Developing Social Media for Community Based Environmental Monitoring

Naomi Augar
Martin Fluker
College of Business
Victoria University
Melbourne, Australia
Email: naomi.augar@vu.edu.au; martin.fluker@vu.edu.au

Abstract

This research-in-progress paper examines the use of social media to support a Community-Based Environmental Monitoring (CBEM) system that operates within National Parks in Australia. The system and its social media presence have been in operation for several years and the Facebook page has over 250 followers. However, limited engagement with postings and modest growth of the Facebook following has prompted further research. This initial exploratory case study used a survey to examine the social media usage patterns of CBEM system users and their perceptions of the CBEM social media presence. The study found that while almost 90 per cent of respondents reported using Facebook on a regular basis, only a quarter followed the CBEM social media presence. Based on the results, potential system enhancements and future research are proposed.

Keywords

Social media, community-based environmental monitoring, citizen science, crowdsourcing, ethics.

INTRODUCTION

In Australia, almost three quarters of households have internet connections and internet uptake in households in urban centres is consistently stronger than in regional centres (Australian Bureau of Statistics 2011). In a country of 23 million people, there are over 12 million internet subscriptions and download rates are increasing at a rapid rate (Australian Bureau of Statistics 2013). Smart phone penetration is high in Australia, with two thirds of the population owning a smart phone (Ipsos MediaCT 2013).

Social media, such as Facebook, and micro blogs like Twitter, allow users to post messages and interact with others online (Kaplan and Haenlein 2010; Wollan 2011). Social media is penetrating new areas of life beyond connecting with friends and family. Increasingly, Australians are connecting with businesses via social media (Neilsen 2012). Politicians are communicating with constituents and potential voters via Facebook and Twitter (Steiglitz et al. 2012). Non-profits and environmental groups are also leveraging social media to better engage with stakeholders (Guo and Saxton 2013; Nah and Saxton 2013). Social media is also being used to support tourism marketing for travel agents (Huang 2012) through to supporting tribal tourism engagement (Pratt et al. 2012).

Australia is well known for wilderness areas of international significance (Cloesen 2003), which are a key tourism draw card (Tourism Australia 2013). It is essential to protect the natural environment for generations to come (Cloesen 2003). According to a key Australian Land Management Agency, Parks Victoria (2009, p.83), "community participation and engagement is the lens through which all work in the parks are planned and implemented". This paper examines an Australian based Community-Based Environmental Monitoring (CBEM) system that leverages social media to enable Land Management Agencies such as Parks Victoria to engage with stakeholders and park users who have a shared interest in conserving and maintaining the natural environment.

Despite the system being in operation for some time and having many contributors, the social media presence has a modest following. The purpose of this initial research is to explore who the users of the CBEM system are, how they use social media in general, whether and how they use the CBEM social media presence and how the social media presence might be improved. The paper is organised as follows. The next section introduces the literature that framed the study. The CBEM social media presence that is the focus of the study is then described, followed by the methodology and results of the research. The paper concludes with a discussion of the findings with respect to the literature and a summary that signals future research.

BACKGROUND

In recent years social media has changed the way individuals and organisations communicate (Emamjome et al. 2013). Increasingly, social media is being used to promote awareness around issues and causes, and to rally individuals to action (Goolsby 2010). It provides a mechanism to gather real time information that can inform decision making about large events and critical situations (Haghighi et al. 2013). Social media can also be used to form online communities which can allow users to connect with others who share similar interests (Goolsby 2010; Jung-Eun and Hee-Woong 2013). Participation in such online communities and social media has been linked to enhanced sense of well-being and increased social capital (Ding et al. 2012).

Crowdsourcing and citizen science

Increasingly, research organisations are using social media to publicize projects and recruit and communicate with participants. Mobilising distributed individuals to participate on a project via the internet is often referred to as crowdsourcing. Crowdsourcing involves using internet technology to advertise and secure resources to complete tasks, often times for a fee (Howe 2006). Citizen science builds on this idea, describing a process whereby lay people collect, analyse and/or disseminate data as part of a scientific project (Haklay 2013), often voluntarily. Haklay (2013), points out that many volunteers will have an interest in the subject of the project under investigation and a desire to learn more about it. Typically, volunteers are males with high education levels and standards of living. Haklay (2013, p.113), also notes a phenomenon of 'participation inequality', where some volunteers contribute far more than others.

