Crowdsourcing: A Snapshot of Published Research
Completed Research Paper

Alvin Tarrell*
atarrell@unomaha.edu

Nargess Tahmasbi*
ntahmasbi@unomaha.edu

David Kocsis*
dkocsis@unomaha.edu

Jay Pedersen*
jpedersen@unomaha.edu

Abhishek Tripathi*
atripathi@unomaha.edu

Jie Xiong*
jxiong@unomaha.edu

Onook Oh, Ph.D.*
ooh@unomaha.edu

Gert-Jan deVreede, Ph.D.*
gdevreede@unomaha.edu

* All authors are affiliated with the University of Nebraska - Omaha

ABSTRACT

Crowdsourcing, originally defined as "*taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in an open call,*" is a distributed, collaborative, cross-organizational process seeing increased use among practitioners. As such, crowdsourcing presents great opportunities for information systems (IS) and business-related research. This paper presents preliminary findings from a foundational literature review of published crowdsourcing research from 2006 onward. We identify what crowdsourcing research is going on, where it is going on, and its foci. Our findings document increasing research interest in crowdsourcing and identify the primary publication outlets and home countries of authors involved in that research. Finally, we present a keyword analysis for identified articles, and relate those keywords to a preliminary framework describing crowdsourcing. These findings provide a good summary of current crowdsourcing research, and will help guide researchers interested in further crowdsourcing study.

Keywords

Crowdsourcing, collective intelligence, co-creation, collaboration, innovation, literature review.

INTRODUCTION

Crowdsourcing – using the collective intelligence of a large group of people to help solve problems – is an approach used throughout history (Howe 2008; Surowiecki 2004). Businesses and other entities are increasingly turning to crowdsourcing as a means of obtaining external expertise, accessing the collective wisdom and creativities resident in the virtual crowd, and even reducing costs. One popular website which monitors and assists in those efforts reports 2328 entities currently offering crowdsourcing , an increase of more than 100% over the last two years (www.crowdsourcing.org).

A phenomenon of such interest among practitioners deserves equal interest in the academic community, particularly within the IS discipline, which has its roots in the intersections of technology and its use in the business community. Crowdsourcing by definition involves distributed, collaborative, and cross-organizational networks – areas which are historically well-represented in the body of IS research. However, crowdsourcing stretches those network dimensions to new lengths, and so may demand altered or more imaginative application of our traditional understandings and research methodologies. It is therefore vital that IS researchers begin not only to learn more about crowdsourcing, but also to expand our research methods and capabilities so we may better assist in analyzing the socio-technical challenges and complexities it introduces. This paper is aimed at that first issue – educating IS researchers about crowdsourcing and on-going crowdsourcing research. Findings related to adjusting our research methodologies and capabilities are left for later study and analysis.

Although concepts behind crowdsourcing have been known for decennia, Howe (2006) recently sparked more interest. He coined the term crowdsourcing and defined it as "*the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in an open call.*" Practitioners and researchers have become involved since then, each offering their own variation and contribution to the definition (Brabham

2009; Howe 2008; Surowiecki 2004). Other terms have also been used, including 'peer production', 'user-generated content', and 'smart mobs' (Doan 2012; Haythornthwaite 2009; Warr 2008). These variations are expected given the nascent state of the concept. We focus on 'crowdsourcing', as that term seems to dominate the literature (Howe 2008).

LITERATURE REVIEW

Researchers have offered alternate definitions for crowdsourcing since Howe (2006) first coined the term. Recently, Estelles-Arolas and Gonzalez-Ladron-de-Guevara (2012) studied crowdsourcing definitions, and offer an integrated definition:

Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge, or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage what the user has brought to the venture, whose form will depend on the activity undertaken.

This updated definition is more complex than those offered previously, and may be too unwieldy for practical use. It does however hint at the various research foci involved in developing a better understanding of this phenomenon and its nuances. Estelles-Arolas and Gonzalez-Ladron-de-Guevara (2012) develop a list of questions to address in developing a deeper understanding of crowdsourcing:

About the crowd: Who forms it, what it has to do, and what it gets in return?

About the initiator: Who it is, and what it gets in return for the work of the crowd?

About the process: The type of process it is, the type of call used, and the medium used?

These are interesting research questions, and they set the stage for future crowdsourcing research. We will not address them directly, and will focus instead on another recent effort which suggests a preliminary framework for classifying and guiding crowdsourcing research (Pedersen et al, 2013). This framework (Figure 1) presents the 'Problem' as the input, the 'Outcome' as the output, and four intervening variables ('Process', 'Governance', 'Technology', and 'People' (itself broken down into 'Owner', 'Crowd', and 'Individual' sub-categories)) offering their influence in between. Future crowdsourcing research should focus on individual elements of this framework, as well as the relationships and dependencies between them.
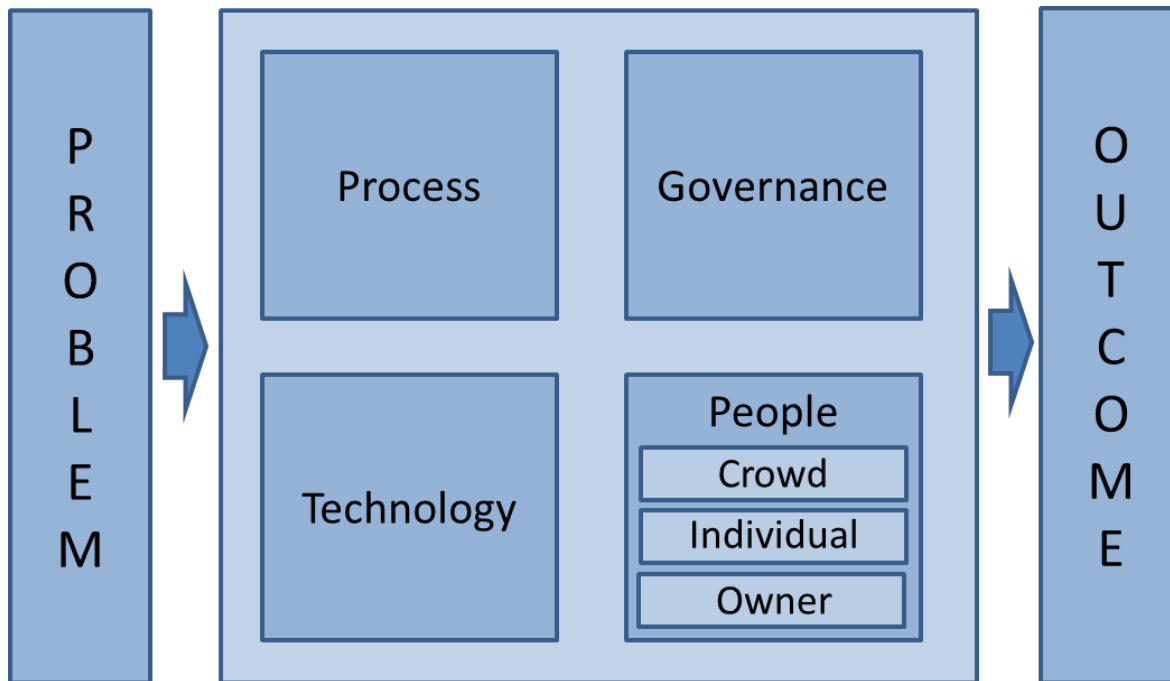

Figure 1: Preliminary Framework for Crowdsourcing Research (from Pedersen et al. 2013)

These two approaches are not mutually exclusive; in fact, they are reasonably closely related. For example, both suggest the importance of the Process, with it being a separate entity in both approaches. Similarly, the Crowd is equally as important, also being a separate entity in both approaches. The Owner is also important, although known as the 'initiator' in the first approach. Pedersen et al (2013) go a bit further, offering additional topics such as Technology and Governance, and also suggesting a framework for linking it all together. Our analysis will therefore be based on Pedersen et al's model (2013).

