous and mass movement of assets, people, resources (and now information) towards the event area [12]. For instance, in the physical world, many people may converge on an event to look at it unfold [13]. In the virtual world you may use a commonly available social media platform such as Twitter, to converge on and comment on an event.

Subba and Bui [14] explain that some convergence behaviors can be expressed in both physical and virtual worlds, some in the physical world only and some in the virtual world only. They argue that all convergence behaviors i.e. physical and virtual have interaction "properties" which include:

- Local vs Global e.g. an event may be local but its impact global;
- Complementarity vs Substitutability e.g. a doctor may go online as a helper but may not necessarily substitute for a doctor at the scene;
- Formality vs Informality e.g. there is formal agency response versus informal community response;

- Legitimacy vs Illegality e.g. desirable, proper and appropriate versus illegal or morally wrong behaviors;
- Planning vs Spontaneity e.g. planned reactions versus ad hoc and emergent behaviors for example the phenomenon of "spontaneous volunteers"; and
- Centralized vs Decentralized e.g. response on the ground versus collaboration and co-operation online.

They also contend that convergence behaviors are a "double edged sword phenomena" (p. 9) as they provide additional assistance and resources to an event response, but they also bring congestion that can cause problems to manage. These behaviors are also context driven i.e. dependent on the type of event, its impact and the resilience of the community it affects, so that convergence behavior is difficult to anticipate. Event managers "have no other option but to spend time in pulling strings to manipulate the convergence process after the convergence process takes place" (p. 9).

Their conclusions focus on the initial work of Fritz and Matthewson [13] which recommended that an "initial attack on the problems of convergence requires the development of a systematic policy and programs for handling information and communications" (p. 9) as it is the characteristics of event information provision and communication that drives convergence behavior towards an event. SM platforms lack the mass systematization of proprietary business systems to coordinate and communicate information in a systemic manner. They instead produce information and communication in a haphazard, organic and disorganized way often producing emergent, persistent, undesirable and unwanted convergence behavior.

This presents a problem for any individual or organization that wishes to either communicate via, or to use information generated by SM to make decisions and negotiate outcomes in relation to an event. It is virtually impossible to authenticate the source and validate the content of SM generated information and communications, and as such, platforms generally rely on community or government agency moderation of tweets and posts for this purpose [15].

Interaction properties between convergence behavior archetypes in both physical and virtual environments are also directly impacted by the haphazard nature of SM information production and communication i.e. lack of systematization can lend an unpredictability to how people will all negotiate and interact with each other, their communities, governments, organisations and other entities both online and in the physical world, during an event.

3.3 Platforms that Enable Anti-Social Behavior

While it is well known that SM platforms have greatly benefited society and individuals by enabling communication, collaboration and co-ordination activities on an unprecedented scale, due to their design and nature i.e. system personalization, they are also enablers of anti-social, narcissistic and ego centric behavior which manifests itself in activities such as propagation of false information or manipulated images, rumours (including misrepresentation of identity), bullying, harassment and coercion, privacy breaches and much more.

Online social networks and SM platforms provide an enabling platform for anti-social and narcissistic behavior as they provide an information and communications channel that is easily manipulated, controlled and personalized to project an image of an individual that may (or may not) be reflective of that individual. This notion also extends to group and convergence behavior.

This type of convergence behavior through the use of SM platforms is also in evidence all around us on a day-to-day basis through the activity of "trolling" where individuals make off-topic or inflammatory statements to provoke others and disrupt supplementary activities and discussions [16]. A study by Buckles et al. [17] highlights that SM trolls have narcissistic tendencies (as well as other negative behavioral traits). On a wider scale and at a societal level, we have also seen this type of intentional negative behavior play out in terrorist, anti-government, and political manipulation of social media platforms to cause general havoc and disruption to society [7] [12].