Citizen science projects can by classified into one of four levels of engagement (Haklay 2013, p.116):

- *Level 4 – 'Extreme Citizen Science'* – Volunteers participate in defining the problem, analysing and collecting data
- *Level 3 – 'Participatory Science'* – Volunteers help to define the problem and collect data
- *Level 2 – 'Distributed Intelligence'* – Volunteers provide basic analysis services
- *Level 1 – 'Crowdsourcing'* – Volunteers act as sensors or provide computing resources

Many citizen science projects fall into the Level 1 category whereby the volunteer collects images, or similar observation based data that is forwarded onto scientists for analysis. However, as technology has advanced and science education standards have improved, the ability for lay people to conduct analysis as part of citizen science projects has increased (Haklay 2013).

The ethics of crowdsourcing

Crowdsourcing has affordances including immediate access to a broad range of participants for relatively low or no cost (Harris and Srinivasan 2013). Where crowdsourcing is applied to scientific endeavours, citizen science, benefits such as public engagement and awareness around social issues can be achieved (Riesch and Potter 2014). However, there are also ethical considerations associated with harnessing 'the crowd' (Harris and Srinivasan 2013; Harris 2011; Riesch and Potter 2014; Schmidt 2013; Silberman et al. 2010).

The challenges facing crowd workers (people who complete crowd sourced tasks) are relatively well documented. Issues such as exploitation, where individuals receive poor remuneration (Harris 2011; Silberman et al. 2010) and are sometimes deceived by recruiters into sharing personal information (Silberman et al. 2010), or not paid for work they have completed (Silberman et al. 2010), are not uncommon in crowdsourcing literature. Crowd workers may also be recruited to do unethical tasks (Harris and Srinivasan 2013; Silberman et al. 2010) such as posting fake product reviews (Harris 2011), conducting surveillance (Harris and Srinivasan 2013; Harris 2011) or writing assignments for students (Lancaster and Clarke 2012). Given the anonymity and diversity of the crowd and the relative absence of policing, ethical standards vary, giving rise to what some may consider to be unethical practices (Harris and Srinivasan 2013; Harris 2011).

There are challenges facing those who are recruiting crowd workers. Harris and Srinivasan (2013, p.68) point out that crowd sourced contributions can be of poor quality, highlighting issues such as "worker spam", where random contributions that do not meet the specified requirements are supplied. Poor quality data can compromise citizen science endeavours, causing concern for project leaders (Riesch and Potter 2014). The collaborative nature of crowd sourced activities also gives rise to discussion around who owns the intellectual property that is generated by crowd based activities (Riesch and Potter 2014; Wolfson and Lease 2011).

Social media engagement

While setting up a Facebook page and alerting project participants to its existence is straight forward, the ability to continue to attract followers and engage them in active discussions is not always easy. Kaplan and Haenlein (2010, p.65) note that "being active", posting regularly and responding to the posts of followers, is essential to achieve success with social media. However, not all posts are created equal. Kaplan and Haenlein (2010, p.65) highlight the need for page Administrators to be informal, funny, humble, honest and to try to tap into what interests their users. Mangold and Faulds (2009) encourage Administrators to support and promote causes and issues that users feel are important. Finally, Kietzman et al. (2011) recommend monitoring social media closely to ensure that issues that arise are responded to in a timely manner.

However, even the most dynamic and engaging of social media presences may fail to develop a following. Individuals are increasingly faced with multiple channels of information on a daily basis. Television and print based media now competes with social media for an individual's attention. Individuals must manage their access to such channels to avoid information or conversational overload (Jones et al. 2004). While some individuals choose not to participate online (Harris 2013), many Australians use social media such as Facebook on a regular basis (Cowling 2013).

While individuals are increasingly following businesses and organisations on Facebook (Augar and Zeleznikow 2013), such engagement does not necessarily drive an individual's Facebook use. Rather research indicates that the majority of users are focused on maintaining existing friendships, connecting with family and meeting new friends, e.g. (Augar et al. 2014; Joinson 2008).

Australasian CBEM projects

There are several CBEM projects in Australia, Asia and beyond e.g. (Abon et al. 2012; McKenzie et al. 2000; Pecl et al. 2010; Savan et al. 2003; Siebeck et al. 2008). In Australia for example, the Range Extension Database for Mapping Species Movements (REDMAP) project, collects photos taken by community members of fish thought to be outside the area in which they have historically been known to live in (Pecl et al. 2010). The project aims to catalogue unusual fish movements and engage scientists in exploring the impact of climate change on fish locations (Pecl et al. 2010). Beyond the scientific objectives, the project aims to increase awareness, education and communication around marine issues in the community and beyond (Pecl et al. 2010).