RESEARCH METHOD AND FINDINGS

This research represents a structured literature review of articles related to crowdsourcing in top-level IS journals and conference proceedings, expanded to include research cited by the identified articles. Our findings are important as they clearly demonstrate the increasing interest in crowdsourcing within the IS and business research communities, identify the major publication sources for crowdsourcing research, and also identify the foci for crowdsourcing research – both geographically and conceptually. Although there is still much to be done, these preliminary results provide a valuable snapshot to help guide future crowdsourcing research.

Our research employed a foundational literature review as recommended by Webster and Watson (2002). This method is particularly appropriate when examining "an emerging issue that would benefit from exposure" (Webster and Watson 2002), making it particularly applicable to crowdsourcing. Our review began with the major IS conferences (AMCIS, HICSS, ICIS, and ECIS) and the top 11 IS journals (Clark et al. 2011). Table 1 below details those journals included. Although Clark et al. (2011) make a distinction of relative rankings between these top IS journals, our review recognized no such division.

Journal	Acronym
Management Information Systems Quarterly	MISQ
Information Systems Research	ISR
Journal of Management Information Systems	JMIS
Journal of the Association for Information Systems	JAIS
European Journal of Information Systems	EJIS
Information Systems Journal	ISJ
Journal of Information Technology	JIT
Journal of Strategic Information Systems	JSIS
Communications of the Association for Information Systems	CAIS
Information and Management	I&M
Decision Support Systems	DSS

Table 1: Journals Analyzed in Preliminary Literature Review

Our literature search ranged from January 2006 through January 2013; the starting date was based on introduction of the term (Howe 2008), and the ending date was the most recent literature available. Indexes were first scanned to manually identify potential candidate articles, and then a keyword search for "crowdsourcing", "crowd sourcing", and "collective intelligence" was conducted. Articles located based on these criteria were then manually screened for applicability. Finally, a Web of Science search on publications cited in these selected articles was conducted, with additional articles found again screened to select only those truly relevant to crowdsourcing. Webster and Watson (2002) refer to this as a "going forward" search.

The final collection totaled 135 published articles related to crowdsourcing. As expected for such a new concept, conference papers made up a large percentage, with 64 of the 135 (47.4%) coming from conferences. Another 33.3% (64 articles) came from journals other than our 11 majors, with the final 19.2% (26 articles) coming from those major journals.

Figure 2 shows the breakdown between the various conferences and journals. Note the fairly even distribution of presentations across HICSS, ICIS, and AMCIS, with a somewhat lower representation at ECIS. 'Other' conferences were also well-represented, with leaders being ACM's Computer-Human Interaction (CHI) (5 articles) and the Computer-Supported Collaborative Work (CSCW) conference (2 articles). Nine other conferences had one crowdsourcing-related

presentation. For journals, *Management Science* (a business journal, 'MS' in Figure 2), ended up as the leader in crowdsourcing publications, even though it was not one of the 11 used as starting points. Note also the dominance of other journals not on our starting list – 'Other' in Figure 2. One-third of identified articles came from this source, with MIT's *Sloan Management Review* (4 articles) and the *International Journal of Electronic Commerce* (3 articles) being the leaders among this group. *Organization Science*, *CAIM*, and *JIS* had two articles each, and 29 other journals have one each. Taken together, these results show the broad interest in crowdsourcing across the IS and IS-related research communities.
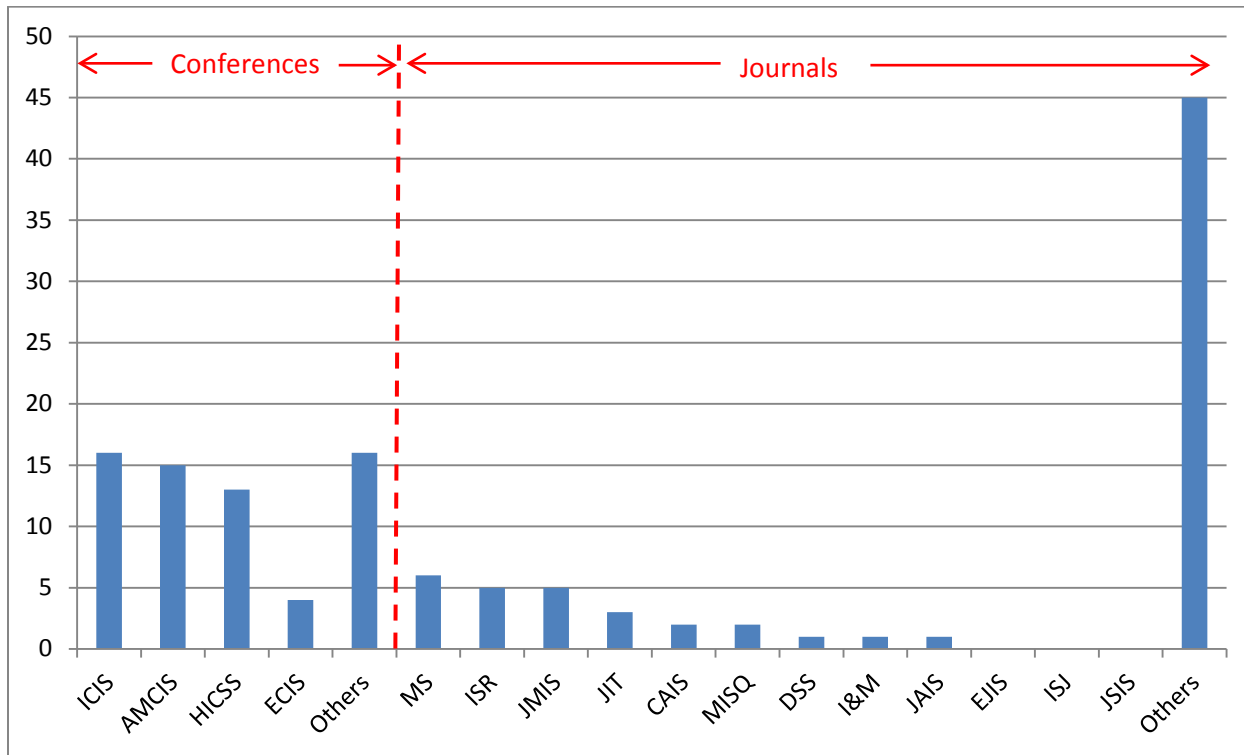

Figure 2: Crowdsourcing Publications by Source, January 2006 – January 2013

Figure 3 shows the increase in publication of crowdsourcing-related articles over the past seven years, showing conclusively the growing interest in this phenomenon. Note however that there may be somewhat of a reduction in the rate of change from 2011 to 2012. It is difficult to draw firm conclusions based on this sparse data, but it will be important to view the trajectory over the next few years to verify continuing growth of interest in crowdsourcing. It may also just be that this newer research is not yet widely cited, reducing its chances of being found by our research methodology. Note also that publication counts for 2013 are not shown in the graph, as only one month of publications were available for our analysis.