3.4   Social Media Distrust

We contend that these three factors, which are the unintended consequences of current SM platform ISD approaches, form a significant barrier to trust in SM platforms for society and crisis managers who wish to use them as potential information and communications platforms for Bright ICT for the common good (see Figure 1).
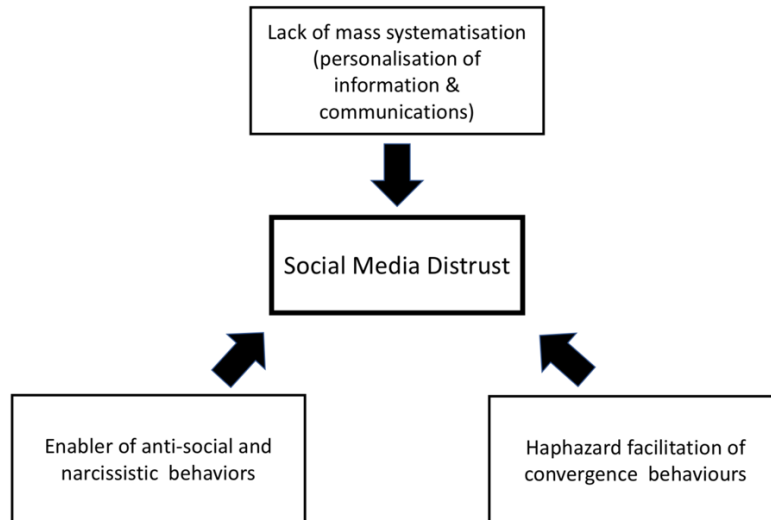
Fig 1. Factors Contributing to Social Media Distrust

Roy Morgan Research [18] surveyed Australians and found that 47% distrusted information provided on social media platforms. Their respondents, top 5 distrust drivers were:
- Fake News / manipulation of the truth;
- False statistics / audience measurement;
- Personal information stolen & distributed;

- Anyone can make claims without any evidence; and
- News is sensationalised / becomes entertainment.

Distrust of SM platforms limits their application for Bright ICT and the associated benefits to society. This distrust is tied to the lack of mass systematisation (social media analytics) and the resulting antisocial and haphazard convergence behaviours that result. How then can we mitigate for the unintended consequences of the fourth era of ICT adoption and use so that SM technologies can more effectively produce societal benefits?

4 RISE_SMA Project Aims and Objectives

The RISE-SMA project seeks to develop more innovative theoretical approaches and methods for analysing social media data which are very important for the assurance of social cohesion during times of crisis.

The project team is tackling the project from a multi-disciplinary/academic-practitioner perspective that will define and scope the project inclusive of multiple viewpoints and which will create analytic solutions including all stakeholders in the ISD process. This will ensure effective outcomes by rendering the users of these analytics solutions aware of their power in the ISD process.

The RISE_SMA project team is co-ordinated by University of Duisburg-Essen (Germany) and consists of partners from Leiden University (Netherlands), the University of Agder (Norway), the University of Sydney (Australia), Queensland University of Technology (Australia), UNISINOS (Brazil) and the University of Padjadjaran (Indonesia) as well as the software development company Virtimo in Berlin (Germany) and the municipality of Kristiansand (Norway).

4.1 Social Methodology and Research Design

We took an engaged research approach to the development of more innovative theoretical approaches and methods for analysing social media data by holding a 2-day workshop with academics and practitioners. This followed a similar live methods design process used in a number of successful projects for the Communications and Technology for Society Research Group[4] including elements such as: 1) imprography - for structured presentations and unstructured discussions; 2) collaboration - bringing together academics/practitioners to co-create a research agenda, problem statement/s and proposed solutions from all perspectives; and 3) creativity - imprography facilitates all workshop participants to put their ideas and suggestions forward without "fear of failure" [19] [20].

During our workshop researchers/practitioners engaged with each other without taking control of the course or direction of the discussion, emphasizing and respecting the

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[4] https://sydney.edu.au/business/our-research/research-groups/communications-and-technology-for-society.html

equality of experience of all participants from their own perspective "No input to the workshop is superior to any other" [20].

Our live research methods approach to workshop design differs in important aspects from other workshop methods where usually an academic research team sets the research agenda and controls the workshop structure and discussions [19]. Our approach to the workshop documented for this paper aims for the co-creation and reframing of problems and solutions by all workshop participants. Hence, it is not limited to simply analysing existing knowledge and modes of thought. Importantly, our engaged scholarship approach allows for new thinking about and deep understanding of the research area that participants i.e. academics/practitioners develop through their participation in the workshop.

Our approach also presents and re-presents the research agenda, problems and solutions in real-time; as participants work through cycles of discovery, framing and co-creation throughout the workshop. The workshop design was as follows.

Location, Date and Timing: Sydney Australia, 6th & 7th March 2019 from 10am-4pm.

Purpose: To develop more innovative theoretical approaches and methods for analysing social media data for the assurance of social cohesion during times of crisis.