SeaGrass-Watch is a Queensland, Australia based project that monitors the health of seagrass habitats. Community members are trained to monitor seagrass habitats and report data back to the project (McKenzie et al. 2000). Since its inception in 1998, the project has grown to involve sites in 25 countries (Seagrass-Watch 2014). A similar initiative, CoralWatch, is a global project that encourages community members to log and report coral health levels determined using a standardised colour chart provided by the project team (Siebeck et al. 2008). By reviewing the change of coral colour at a particular location over time, experts can assess the health of a reef (Siebeck et al. 2008). Another project in the Phillipines engages local residents in monitoring rainfall to try to minimise the impact of sudden flood events on the local population and environment (Abon et al. 2012).

Heath, Singh and Ganesh (2014, p.584) note that "…social media engagement involves the communicative exchange of ideas". User engagement with a project via social media can be critical to its success. Ideally, users are regularly uploading data and/or responding to project postings via social media. Three of the CBEM projects discussed previously use social media to engage with the community (REDMAP 2014; Seagrass-Watch 2014; University of Queensland 2014). It should be noted that the use of social media is not required to support crowdsourcing and citizen science. However, it is being used to engage with participants in several current citizen science projects (REDMAP 2014; Seagrass-Watch 2014; University of Queensland 2014), including the one examined as part of this research.

The CoralWatch project Facebook page had over 2,300 followers at the time of writing, with Administrators posting several times a week about the project and marine issues around the world (University of Queensland 2014). Despite a significant following, user engagement with the page was modest, mostly consisting of 0-30 likes on posts with the occasional comment or share. The Seagrass-Watch page attracted a far more modest following of 141, but Administrators had not posted on the site for over a year at the time of writing (Seagrass-Watch 2014). Finally, rather than using a Facebook page, the REDMAP project developed a Facebook app, that allows users to upload images to the project database via their Facebook account (REDMAP 2014). At the time of writing 62 users had installed the app (REDMAP 2014). The following section introduces the CBEM system that is the focus of the research.

THE CBEM SYSTEM AND SOCIAL MEDIA PRESENCE

The CBEM system has been operating in national and regional parks in Australia for six years to date. It is currently operational in over 90 locations. The system comprises physical installations of photo-points in parks, supported by an email, web and social media presence. At each park location, chest height wooden posts are installed adjacent to areas of interest as specified by Land Managers. Examples of these locations include trails or walking paths subject to flood or erosion, areas that are ear-marked for repair work in the near future, or parklands subject to invasive plants or other environmental pests. The wooden posts are signed with messages inviting park users to place their own camera or mobile phone in the universal camera cradle on top of the post in order to take a photo of the specific area being monitored. The visitor is then directed to send the photo via email to the system Administrator. When the Administrator receives an image from a new contributor for the first time, they are invited to join the CBEM social media presence (via email) and their contact details are added to a participant database. Contributors can opt in or out of participation on the Facebook site at their own discretion. The Administrator uploads both community contributed and Administrator contributed photographs into web albums (one album per photo-point) so that they can be viewed via links placed in the social media feeds. Copies of new photos are also emailed to relevant Land Managers.

After the CBEM was first implemented the Administrator established a social media presence across a number of platforms including Facebook, Google+ and Twitter as well as a photo sharing web site. However, in the years since establishing the system, the social media presence has been refined down to just Facebook which is complimented by Picasa web albums, that host contributed photos. From an administrative perspective, the system is functional and it is now simple to manage. The Administrator updates the Facebook page between one to three times a week. Posts relate to the latest photographs from CBEM sites, updates on new installations, environmental issues, feedback received from contributors and community engagement activities.

At the time of writing the page had attracted 265 followers. Most posts from the Administrator attract one or two likes from followers. However, comments in reply to posts are rarely received and posts are rarely shared. This research seeks to explore opportunities to enhance engagement with the social media presence by exploring stakeholder use of social media and perceptions of the CBEM social media presence. The findings of the work will inform the future development of the CBEM system. However, while the results are not intended to be representative or generalizable, it is envisaged that the findings may be instructive to other non-profit or research based organisations seeking to enhance engagement with stakeholders via social media. The next section describes the methodology used to explore stakeholder perspectives.

METHODOLOGY

Leedy (1997, p.157) notes that a "…case study is conducted to shed light on a phenomenon, be it a process, event, person, or object of interest to the researcher". Benbasat et al. (1987) posit that a case study methodology is a suitable method for exploring Information Systems. Therefore, a single exploratory case study methodology (Yin 2009) was adopted to gain insights into park visitor use of social media and their perceptions of the CBEM system's social media presence. The focus on the user perceptions and experience of the system aims to develop the system using their feedback; a socio-technical approach (Bostrom and Heinen 1977a; Bostrom and Heinen 1977b). While the broader issues relating to the environment were also explored as part of the research (Augar and Fluker 2014), this paper reports the initial findings relating to social media.