Figure 4 shows the geographic distribution of authors of the 135 crowdsourcing articles. Obviously, the vast majority of interest in crowdsourcing currently resides in the US, although researchers based in several other countries are also contributing. Germany appears to be the clear #2, with China, Switzerland, The Netherlands, the UK, and Australia making up the next group (6-8 articles). Canada, Austria, Ireland and Taiwan each have between 3 and 5 articles, while Denmark, Finland, Singapore, and Sweden each have two. Eleven other countries are home to authors with one crowdsourcing publication. We also find it noteworthy that there seems to be significant interest in crowdsourcing among European researchers, but that same interest is not reflected in presentations at the European Conference on Information Systems (ECIS).
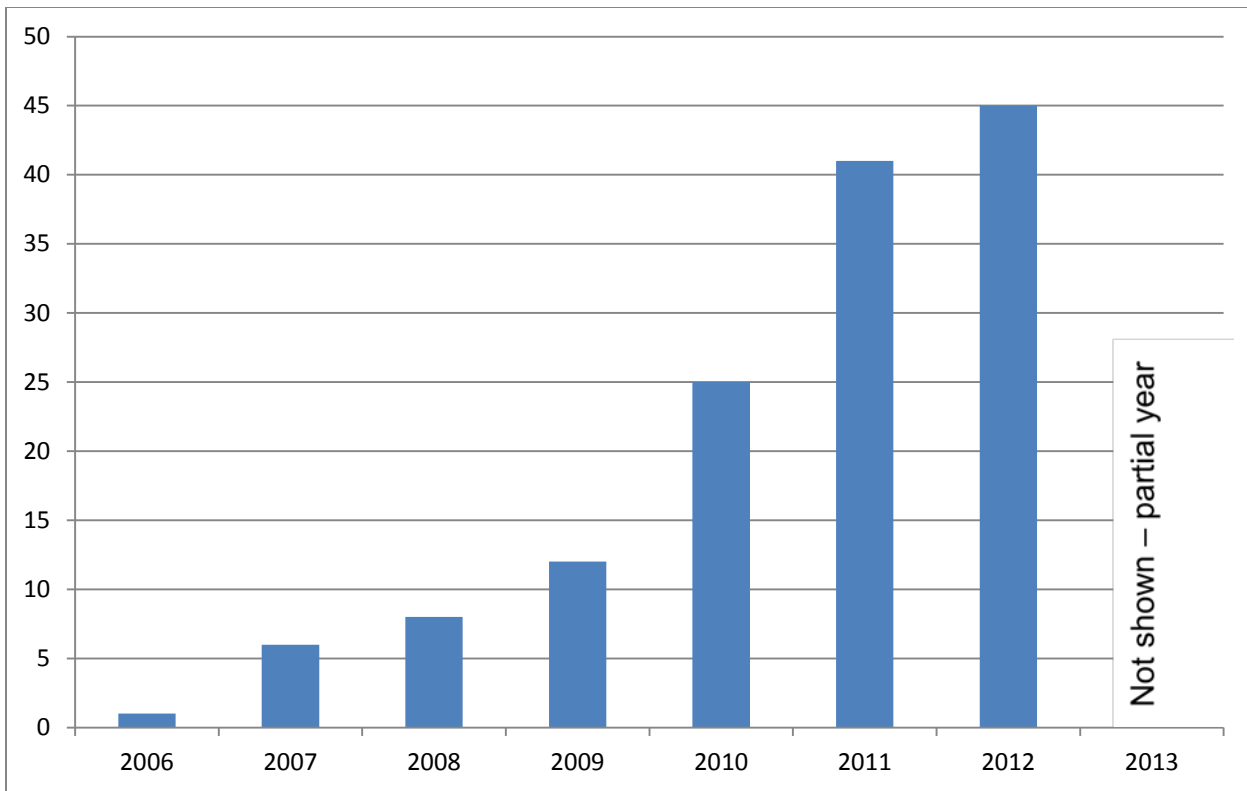
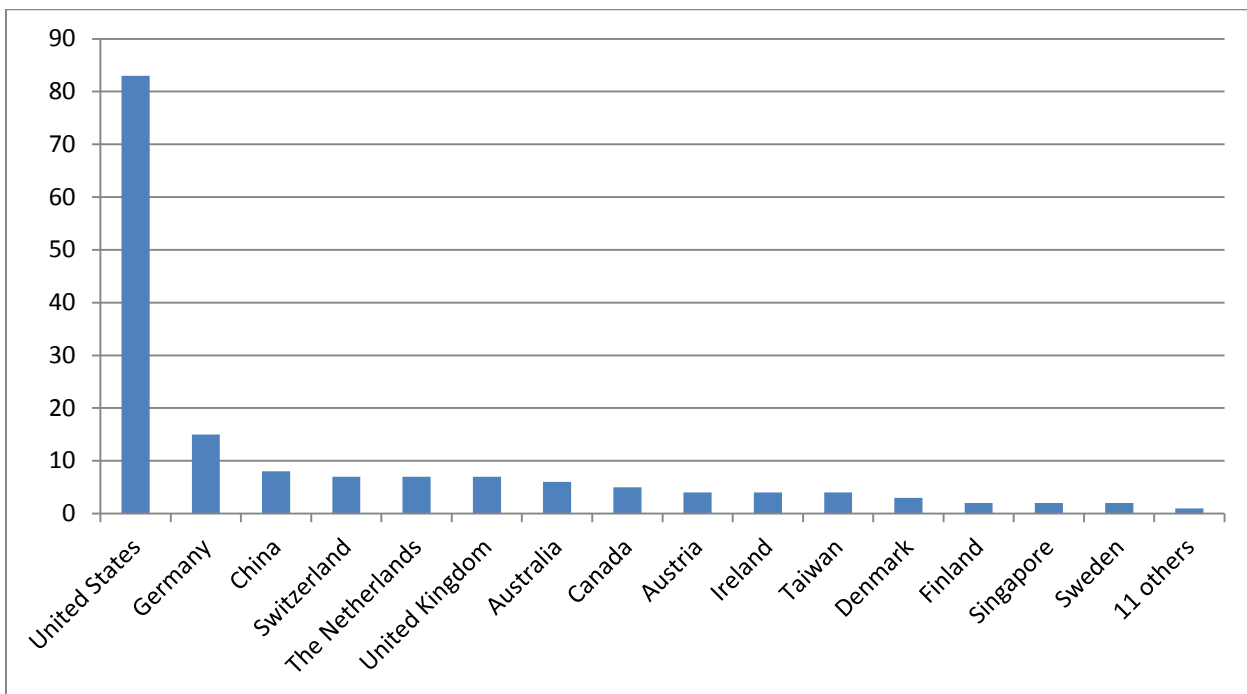**Figure 3: Crowdsourcing Publications by Year (2013 is January only)**