Participants: 12 practitioner and academic participants (50/50 split) with experience in: emergency services; social media management and analytics; industry; government emergency co-ordination; geospatial information management; software development; and disaster recovery research.

Research Team: Two senior researchers, one post-doctoral researcher and three PhD candidates from Information Systems with an emphasis on IS in crisis situations and methods as they apply to data analytics.

Structure:

Day 1- Sessions

- RISE_SMA Description and Objectives - project co-ordinator and administrator (University of Duisburg Essen);
- Workshop Introduction and Outline (15 minutes) - project co-ordinator (University of Duisburg Essen) and team leader (University of Sydney);
- Practitioner Presentations - areas of importance for RISE_SMA - all practitioners;
- Aggregation, prioritisation and representation of practitioner areas of importance i.e. similarities, differences, systems integration issues, relationship of areas of importance to experience etc. What would a practitioner "wish list" for RISE_SMA outcomes look like? - all workshop participants; and
- Social Media Research Presentation: Issues, Trends and Future Directions – project co-ordinator (University of Duisburg Essen) and team leader (University of Sydney).

Day 2 - Sessions

- Practitioner Areas of Importance - Alignment With RISE_SMA Project Objectives i.e. what issues align, what issues don't align, why do we think this is and

what should we do about it? - discussion facilitated by project co-ordinator and administrator (University of Duisburg Essen);

- Academic Presentations - Current and Future Research That Relates to RISE_SMA Objectives - all academics; and
- RISE_SMA Planning and Next Steps - all workshop participants.

Preparation: All practitioners were asked to prepare three PowerPoint slides outlining: 1) what social media means to your organisation (what do you use it for currently?); 2) key issues, problems and expectations with the use of social media in your organisation (what needs improving for the future?); and 3) your "wish list" of key outcomes for the RISE_SMA project. All academics were asked to prepare 2 PowerPoint slides outlining: 1) what research you're conducting now that relates to RISE_SMA; and 2) what you'd like to research in the future in the context of the project.

Expected Research Outcomes: The RISE_SMA project's official kick off workshop is scheduled for April 2018. In order to create a good basis for this kick-off event, the project co-ordinator (University of Duisburg-Essen) as well as research partners from Communications and Technology for Society Research Group (University of Sydney), conducted a joint workshop with practitioners from crisis social media, communications and emergency information managers to trial an engaged scholarship approach [22] [23] [20]. One goal was to firstly better understand issues surrounding the use of SM platforms for crisis communications as well as to co-create project areas of focus with both academic and practitioner team members. We utilised a "live" collaborative form of engaged scholarship i.e. workshops, so that all academic/practitioner project participants could develop insight together regarding the unforeseen consequences of SM platform, inform each other and develop a mutual understanding of research problem while formulating a focus for comprehensive and relevant analytics solutions. "We also believe that diffracting academic and professional expertise contributes to each other's development and can contribute to generating innovative ideas" [22 – p. 114]

In sum, this workshop was focussed on developing a better understanding of the problems and issues of social media use for crisis management and situational awareness purposes; and then on co-producing and framing a research agenda with all of the workshop participants.

5   Results and Discussion

The workshop gave us the opportunity to include all stakeholders in the process of project creation and agenda setting as well as identifying areas of focus for the production of useful and relevant analytics. It was facilitated by the two senior researchers on the project team and there was a planned agenda order.

This was not strictly followed so as to allow workshop participants to 'free wheel' with ideas of importance if and when they occurred out of the workshop sequence. Practitioner presentations assisted participants to better understand the problems associated with SM platform use for society and crisis management and academic presentations assisted participants to better understand what SM research trends might be important for the future.

5.1 Workshop Insights

Over the course of the 2 days of the workshop the group created an assessment of the current situation of SM platform use in crisis and emergency management. The assessment highlighted that:

- SM communications management within crisis management agencies can have many different areas of focus e.g. roles such as public information officer, warning officer, public intelligence and social media intelligence analyst are created to manage SM communications to and from the general public;
- Crisis management agencies continually improve their SM analysis procedures based on their own experiences and are often driven by a high degree of self-organisation and intrinsic motivation;
- Due to the current cost of SM analytics, government may use a combination of proprietary and open source analytics packages to work with social media information. Use of appropriate public domain tools to analyse SM communications, however, may have associated privacy issues or they may be too complex to use and/or be unsupported;
- Spread of misinformation on SM platforms is an ongoing issue i.e. people may not trust SM platforms, but they do trust their online local communities/local groups where rumours may take root and be difficult to quash;
- Moderation tools like SpreadSocial are essential to the connection of all crisis management agency pages and Twitter accounts;
- Community expectations of the efficacy and use of SM platforms for crisis information seeking and reporting must be continually managed i.e. not just during a crisis;
- Well-being of crisis agency social media officers must be continually managed i.e. negative comments especially police postings about crimes / missing people can have a deep psycho/social impact on officers dealing with these communications;
- SM analytics training for government SM managers is paramount in order to effectively gather community intelligence for situational awareness as well as how to structure outgoing information and messaging; and
- Incident control and situational awareness through SM use needs to be managed over: a) multiple jurisdictions i.e. national, state, regional level and locally and 2) various threat types and levels.

As a result of this current assessment of SM adoption and use, the group highlighted possible research opportunities and areas. These included the co-development of analytics methods, frameworks and approaches that addressed:

- Identification, credentialing, organizing, managing, training and utilizing of digital volunteers (from all over the world) for public good;
- E-learning training modules for SM analytics approaches, frameworks and techniques;
- Automated threat analytics;
- Big data analytics (including geospatial data) i.e. more effective assessment and use of high volumes of information (text, image, video, sound) generated by SM

platforms e.g. how validate and assess photos, information etc. early enough to adequately and accurately inform situational awareness;

- 24x7 monitoring and assessment centre capability with trained people;
- Community education regarding tools and techniques on: 1) how to upload useful crisis information, and 2) how to receive and use information e.g. how to stay cool in a heat wave;
- Creation of bots to manage and influence SM communications e.g. a ChatBot to disseminate warnings or interact with people in trouble;
- Use of geospatial information with SM data to assess crisis situations (location, spread, impact etc.), locate individuals impacted by or victims of the situation, dispatch resources to the crisis location through a multi-disciplinary approach to develop systems to combine social media with GIS data; and
- Techniques and approaches to integrate location information into SM posts as a matter of priority i.e. management of the debate over data protection vs importance of data use in crisis management

5.2 Post Workshop Analysis of Research Notes and Workshop Materials

Post workshop, our research team (two senior researchers, one post-doctoral researcher and 3 PhD candidates) met to debrief the workshop and further synthesized and refined workshop outputs and our notes to highlight the following key areas:

Multiple research agendas for the assessment and development of social media analytics for Bright ICT in society for crisis management became evident as we analysed the workshop brainstorming and clustering activities which mainly occurred on Day 2. These research agendas included:

- Digital volunteers and systems to manage them i.e. a virtual operations support team (VOST). This agenda is of critical focus as crisis management agencies already have tried and tested systems to recruit, train and manage their existing and considerably skilled volunteer teams. Digital volunteers, whether present online or in person, can supplement agency volunteers but they present a particular challenge for crisis managers;
- Development of SM bots as a benign and useful influence on social media crisis communications; and
- Social media crisis communication for the development of situational awareness.

Multiple project areas were also identified by workshop participants to be pursued by the RISE_SMA research group which include:

- Development of 'proof of concept' training bots for crisis management SM analysis purposes - in conjunction with RISE_SMA project partners and IEERG member institutions and their student programmers;
- Organizational framework development for a VOST implementation. A possibility might be to look at matching resources/capability with demand e.g. Uber or AirBnB model could be useful but what are the limitations; and
- Creation of multiple 'fact sheets' highlighting the current 'state of the art' in plain English (and echoing the three research agendas) for consumption by practitioners and the general public on the current status of: Digital volunteers and

VOST; Intelligent agents in crisis communications e.g. chatbots; and SM models for crisis communications i.e. integrated situational awareness/intelligence.

6   Contribution, Limitations and Future Research Directions

6.1   Contribution

It would seem that we are now entering a fifth era of IT adoption and use of *social influence.* This presents us with some difficult issues and unintended consequences to overcome. Users of technologies in the fourth era have been intentionally professionally manipulated in their understanding of the design architectures and choices made by technology companies, as they have had little awareness of the ISD processes behind these platforms. The technology companies, however, also seem to have been largely unaware of the utility of their system designs to disrupt society by allowing negative and socially disruptive behaviour to flourish without consequence [24]. Added to this, we are now bringing more smart sensors online, embedding more goods with computing power as well as developing and launching applications that depend on location-based services that can track individuals via GPS.