While interviews can provide in depth insight, surveys are able to provide access to a large cross section of participants in a scalable, time efficient manner. Therefore, a voluntary, anonymous, online survey comprising multi and single answer questions alongside open ended questions was administered via Survey Monkey™ to gather data. Ethics approval was sought and received for the survey from the university ethics committee. Research participants were purposively selected; an invitation to complete the survey was emailed to all park users who had contributed a photo to the system (n=120; participants registered in the administrator maintained database). A total of 42 park users completed the survey. Data was analysed via a descriptive, univariate approach (Babbie 2007; Jennings 2010). Single and multi-answer responses were transformed into frequency distribution charts to identify trends and user preferences. Open answer questions were manually classified using a *coding in detail* approach (Bazley 2007, p.69) to uncover emerging themes.

This study focuses on a limited sample of CBEM system users and the results are presented to provide insights into users and their perceptions of the CBEM social media presence, with the goal of further developing the system. The sample size and composition is such that the results are not representative, nor generalizable. The following section presents the survey results.

SURVEY RESULTS

Sixty two per cent of respondents were male. The majority were aged between 31 to 40 years of age, as shown in Table 1. Eighty seven per cent of respondents were from Australia; the remainder were tourists from the USA, Germany, New Zealand and other European countries. The vast majority of Australian respondents lived in and around Melbourne and Geelong in Victoria. Almost 40 per cent of respondents described themselves as having professional occupations. While technical and teaching were the next most frequent occupations reported, at 13 and 10 per cent respectively.

Table 1. Respondent age

Age	Percentage of respondents
18-20	2.6%
21-30	12.8%
31-40	41%
51-60	15.4%
60+	12.8%

Respondents were asked to indicate how often they used social media such as Facebook, YouTube and Twitter, the results are shown in Figure 1. The majority of park users, 65 per cent, used social media at least once a day. Most responses in the other category indicated that they used social media only occasionally with only two indicating that they never used social media.

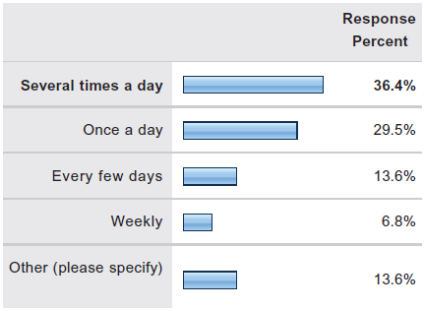

Figure 1: Social media use frequency

Respondents were also asked to indicate which social media sites they used on a regular basis. Facebook was used by the vast majority of respondents (84 per cent) as shown in Figure 2.

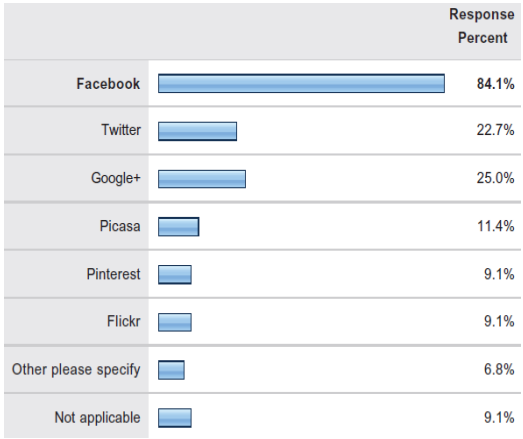

Figure 2: Social media sites used on a regular basis

One question asked users to describe how and why they used social media. Respondents could select more than one option in their response. The vast majority of respondents indicated that they used it to keep in touch with family and friends as shown in Figure 3 below.

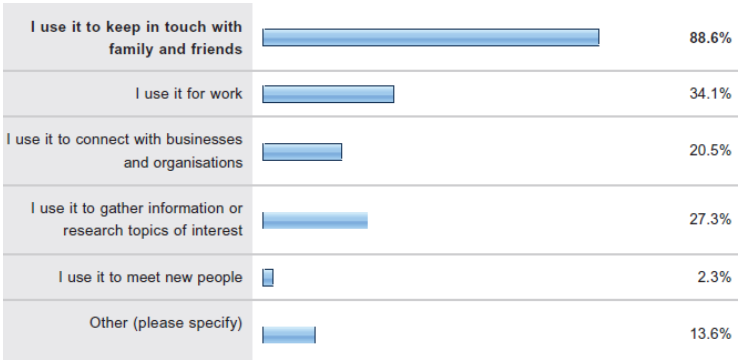

Figure 3: Reason for using social media

Respondents who connected with organisations via social media were invited to further describe them in response to an open ended question. The majority indicated environmental organisations and businesses that they had some interest or affiliation with. A few respondents indicated they followed a sporting club, music groups and pages dedicated to their hobbies, such as cycling groups.