Figure 4: Crowdsourcing Authors by Country, January 2006 – January 2013

Finally, we did a keyword analysis across the 135 articles. Our first analysis provided wildly divergent keywords, resulting in a collection of more than 100 separate entries. To address that issue, we restricted our keywords to those which appeared in at least two articles. That brought our final list to a more manageable group of 50 keywords. Those keywords and their relationship to other keywords on the list are shown in Figure 5. Each keyword is shown as a node, with the size of each node proportional to the number of occurrences of that keyword among our 135 articles. The connections between the nodes show other keywords which are included in those same research articles.
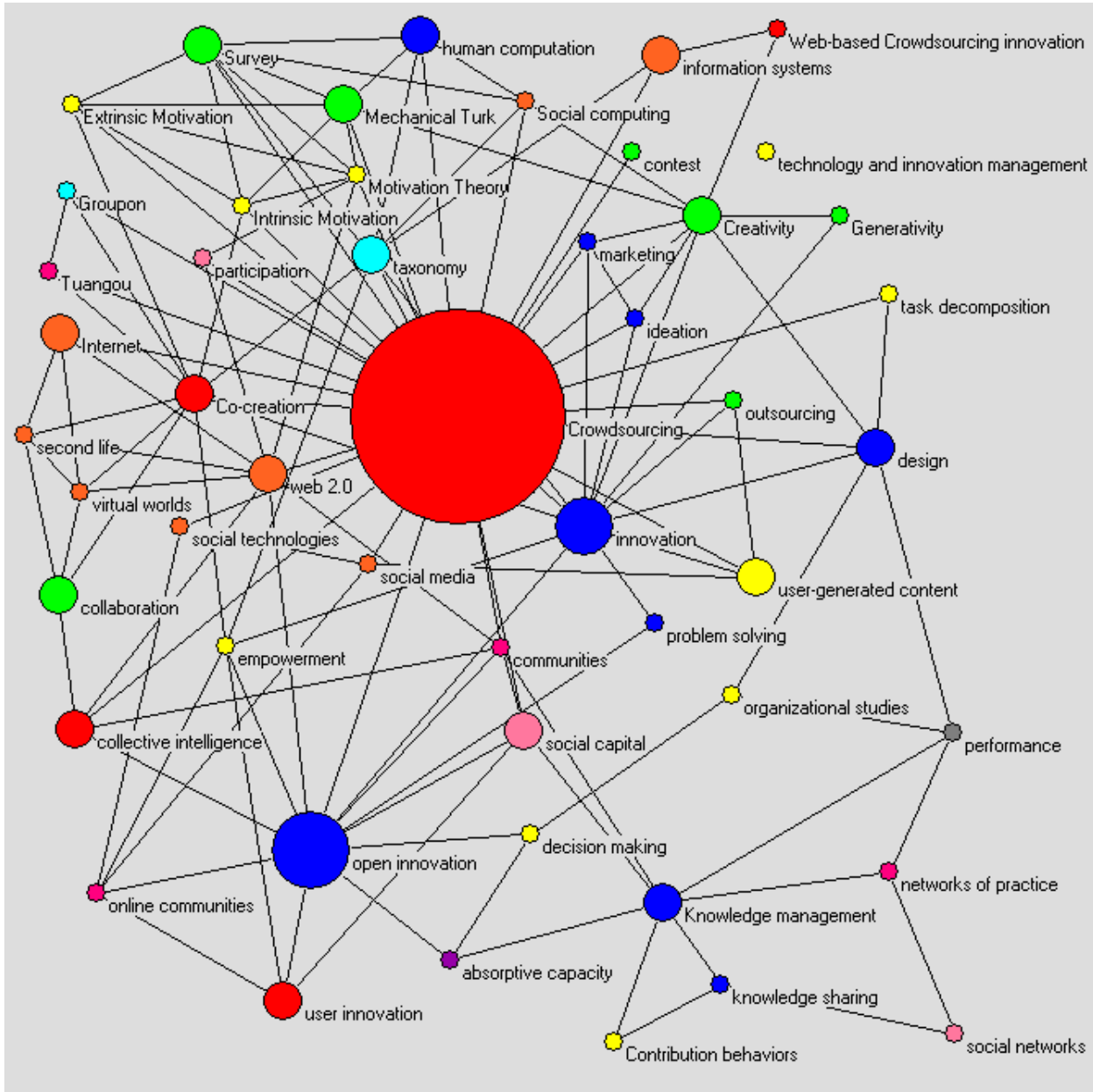

Figure 5: Keyword Analysis and Relationships for Crowdsourcing Publications

We also assigned the keywords to one of the model elements suggested by Pedersen et al. (2013) in an attempt to better depict where crowdsourcing research is concentrating. Table 2 shows the 50 keywords, the occurrence count for each, and the element to which it applies. (Note that we created two additional categories – 'Alternate Names' and 'Other' – to better capture keywords that did not seem to fit within the elements of the framework.) Note also that this is a subjective classification, and many of the keywords might fit into several elements of the model. We feel this depiction is instructive though, in that it shows that many key IS research areas – say 'motivation' or 'knowledge management' – are actively associated with ongoing crowdsourcing research. We think this is important, as it may show many researchers that they are not as far removed from crowdsourcing research as they might otherwise imagine.

Alternate Names		Technology	
co-creation	8	information systems	3
collective intelligence	6	Internet	3
crowdsourcing	54	second life	2
user innovation	3	Social computing	2
web-based crowdsourcing innovation	2	social media	2
Other		social technologies	2
Groupon	2	virtual worlds	2
taxonomy	4	web 2.0	3
Problem		**Governance**	
design	3	contribution behaviors	2
human computation	3	decision making	2
ideation	2	empowerment	2
innovation	13	extrinsic motivation	2
knowledge management	6	intrinsic motivation	2
knowledge sharing	2	Motivation Theory	2
marketing	2	organizational studies	2
open innovation	14	task decomposition	2
problem solving	2	technology and innovation management	2
Process		user-generated content	3
collaboration	5	**People**	2
contest	2	communities (Crowd)	2
creativity	6	networks of practice (Crowd)	2
generativity	2	online communities (Crowd)	2
Mechanical Turk	4	Tuangou (Crowd) (*group buying*)	2
outsourcing	2	participation (Individual)	2
survey	3	social capital (Individual)	3
Outcome		social networks (Individual)	2
performance	2	absorptive capacity (Owner)	2

Table 2: Keywords – Count of Occurrence and Assignment to Model Element (based on Pedersen et al., 2013)