Table 3. Fifth Era of IT Adoption and Location of ISD Power

IT Adoption ERA	Technology in Use	Location of IS Development Expertise and Power	IS Development Trend
Fifth Era (now into the future) *Social Influence.*	Ubiquitous personal computing (smart phones); Search engines; Social media; Smart sensors; Spatial systems; 5G communications; GPS tracking; Digital imaging; Rapid visualisation; Artificial intelligence; Satellites; Computer embedded "things" (cars, protheses, etc).	Tech companies – low Manufacturing companies - high Data/information services - high Business – low Government – low End users – low	Cloud computing; Social networks: Location-based services; Corporate data harvesting and profiling; Shared marketing intelligence; Corporate and personal brand curation; Mass social manipulation and influencing; Embedded autonomous systems; Digital twin simulation (for design and development purposes).

This situation has ultimately led to general user distrust of SM platforms, which then impacts their usefulness for crisis communications. Development of digital volunteering and VOST organisational frameworks, targeted bot applications and appropriate SM management models and frameworks all offer potential solutions to the restoration

of trust in social networking platforms and new technological developments for crisis communication purposes. As the fifth ICT adoption era of social influence gains momentum, it is of critical importance that we develop frameworks, approaches, applications and analytics to deal with the unintended consequences of the fourth era and to enable Bright ICT outcomes for society. RISE_SMA is clearly focused on this task.

6.2   Limitations

We are aware that our workshop results depend on the opinions and ideas of participating stakeholders and their operating context. The Australian setting of crisis response and management, therefore, has been the starting position for discussion of this topic. In our opinion this workshop format was quite effective, however, to identify the existing lack of knowledge and requirements for action regarding the use of SM platforms in crisis situations from both an academic perspective and practice-driven point of view.

This workshop presented us with a unique opportunity to work with practitioners to co-develop a deeper understanding of the critical issues, problems and limitations with SM use for crisis communications, management and situational awareness purposes (and hence better facilitation of the application of SM platforms to Bright ICT outcomes). It also enabled us to co-create, with experienced practitioners and researchers, a relevant data analytics research agenda and identify research projects of importance to practice for RISE_SMA to focus their efforts on.

6.3   Future Research Directions

This workshop has also enabled us to take an engaged scholarship approach and utilize a live workshop method that we had previous project success with. There is potential for this approach and method to be replicated and utilized by other RISE_SMA partner institutions at other locations to assess whether the same research agendas and potential projects might be applicable in other jurisdictions or whether there might be significant differences between jurisdictions.

An area of particular importance for the future direction of the project confirmed by our workshop participants is *identifying and defining mechanisms for organization/self-organization of digital volunteers in crisis situations via SM platforms.* SM platforms have enabled self-organizing group structures, outside of the already well established and effective volunteer teams in crisis management agencies, where individuals and communities may take an active role in a crisis through their convergence behaviour, for example as happened in the Christchurch Earthquake in 2011 with the Student Volunteer Army [25]. It is expected that new information and ideas will emerge from the RISE_SMA project on how individuals and communities organize via SM in crises and disaster scenarios, as will factors influencing the future role of SM to enable resilient communities. For instance, Taylor et al. [26] explored public SM use from January to March 2011 in Australia and New Zealand during a time where a number of natural disasters occurred. They focused in particular on the 'Cyclone Yasi Update' Facebook page, which was a community-run disaster information hub. This hub combined official information with personalized 2-way communication (which also facilitated the quashing of rumors) and orientated people to the applicable accurate sources of information.

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This provided "a single initial trusted point of contact for people who needed to prioritize their activities to protect themselves, rather than spend time searching for information" [26 – p. 22]. Examples such as the 'Cyclone Yasi Update' Facebook community information hub, can teach us valuable lessons about digital volunteers. Convergence behavior as it relates to the principles of self-organizing systems is a little understood topic that has the potential to make a major contribution to enhancing the use of SM to organize digital volunteers in crisis situations.

The changing nature of communities from groups of close friends and relatives to extended group members of networks, and how community dynamics are affected by SM in times of disasters, is intricately bound up with, *crisis agency organization and management practices* and *convergence behavior archetypes and their properties*. There is an urgent need to study these management practices and their interrelationship with these archetypes and their evolution in the online world. This is particularly critical if we are to better understand the interplay of convergence behaviors, information and communications personalization characteristics of SM and the enablement (or disablement) of anti-social behavior that occurs during a disaster.

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