Respondents were asked which technology they used to engage with the CBEM system on. The results are shown in Figure 4. Almost half the respondents connect with the system via email only. Twenty eight per cent engage via Facebook and almost 24 per cent via Picasa.

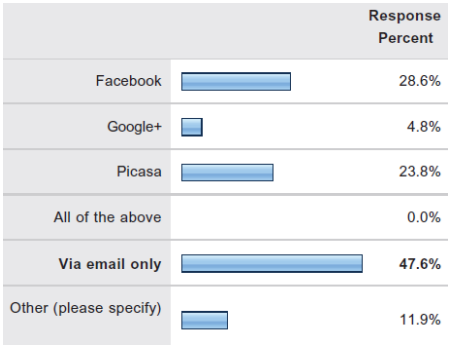

Figure 4: Technology used to engage with the CBEM system

Ninety one per cent of respondents indicated that they had visited the Picasa or Facebook sites for the CBEM system after receiving the 'thank you' email containing a link to the sites from the Administrator when they emailed a photo taken during a visit to the park. Seventy three per cent of respondents indicated that when they visited the Picasa site, they looked at photos from other contributors, in addition to their own photo contribution. However, as shown in Figure 5 below, the majority of users only visit the site once and never return.

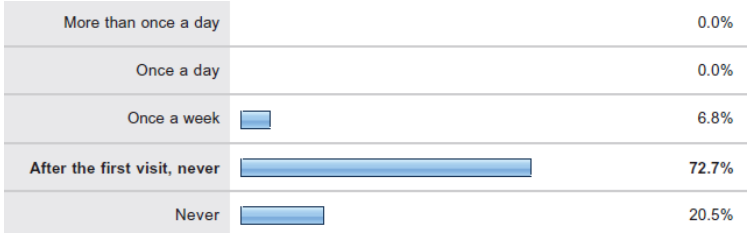

Figure 5: Viewing frequency of the Picasa web albums

Only two respondents (under five per cent) indicated that they had posted on the Facebook page. Of those, they indicated that they had posted between one and three times.

Two questions focused on what respondents liked and disliked about the social media presence. When asked to indicate what they liked about the CBEM social media presence, 41 per cent indicated that they liked seeing photos of the park they had visited and another 23 per cent noted that they liked to hear the latest news about the project. When asked to indicate anything they disliked about the social media presence, 33 per cent of

respondents indicated they did not want to be on too many email/notification lists, with three per cent indicating that not enough updates were uploaded. However, the majority of respondents had no opinion, as they did not follow the social media presence online.

Finally, respondents were asked to indicate how the social media presence could be improved. The majority of respondents had no feedback on improving the presence. However, the introduction of videos and inclusion of information about posts on walking guides were suggested by a few respondents. A few other respondents indicated they were interested in hearing about how the images have been responded to by Land Managers and local government.

DISCUSSION

Results indicate that the CBEM users surveyed mirror the Australian population in terms of their use of social media. The vast majority use Facebook, many of them checking the site several times a day. This finding validates in part the Administrator's recent decision to focus entirely on Facebook, rather than maintaining a presence on other platforms including Google+ and Twitter, which had become a time consuming exercise.

Unfortunately, the results show that while over 80 per cent of respondents use Facebook regularly, only a quarter of them follow the CBEM system page. Most respondents check the page and view the image albums once, on receiving an email from the Administrator, and then do not hear about the project again, until the Administrator sends an email update. Almost 50 per cent of users interact with the system via email only. Developing a facility for users to upload photos directly via Facebook, that requires an App or for users to follow the page may support community growth and connection with the project in future.

However, only 25 per cent of users indicated that they followed similar environmental organisations via Facebook. Thirty three per cent indicated that they didn't want to be on too many email lists. It may be that users prefer to maintain a social space, avoiding information or conversational overload (Jones et al. 2004), given the dominant reason given for using Facebook was to interact with family and friends.

User feedback about the content on the Facebook page was positive indicating that the current method of regularly providing updates on the project with plenty of images is appreciated. However, some useful ideas for adding more video content and personal updates from council stakeholders and park management about how the images have impacted decision making are being acted on and will be included in future posts.

Currently, the system operates at *Level 1 Crowdsourcing* according to Hacklay's (2013, p.116) model of levels of engagement in citizen science projects. The researchers believe that park user engagement could be enhanced by increasing their role in the analysis of data gathered; moving the system engagement to Level 2 Distributed Intelligence (Haklay 2013). However, the researchers are mindful of issues such as poor data quality that can be problematic for citizen science projects (Riesch and Potter 2014). A project is underway in partnership with local councils, primary schools and environmental scientists whereby students and teachers will gather images and conduct field studies to identify flora, fauna and other environmental conditions and CBEM post sites with the guidance and input of scientists to enrich the data provided to Land Managers. It is hoped that the scientists and teachers will share their experiences via video interviews posted on the CBEM Facebook page.