CONCLUSIONS

This research intended to provide a snapshot of crowdsourcing research published to date. We started with major IS conferences and journals, then branched out into other sources cited in articles we found using the "going forward" technique described by Webster and Watson (2002). We finished with 135 articles for analysis, and from those we took away six key points. First, most crowdsourcing research is currently published in conferences and "minor" journals, not surprising for a topic which has only recently joined the mainstream. Second, interest in crowdsourcing as measured by publication rates has grown steadily over the last seven years, indicating growing interest in crowdsourcing within the academic community. Third, a slight reduction occurred in the rate of growth in crowdsourcing publications from 2011 to 2012, so it will be interesting to see what occurs in 2013 for crowdsourcing publications. Fourth, most research related to crowdsourcing is published by authors based in the United States. Germany is a strong second, followed by an even distribution across various countries, including other European countries. This European involvement is interesting, particularly given the fewer crowdsourcing publications at ECIS relative to other major IS conferences. Fifth, our keyword analysis indicates mainstream IS research areas are also associated with crowdsourcing research. For example, several papers were related to intrinsic and extrinsic motivational factors, topics commonly found in IS research. Similarly, topics such as 'knowledge management' and 'knowledge sharing' were represented as well. In short, this means that many IS researchers are not as removed from crowdsourcing research as they might otherwise believe. Crowdsourcing is not necessarily such a new concept, but may instead be a new way of applying existing concepts. Last, certain entities of the framework suggested by Pedersen et al (2013) are well represented by ongoing research, but others are not included to any significant degree. For example, the Outcome entity is significantly under-represented, and may present opportunity for future research.

RECOMMENDATIONS FOR FUTURE RESEARCH

This research was not an in-depth analysis of published crowdsourcing research; rather it is a snapshot to understand where researchers are publishing crowdsourcing papers, and key topics. Future research demands more detailed analysis of the articles, expanding the literature search to examine additional sources and research domains, and understanding each component of the Pedersen et al (2013) framework.

REFERENCES

1. Adamczyk, S., Bullinger, A. C. and Moslein, K. M. (2012) Innovation contests: A review, classification and outlook, *Creativity and Innovation Management,* 21, 4, 335-360.

2. Andriole, S. J. (2012) Seven indisputable technology trends that will define 2015, *Communications of the Association for Information Systems,* 30, 1, Article 4.

3. Antorini, Y. M., Muniz, A. M. and Askildsen, T. (2012) Collaborating with customer communities: Lessons from the lego group, *MIT Sloan Management Review,* 53, 3, 73-79.

4. Arakji, R. Y. and Lang, K. R. (2007) Digital consumer networks and producer--consumer collaboration: Innovation and product development in the video game industry, *Journal of Management Information Systems,* 24, 2, 195-219.

5. Archak, N. and Ghose, A. (2010) Learning-by-doing and project choice: A dynamic structural model of crowdsourcing, *Proceedings of the Thirty First International Conference on Information Systems*, Saint Louis, MO, USA, Paper 239.

6. Archak, N. and Sundararajan, A. (2009) Optimal design of crowdsourcing contests, *Proceedings of the Thirtieth International Conference on Information Systems*, Phoenix, AZ, USA, Paper 200.

7. Baldwin, C. and von Hippel, E. (2011) Modeling a paradigm shift: From producer innovation to user and open collaborative innovation, *Organization Science,* 22, 6, 1399-1417.

8. Bao, J., Sakamoto, Y. and Nickerson, J. V. (2011) Evaluating design solutions using crowds, *AMCIS 2011 Proceedings - All Submissions*, Detroit, MI, USA, Paper 446.

9. Bateman, P. J., Gray, P. H. and Butler, B. S. (2011) The impact of community commitment on participation in online communities, *Information Systems Research,* 22, 4, 841-854.

10. Baumoel, U., Georgi, S., Ickler, H. and Jung, R. (2009) Design of new business models for service integrators by creating information-driven value webs based on customers' collective intelligence, *Proceedings of the 42nd Annual Hawaii International Conference on System Sciences*, Big Island, HI, USA, 10 pages.

11. Bayus, B. L. (2013) Crowdsourcing new product ideas over time: An analysis of the dell ideastorm community, *Management Science,* 59, 1, 226-244.

12. Bazilian, M., Rice, A., Rotich, J., Howells, M., DeCarolis, J., Macmillan, S., Brooks, C., Bauer, F. and Liebreich, M. (2012) Open source software and crowdsourcing for energy analysis, *Energy Policy,* 49, 149-153.

13. Blohm, I., Riedl, C., Leimeister, J. M. and Krcmar, H. (2011) Idea evaluation mechanisms for collective intelligence in open innovation communities: Do traders outperform raters?, *Proceedings of the Thirty Second International Conference on Information Systems*, Shanghai, China, Paper 19.

14. Bonabeau, E. (2009) Decisions 2 0: The power of collective intelligence, *MIT Sloan Management Review,* 50, 2, 45 - 52.

15. Bothner, M. S., Podolny, J. M. and Smith, E. B. (2011) Organizing contests for status: The matthew effect vs. The mark effect, *Management Science,* 57, 3, 439-457.

16. Boudreau, K. J., Lacetera, N. and Lakhani, K. R. (2011) Incentives and problem uncertainty in innovation contests: An empirical analysis, *Management Science,* 57, 5, 843-863.

17. Brabham, D. C. (2009) Crowd sourcing the public participation process for planning projects, *Planning Theory,* 8, 3, 242 - 262.

18. Brabham, D. C. (2010) Moving the crowd at threadless motivations for participation in a crowdsourcing application, *Information Communication & Society,* 13, 8, 1122-1145.

19. Brabham, D. C. (2012) Motivations for participation in a crowdsourcing application to improve public engagement in transit planning, *Journal of Applied Communication Research,* 40, 3, 307-328.

20. Brandel, M. (2008) Crowd sourcing: Are you ready to ask the world for answers? (cover story), *Computerworld,* 42, 10, 24 - 26.

21. Buecheler, T., Sieg, J. H., Füchslin, R. M. and Pfeifer, R. (2011) Crowdsourcing, open innovation and collective intelligence in the scientific method: A research agenda and operational framework, *Proceedings of the Twelfth International Conference on the Synthesis and Simulation of Living Systems*, 679-686.

22. Chen, L. and Liu, D. (2012) Comparing strategies for winning expert-rated and crowd-rated crowdsourcing contests: First findings, *AMCIS 2012 Proceedings - All Submissions*, Seattle, WA, USA, Paper 16.

23. Chen, L., Marsden, J. R. and Zhang, Z. (2012) Theory and analysis of company-sponsored value co-creation, *Journal of Management Information Systems,* 29, 2, 141-172.

24. Christodoulides, G., Jevons, C. and Bonhomme, J. (2012) Memo to marketers: Quantitative evidence for change how user-generated content really affects brands, *Journal of Advertising Research,* 52, 1.

25. Clark, J.G., Au, Y.A., Walz, D.B., and Warren, J. (2011) Assessing researcher publication productivity in the leading information systems journals: a 2005-2009 update, *Communications of the Association for Information Systems*, 29, 1, 459-504.

26. Cullen, R. and Morse, S. (2011) Who's contributing: Do personality traits influence the level and type of participation in online communities, *Proceedings of the 42th Annual Hawaii International Conference on System Sciences*, IEEE, Big Island, HI, USA, 11 pages.

27. Datta, R. (2008) Collective intelligence: Tapping into the wisdom of crowds, *KM Review,* 11, 3, 3.

28. Davis, J. and Lin, H. (2011) Web 3.0 and crowdservicing, *AMCIS 2011 Proceedings - All Submissions*, Detroit, MI, USA, Paper 192.

29. DiGiammarino, F. and Trudeau, L. (2008) Virtual networks: An opportunity for government, *Public Manager,* 37, 1, 5 - 11.

30. Doan, A., Ramakrishnan, R. and Halevy, A. Y. (2011) Crowdsourcing systems on the world-wide web, *Communications of the ACM,* 54, 4, 86 - 96.

31. Dubach, E., Muhdi, L., Stöcklin, D. and Michahelles, F. (2011) Crowdsourcing for "kiosk of the future"–a retail store case study, *AMCIS 2011 Proceedings - All Submissions*, Detroit, MI, USA, Paper 324.

32. Erat, S. and Krishnan, V. (2012) Managing delegated search over design spaces, *Management Science,* 58, 3, 606-623.

33. Erickson, L., Petrick, I. and Trauth, E. (2012) Hanging with the right crowd: Matching crowdsourcing need to crowd characteristics, *AMCIS 2012 Proceedings - All Submissions*, Seattle, WA, USA, Paper 3.

34. Erickson, L. B., Trauth, E. M. and Petrick, I. (2012) Getting inside your employees' heads: Navigating barriers to internal-crowdsourcing for product and service innovation, *Proceedings of the Thirty Third International Conference on Information Systems*, Orlando, FL, USA, 11 pages.

35. Estellés-Arolas, E. and González-Ladrón-de-Guevara, F. (2012) Towards an integrated crowdsourcing definition, *Journal of Information Science,* 38, 2, 189-200.

36. Feller, J., Finnegan, P., Hayes, J. and O'Reilly, P. (2010) Leveraging 'the crowd': An exploration of how solver brokerages enhance knowledge mobility, *Proceedings of the 18th European Conference on Information Systems*, Pretoria, South Africa, Paper 16.

37. Feller, J., Finnegan, P., Hayes, J. and O'Reilly, P. (2012) 'Orchestrating' sustainable crowdsourcing: A characterisation of solver brokerages, *The Journal of Strategic Information Systems,* 21, 216-232.

38. Frey, K., Luthje, C. and Haag, S. (2011) Whom should firms attract to open innovation platforms? The role of knowledge diversity and motivation, *Long Range Planning,* 44, 5-6, 397-420.

39. Fuller, J., Hutter, K. and Faullant, R. (2011) Why co-creation experience matters? Creative experience and its impact on the quantity and quality of creative contributions, *R & D Management,* 41, 3, 259-273.

40. Füller, J., Mühlbacher, H., Matzler, K. and Jawecki, G. (2009) Consumer empowerment through internet-based co-creation, *Journal of Management Information Systems,* 26, 3, 71-102.

41. Geiger, D., Rosemann, M. and Fielt, E. (2011) Crowdsourcing information systems: A systems theory perspective, *Proceedings of the 22nd Australasian Conference on Information Systems*, Sydney, Australia, Paper 33.

42. Geiger, D., Rosemann, M., Fielt, E. and Schader, M. (2012) Crowdsourcing information systems–definition, typology, and design, *Proceedings of the Thirty Third International Conference on Information Systems*, Orlando, FL, USA.

43. Geiger, D., Seedorf, S., Schulze, T., Nickerson, R. and Schader, M. (2011) Managing the crowd: Towards a taxonomy of crowdsourcing processes, *AMCIS 2011 Proceedings - All Submissions*, Detroit, MI, USA, Paper 430.

44. Ghose, A., Ipeirotis, P. G. and Beibei, L. (2012) Designing ranking systems for hotels on travel search engines by mining user-generated and crowdsourced content, *Marketing Science,* 31, 3, 493-520.

45. Gloor, P. A. and Cooper, S. M. (2007) The new principles of a swarm business, *MIT Sloan Management Review,* 48, 3, 81-84.

46. Greer, C. R. and Lei, D. (2012) Collaborative innovation with customers: A review of the literature and suggestions for future research, *International Journal of Management Reviews,* 14, 1.

47. Gregg, D. G. (2009) Developing a collective intelligence application for special education, *Decision Support Systems,* 47, 4, 455-465.

48. Gregg, D. G. (2010) Designing for collective intelligence, *Communications of the ACM,* 53, 4, 134-138.

49. Grier, D. A. (2011a) Foundational issues in human computing and crowdsourcing, *CHI 2011 Workshop on Crowdsourcing and Human Computation*, 4 pages.

50. Grier, D. A. (2011b) Not for all markets, *Computer,* 44, 5, 6-8.

51. Grissemann, U. S. and Stokburger-Sauer, N. E. (2012) Customer co-creation of travel services: The role of company support and customer satisfaction with the co-creation performance, *Tourism Management,* 33, 6, 1483-1492.

52. Haefliger, S., Monteiro, E., Foray, D. and von Krogh, G. (2011) Social software and strategy, *Long Range Planning,* 44, 5-6, 297-316.

53. Hau, Y. S. and Kim, Y.-G. (2011) Why would online gamers share their innovation-conducive knowledge in the online game user community? Integrating individual motivations and social capital perspectives, *Computers in Human Behavior,* 27, 2, 956-970.

54. Haythornthwaite, C. (2009) Crowds and communities: Light and heavyweight models of peer production, *Proceedings of the 42nd Annual Hawaii International Conference on System Sciences*, IEEE, Big Island, HI, USA, 10 pages.

55. Hoffmann, H., Bullinger, A. and Fellbaum, C. (2013) Towards the automated evaluation of crowd work: Machine-learning based classification of complex texts simplified by laymen, *Proceedings of the 46th Annual Hawaii International Conference on System Sciences*, Maui, HI, USA, 10 pages.

56. Hong, Y. and Pavlou, P. (2012) An empirical investigation on provider pricing in online crowdsourcing markets for IT services, *Proceedings of the Thirty Third International Conference on Information Systems*, Orlando, FL, USA, 16 pages.

57. Hooff, B. v. d., Weenen, F. d. L. v., Soekijad, M. and Huysman, M. (2010) The value of online networks of practice: The role of embeddedness and media use, *Journal of Information Technology (Palgrave Macmillan),* 25, 2, 205-215.

58. Howe, J. (2006), The rise of crowdsourcing, *Wired*, 14, 6, June. (http://www.wired.com/wired/archive/14.06/crowds.html?pg=4&topic=crowds&topic_set=).

59. Howe, J. (2008) Crowdsourcing, why the power of the crowd is driving the future of business, New York, NY: Crown Business.

60. Huang, Y., Singh, P. and Mukhopadhyay, T. (2012) Crowdsourcing contests: A dynamic structural model of the impact of incentive structure, *Proceedings of the Thirty Third International Conference on Information Systems*, Orlando, FL, USA, 17 pages.