The CBEM project is still in its initial stages, and to date, the use of social media has emerged primarily to share the photographic record with members of the public who contribute. However, the true value of social media to the project is yet to be realised. A key feature of social media sites is their viral nature, whereby posts in news feeds are shared with friends allowing for information, images and videos to spread rapidly across a social network of users due to the network design of the site (Ernecke et al. 2009). The Administrator will continue to try to personalise his approach building on the engagement advice from the literature (Kaplan and Haenlein 2010; Kietzmann et al. 2011; Mangold and Faulds 2009).

CONCLUSION AND FUTURE WORK

Through focusing on the social aspects and the user perceptions of the CBEM system, this research aims to further develop social media to support community engagement with environmental management. Broadening the reach of the project and boosting participation will provide a richer data set for Land Management Agencies to make informed decisions about caring for the environment. Importantly, it also provides a valuable channel for Land Management Agencies to engage with the community.

The research has uncovered a need to drive more natural environment users toward the social media presence of the CBEM system under investigation so as to maintain and enhance levels of engagement; this includes informing the users of the health of the natural environment they have visited, and to encourage both return visitation and continued participation in the CBEM project. Direct photograph uploads to Facebook via the page

or an App are both being considered as ways to enhance levels of engagement. In addition, user suggested enhancements to content via social media are already being implemented with video content and personal updates from Land Managers being prepared for the Facebook page.

Future research will focus on engaging students and scientists in the data gathering and analysis process. The aim is to try and enrich the data set for Land Management Agencies and to enhance levels of community engagement with the system, ultimately creating a sustainable approach to Community-Based Environmental Management.

REFERENCES

Abon, C.C., David, C.P.C., and Iii, G.Q.T. 2012. "Community-Based Monitoring for Flood Early Warning System: An Example in Central Bicol River Basin, Philippines," *Disaster Prevention and Management* (21:1), pp. 85-96.

Augar, N., and Fluker, M. 2014. "Towards Understanding User Perceptions of a Tourist-Based Environmental Monitoring System: An Exploratory Case Study," *Asia Pacific Journal of Tourism Research*), pp. 1-13.

Augar, N., Tayba, A., and Zeleznikow, J. 2014. "'How Does Internet and Social Media Use Impact Relationships? – Exploring University Student Perceptions," in: *Group Decision and Negotiation Conference*. Toulouse, France: University of Toulouse, pp. 254-261.

Augar, N., and Zeleznikow, J. 2013. "'I Just Saw This on Facebook, I Need It Now': Exploring Small Business Use of Facebook," in: *Australasian Conference on Information Systems*. Melbourne, Australia: RMIT.

Australian Bureau of Statistics. 2011. "4102.0 - Australian Social Trends, Jun 2011." Retrieved 11 December 2013, from http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4102.0Main+Features50Jun+2011

Australian Bureau of Statistics. 2013. "8153.0 - Internet Activity, Australia, June 2013." Retrieved 12 November 2013, from http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/8153.0Media%20Release1June%202013?opendocument&tabname=Summary&prodno=8153.0&issue=June%202013&num=&view=

Babbie, E. 2007. *The Practice of Social Research*, (11th ed.). Belmont, California: Thomson Wadsworth.

Bazley, P. 2007. *Qualitative Data Analysis with Nvivo*. California: Sage Publications Inc.

Benbasat, I., Goldstein, D.K., and Mead, M. 1987. "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly* (11:3), pp. 369-386.

Bostrom, R.P., and Heinen, J.S. 1977a. "Mis Problems and Failures: A Socio-Technical Perspective, Part Ii: The Application of Socio-Technical Theory," *MIS Quarterly* (1:4), pp. 11-28.

Bostrom, R.P., and Heinen, J.S. 1977b. "Mis Problems and Failures: A Socio-Technical Perspective. Part I: The Causes," *MIS Quarterly* (1:3), pp. 17-32.

Cloesen, U. 2003. "Approaches Towards Nature Based Tourism Policies in Australia and New Zealand," *Asia Pacific Journal of Tourism Research* (8:1), 2003/01/01, pp. 72-77.