61. Huysman, M. and Wulf, V. (2006) IT to support knowledge sharing in communities, towards a social capital analysis, *Journal of Information Technology,* 21, 1, 40-51.

62. Iandoli, L., Klein, M. and Zollo, G. (2007) Can we exploit collective intelligence for collaborative deliberation? The case of the climate change collaboratorium, *SSRN eLibrary,* MIT Sloan Research Paper No. 4675-08.

63. Jain, R. (2010) Investigation of governance mechanisms for crowdsourcing initiatives, *AMCIS 2010 Proceedings - All Submissions*, Lima, Peru, Paper 557.

64. Jeppesen, L. B. and Lakhani, K. R. (2010) Marginality and problem-solving effectiveness in broadcast search, *Organization Science,* 21, 5, 1016-1033.

65. Joshi, K. D., Lei, C., Datta, A. and Shu, H. (2010) Changing the competitive landscape: Continuous innovation through IT-enabled knowledge capabilities, *Information Systems Research,* 21, 3, 472-495.

66. Kaufmann, N., Schulze, T. and Veit, D. (2011) More than fun and money. Worker motivation in crowdsourcing–a study on mechanical turk, *AMCIS 2011 Proceedings - All Submissions*, Detroit, MI, USA, Paper 340.

67. Khansa, L., Zobel, C. W. and Goicochea, G. (2012) Creating a taxonomy for mobile commerce innovations using social network and cluster analyses, *International Journal of Electronic Commerce,* 16, 4.

68. Khasraghi, H. J. and Tarokh, M. J. (2012) Efficient business process reengineering with crowdsourcing, *International Journal of Applied Information Systems,* 2, 7, 1-5.

69. Kittur, A., Nickerson, J., Bernstein, M., Gerber, E., Shaw, A., Zimmerman, J., Lease, M. and Horton, J. (2012) The future of crowd work, *16th ACM Conference on Computer Supported Coooperative Work (CSCW 2013), Forthcoming*.

70. Kittur, A., Smus, B., Khamkar, S. and Kraut, R. E. (2011) Crowdforge: Crowdsourcing complex work, in *Proceedings of the 24th annual ACM symposium on User interface software and technology*, ACM: Santa Barbara, California, USA, pp. 43-52.

71. Kuan-Ta, C., Chi-Jui, C., Chen-Chi, W., Yu-Chun, C. and Chin-Laung, L. (2010) Quadrant of euphoria: A crowdsourcing platform for qoe assessment, *IEEE Network,* 24, 2, 28-35.

72. Kulkarni, A., Can, M. and Hartmann, B. (2012) Collaboratively crowdsourcing workflows with turkomatic, in *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work*, ACM: Seattle, Washington, USA, pp. 1003-1012.

73. Lampel, J., Jha, P. P. and Bhalla, A. (2012) Test-driving the future: How design competitions are changing innovation, *Academy of Management Perspectives,* 26, 2, 71-85.

74. Lazer, D., Mergel, I., Ziniel, C., Esterling, K. M. and Neblo, M. A. (2011) The multiple institutional logics of innovation, *International Public Management Journal,* 14, 3, 311-340.

75. Lease, M. (2011) On quality control and machine learning in crowdsourcing, *Proceedings of the 3rd Human Computation Workshop (HCOMP) at AAAI*, 97-102.

76. Leimeister, J. M. (2010) Collective intelligence, *Business & Information Systems Engineering,* 2, 4, 245-248.

77. Leimeister, J. M., Huber, M., Bretschneider, U. and Krcmar, H. (2009) Leveraging crowdsourcing: Activation-supporting components for IT-based ideas competition, *Journal of Management Information Systems,* 26, 1, 197 - 224.

78. Lu, B. and Hirschheim, R. (2011) Online sourcing: Investigations from service clients' perspective, *AMCIS 2011 Proceedings - All Submissions*, Detroit, MI, USA, Paper 405.

79. Man-Ching, Y., King, I. and Kwong-Sak, L. (2011) A survey of crowdsourcing systems, 2011 IEEE third international conference on Privacy, security, risk and trust (passat), and 2011 IEEE third international conference on social computing (socialcom), 766-773.

80. Mannes, A. E. (2009) Are we wise about the wisdom of crowds? The use of group judgments in belief revision, *Management Science,* 55, 8, 1267-1279.

81. Mashhadi, A. J. and Capra, L. (2011) Quality control for real-time ubiquitous crowdsourcing, in *Proceedings of the 2nd international workshop on Ubiquitous crowsouring*, ACM: Beijing, China, pp. 5-8.

82. Moon, J. Y. and Sproull, L. S. (2008) The role of feedback in managing the internet-based volunteer work force, *Information Systems Research,* 19, 4, 494-515.

83. Müller, R. M., Thoring, K. and Oostinga, R. (2010) Crowdsourcing with semantic differentials: A game to investigate the meaning of form, *AMCIS 2010 Proceedings - All Submissions*, Lima, Peru, Paper 342.

84. Nam, T. (2010) The wisdom of crowds in government 2.0: Information paradigm evolution toward wiki-government, *AMCIS 2010 Proceedings - All Submissions*, Lima, Peru, Paper 337.

85. Nevo, D., Kotlarsky, J. and Nevo, S. (2013) New capabilities: Can IT service providers leverage crowdsourcing?, *Proceedings of the Thirty Third International Conference on Information Systems*, Orlando, FL, USA, 17 pages.

86. Nickerson, J. V., Sakamoto, Y. and Yu, L. (2011) Structures for creativity: The crowdsourcing of design, *CHI Workshop on Crowdsourcing and Human Computation*, 1-4.

87. Nickerson, J. V., Zahner, D., Corter, J. E., Tversky, B., Yu, L. and Rho, Y. J. (2009) Matching mechanisms to situations through the wisdom of the crowd, *Proceedings of the Thirtieth International Conference on Information Systems*, Phoenix, AZ, USA, Paper 41.

88. Nuttavuthisit, K. (2010) If you can't beat them, let them join: The development of strategies to foster consumers' co-creative practices, *Business Horizons,* 53, 3, 315-324.

89. O'Neill, S., Morgan, L. and Conboy, K. (2011) A framework for investigating open innovation processes in isd, *Proceedings of the Thirty Second International Conference on Information Systems*, Shanghai, China, Paper 6.

90. Olivera, F., Goodman, P. S. and Swee-Lin Tan, S. (2008) Contribution behaviors in distributed environments, *MIS Quarterly,* 32, 1, 23-42.

91. Pedersen, J., Kocsis, D., Tripathi, A., Tarrell, A., Weerakoon, A., Tahmasbi, N., Xiong, J., Deng, W., Oh, O. and Vreede, G. J. d. (2013) Conceptual foundations of crowdsourcing: A review of IS research, *Proceedings of the 46th Annual Hawaii International Conference on System Sciences*, Maui, HI, USA, 579-588.

92. Prpic, J. and Shukla, P. (2013) The theory of crowd capital, Proceedings of the 46th Annual Hawaii International Conference on System Sciences, Maui, HI, USA.

93. Quinn, A. J. and Bederson, B. B. (2011) Human computation: A survey and taxonomy of a growing field, *Proceedings of the 2011 annual conference on Human factors in computing systems*, ACM, 1403-1412.