Cowling, D. 2013. "9 Million Australians Use Facebook Every Day." Retrieved 11 November 2013, from http://www.socialmedianews.com.au/9-million-australians-use-facebook-every-day/

Ding, Y., Qiu, L., and Li, D. 2012. "Celebrity-Following and Social Capital: A Study of User Behavior in Microblogging," *Pacific Asia Conference on Information Systems, PACIS 2012 Proceedings*, Ho Chi Min.

Emamjome, F.F., Rabaa'i, A.A., Gable, G.G., and Bandara, W.W. 2013. "Information Quality in Social Media: A Conceptual Model," *Pacific Asia Conference on Information Systems, PACIS 2013 Proceedings*, Seoul.

Ernecke, R., Maryhofer, P., and Wagner, S. 2009. "Agents of Diffusion - Insights from a Survey of Facebook Users," *Hawaii International Conference on Systems Sciences, 2009 HICSS Proceedings*, Hawaii, USA: IEEE.

Goolsby, R. 2010. "Social Media as Crisis Platform: The Future of Community Maps/Crisis Maps," *ACM Trans. Intell. Syst. Technol.* (1:1), pp. 1-11.

Guo, C., and Saxton, G.D. 2013. "Tweeting Social Change: How Social Media Are Changing Nonprofit Advocacy," *Nonprofit and Voluntary Sector Quarterly*), January 8, 2013.

Haghighi, P.D., Burstein, F., Li, H., and Wang, C. 2013. "Integrating Social Media with Ontologies for Real-Time Crowd Monitoring and Decision Support in Mass Gatherings," *Pacific Asia Conference on Information Systems, PACIS 2013 Proceedings*, Seoul.

Haklay, M. 2013. "Citizen Science and Volunteered Geographic Information: Overview and Typology of Participation," in *Crowdsourcing Geographic Knowledge*, D. Sui, S. Elwood and M. Goodchild (eds.). Springer Netherlands, pp. 105-122.

Harris, C., and Srinivasan, P. 2013. "Crowdsourcing and Ethics," in *Security and Privacy in Social Networks*, Y. Altshuler, Y. Elovici, A.B. Cremers, N. Aharony and A. Pentland (eds.). Springer New York, pp. 67-83.

Harris, C.G. 2011. "Dirty Deeds Done Dirt Cheap: A Darker Side to Crowdsourcing," *Privacy, Security, Risk and Trust (PASSAT) and 2011 IEEE Third Inernational Conference on Social Computing (SocialCom), 2011 IEEE Third International Conference on*, pp. 1314-1317.

Harris, G. 2013. "A Field-Study of Online Community Participation: Preliminary Findings," in: *Australasian Conference on Information Systems*. Melbourne.

Heath, D., Singh, R., and Ganesh, J. 2014. "Social Media at Sociosystems Inc.: A Socio-Technical Systems Analysis of Strategic Action," in: *Hawaii International Conference on Systems Science*. Waikoloa, Hawaii: IEEE, pp. 584-593.

Howe, J. 2006. "The Rise of Crowdsourcing." Retrieved 4 February, 2014, from http://www.wired.com/wired/archive/14.06/crowds.html?pg=1&topic=crowds&topic_set=

Huang, L. 2012. "Social Media as a New Play in a Marketing Channel Strategy: Evidence from Taiwan Travel Agencies' Blogs," *Asia Pacific Journal of Tourism Research* (17:6), pp. 615-634.

Ipsos MediaCT. 2013. "Our Mobile Planet: Australia - Understanding the Mobile Consumer."

Jennings, G. 2010. *Tourism Research*, (2nd ed.). Milton, QLD: John Wiley & Sons Australia Ltd.

Joinson, A.N. 2008. " 'Looking at', 'Looking up' or 'Keeping up with' People? Motives and Uses of Facebook " *CHI 2008 Conference*, pp. 1027-1036.

Jones, Q., Ravid, G., and Rafaeli, S. 2004. "Information Overload and the Message Dynamics of Online Interaction Spaces: A Theoretical Model and Empirical Exploration," *Information Systems Research* (15:2), pp. 194-210.

Jung-Eun, S., and Hee-Woong, K. 2013. "Examining Sns Users' Citizenship Behavior: A Social Capital Perspective," *Pacific Asia Conference on Information Systems, PACIS 2013 Proceedings*, Seoul.

Kaplan, A.M., and Haenlein, M. 2010. "Users of the World, Unite! The Challenges and Opportunities of Social Media," *Business Horizons* (53:1), pp. 59-68.

Kietzmann, J.H., Hermkens, K., McCarthy, I.P., and Silvestre, B.S. 2011. "Social Media? Get Serious! Understanding the Functional Building Blocks of Social Media," *Business Horizons* (54:3), pp. 241-251.

Lancaster, T., and Clarke, R. 2012. "Dealing with Contract Cheating: A Question of Attribution," in: *Proceedings Of 1st Annual Higher Education Academy Conference in Science, Technology, Engineering and Mathematics*. London, UK.

Leedy, P. 1997. *Practical Research: Planning and Design*, (6th edn ed.). New Jersey: Merrill.

Mangold, W.G., and Faulds, D.J. 2009. "Social Media: The New Hybrid Element of the Promotion Mix," *Business Horizons* (52:4), pp. 357-365.

McKenzie, L.J., Long, L., Coles, R.G., and Roder, C.A. 2000. "Seagrass-Watch: Community Based Monitoring of Seagrass Resources," *Biologia marina mediterranea* (7:2), pp. 393-396.

Nah, S., and Saxton, G.D. 2013. "Modeling the Adoption and Use of Social Media by Nonprofit Organizations," *New Media & Society* (15:2), March 1, 2013, pp. 294-313.

Neilsen. 2012. "Media Release - Nielsen Australian Online Report 2011-12." Retrieved June 6, 2012, from http://au.nielsen.com/site/documents/TheAustralianOnlineConsumerReport-2012Info.pdf

Parks Victoria. 2009. "Caring for Country: The Otways and You - Management Plan December 2009." Retrieved 7 March, 2014, from http://parkweb.vic.gov.au/__data/assets/pdf_file/0019/313282/great-otway-np-mp.pdf

Pecl, G., Brodribb, F., Brown, R., Walsh, P., Frusher, S., Edgar, G., Lyle, J., Poloczanska, E., and Stuart-Smith, R. 2010. "Developing Citizen Science as a Communication and Research Tool for Monitoring Ecological Change in the Marine Environment." Retrieved 12 February, 2014, from http://www.nccarf.edu.au/conference2010/wp-content/uploads/Stewart-Frusher.pdf

Pratt, S., Gibson, D., and Movono, A. 2012. "Tribal Tourism in Fiji: An Application and Extension of Smith's 4hs of Indigenous Tourism," *Asia Pacific Journal of Tourism Research*), pp. 1-19.

REDMAP. 2014. "Redmap Facebook App." Retrieved 12 February, 2014, from https://www.facebook.com/appcenter/redmap_au?fb_source=search&fbsid=1101

Riesch, H., and Potter, C. 2014. "Citizen Science as Seen by Scientists: Methodological, Epistemological and Ethical Dimensions," *Public Understanding of Science* (23:1), January 1, 2014, pp. 107-120.

Savan, B., Morgan, A.J., and Gore, C. 2003. "Volunteer Environmental Monitoring and the Role of the Universities: The Case of Citizens' Environment Watch," *Environ Manage* (31:5), May, pp. 561-568.

Schmidt, F.A. 2013. "The Good, the Bad and the Ugly: Why Crowdsourcing Needs Ethics," *Cloud and Green Computing (CGC), 2013 Third International Conference on*, pp. 531-535.

Seagrass-Watch. 2014. "Seagrass-Watch Facebook Page." Retrieved 12 February, 2014, from https://www.facebook.com/pages/Seagrass-Watch/177472662306259

Siebeck, U., Logan, D., and Marshall, N. 2008. "Coralwatch – a Flexible Coral Bleaching Monitoring Tool for You and Your Group," *The 11th International Coral Reef Symposium*, Fort Lauderdale, Florida, pp. 549-553.

Silberman, M.S., Irani, L., and Ross, J. 2010. "Ethics and Tactics of Professional Crowdwork," *XRDS* (17:2), pp. 39-43.

Steiglitz, S., Brockman, T., and Xuan, L.D. 2012. "Usage of Social Media for Political Communication," *Pacific Asia Conference on Information Systems, PACIS 2012 Proceedings*, Ho Chi Min.

Tourism Australia. 2013. "Australia's National Landscape Program: 2012 Outcome Report." Retrieved 18 September 2013, from http://www.tourism.australia.com/documents/corporate/Outcome_Report_-_NL_Program_only.pdf

University of Queensland. 2014. "Coralwatch Facebook Page." Retrieved 12 February, 2014, from https://www.facebook.com/pages/CoralWatch/90710550484

Wolfson, S.M., and Lease, M. 2011. "Look before You Leap: Legal Pitfalls of Crowdsourcing," *Proceedings of the American Society for Information Science and Technology* (48:1), pp. 1-10.

Wollan, R. 2011. "The Social Media Management Handbook: Everything You Need to Know to Get Social Media Working in Your Business." Hoboken: John Wiley & Sons, Inc.

Yin, R.K. 2009. *Case Study Research: Design and Methods*. Thousand Oaks: Sage Publications.

COPYRIGHT