94. Ren, J. (2011a) Exploring the process of web-based crowdsourcing innovation, *AMCIS 2011 Proceedings - All Submissions*, Detroit, MI, USA, Paper 202.

95. Ren, J. (2011b) Who's more creative, experts or the crowd?, *AMCIS 2011 Proceedings - All Submissions*, Detroit, MI, USA, Paper 90.

96. Riedl, C., Blohm, I., Leimeister, J. M. and Krcmar, H. (2010) Rating scales for collective intelligence in innovation communities: Why quick and easy decision making does not get it right, *Proceedings of the Thirty First International Conference on Information Systems*, Saint Louis, MO, USA, Paper 52.

97. Roberts, N. and Grover, V. (2012) Leveraging information technology infrastructure to facilitate a firm's customer agility and competitive activity: An empirical investigation, *Journal of Management Information Systems,* 28, 4.

98. Rodriguez, M. A., Steinbock, D. J., Jennife, H. W., Gershenson, C., Bollen, J., Grey, V. and deGraf, B. (2007) Smartocracy: Social networks for collective decision making, *Proceedings of the 40th Annual Hawaii International Conference on System Sciences*, Big Island, HI, USA, 10 pages.

99. Rosen, P. and Greve, R. (2012) The use of mobile devices as group wisdom support systems to support dynamic crowdsourcing efforts, *AMCIS 2012 Proceedings - All Submissions*, Seattle, WA, USA, Paper 17.

100. Rudmark, D., Arnestrand, E. and Avital, M. (2012) Crowdpushing: The flip side of crowdsourcing, *Proceedings of the 20th European Conference on Information Systems*, Barcelona, Spain, Paper 187.

101. Sabou, M., Bontcheva, K. and Scharl, A. (2012) Crowdsourcing research opportunities: Lessons from natural language processing, *Proceedings of the 12th International Conference on Knowledge Management and Knowledge Technologies*, ACM, 17.

102. Savage, N. (2012) Gaining wisdom from crowds, *Communications of the ACM,* 55, 3, 13-15.

103. Schuhmacher, M. C. and Kuester, S. (2012) Identification of lead user characteristics driving the quality of service innovation ideas, *Creativity and Innovation Management,* 21, 4.

104. Schulze, T., Krug, S. and Schader, M. (2012) Workers' task choice in crowdsourcing and human computation markets, *Proceedings of the Thirty Third International Conference on Information Systems*, Orlando, FL, USA, 11 pages.

105. Schulze, T., Seedorf, S., Geiger, D., Kaufmann, N. and Schader, M. (2011) Exploring task properties in crowdsourcing– an empirical study on mechanical turk, *Proceedings of the 19th European Conference on Information Systems*, Helsinki, Finland, Paper 122.

106. Schuurman, D., Baccarne, B., De Marez, L. and Mechant, P. (2012) Smart ideas for smart cities: Investigating crowdsourcing for generating and selecting ideas for ict innovation in a city context, *Journal of Theoretical and Applied Electronic Commerce Research,* 7, 3, 49-62.

107. Shah, C. and Marchionini, G. (2010) Awareness in collaborative information seeking, *Journal of the American Society for Information Science and Technology,* 61, 10, 1970-1986.

108. Shang, S. S. C., Li, E. Y., Wu, Y.-L. and Hou, O. C. L. (2011) Understanding web 2.0 service models: A knowledge-creating perspective, *Information & Management,* 48, 4/5, 178-184.

109. Shao, B. J., Shi, L., Xu, B. and Liu, L. (2012) Factors affecting participation of solvers in crowdsourcing: An empirical study from china, *Electronic Markets,* 22, 2, 73-82.

110. Shu, W. and Chuang, Y. H. (2011) Why people share knowledge in virtual communities, *Social Behavior and Personality,* 39, 5, 671-690.

111. Siau, K., Nah, F. F. H., Mennecke, B. E. and Schiller, S. Z. (2010) Co-creation and collaboration in a virtual world: A 3d visualization design project in second life, *Journal of Database Management,* 21, 4, 1-13.

112. Simula, H. (2013) The rise and fall of crowdsourcing?, Proceedings of the 46th Annual Hawaii International Conference on System Sciences, Maui, HI, USA, 9 pages.

113. Skaržauskaitė, M. (2012) The application of crowd sourcing in educational activities, *Social Technologies,* 2, 1, 67-76.

114. Soliman, W. and Tuunainen, V. (2012) Crowdsourcing as a mobile service-case study: Publishing photography, *Proceedings of the 20th European Conference on Information Systems*, Barcelona, Spain, Paper 115.

115. Stanoevska-Slabeva, K. (2011) Enabled innovation: Instruments and methods of internet-based collaborative innovation, *1st Berlin Symposium on Internet and Society*, 40 pages.

116. Sun, Y., Wang, N., Yin, C. X. and Che, T. (2012) Investigating the non-linear relationships in the expectancy theory: The case of crowdsourcing marketplace, *AMCIS 2012 Proceedings - All Submissions*, Seattle, WA, USA, Paper 6.

117. Surowiecki, J. (2004) *The wisdom of the crowds.* New York, NY: Anchor Books.

118. Terwiesch, C. and Yi, X. (2008) Innovation contests, open innovation, and multiagent problem solving, *Management Science,* 54, 9, 1529-1543.

119. Tilson, D., Lyytinen, K. and Sørensen, C. (2010) Digital infrastructures: The missing IS research agenda, *Information Systems Research,* 21, 4, 748-759.

120. Van Osch, W. (2012) *Generative collectives*, University of Amsterdam.

121. Vivacqua, A. S. and Borges, M. R. S. (2012) Taking advantage of collective knowledge in emergency response systems, *Journal of Network & Computer Applications,* 35, 1, 189 - 198.

122. Vreede, G.-J. d., Briggs, R. O. and Massey, A. P. (2009) Collaboration engineering: Foundations and opportunities: Editorial to the special issue on the journal of the association of information systems, *Journal of the Association for Information Systems,* 10, 121-137.

123. Vukovic, M. and Bartolini, C. (2010) Towards a research agenda for enterprise crowdsourcing, in *Leveraging applications of formal methods, verification, and validation,* T. Margaria and B. Steffen (eds.), Springer Berlin Heidelberg, 425-434.

124. Wagner, C. and Prasarnphanich, P. (2007) Innovating collaborative content creation: The role of altruism and wiki technology, *Proceedings of the 40th Annual Hawaii International Conference on System Sciences*, IEEE, Big Island, HI, USA, 10 pages.

125. Walter, T. and Back, A. (2011) Towards measuring crowdsourcing success: An empirical study on effects of external factors in online idea contest, *MCIS 2011 Proceedings*, Paper 63.

126. Walter, T. and Back, A. (2013) A text mining approach to evaluate submissions, *Proceedings of the 46th Annual Hawaii International Conference on System Sciences*, Maui, HI, USA, 10 pages.

127. Wang, W.-T. and Wei, Z.-H. (2011) Knowledge sharing in wiki communities: An empirical study, *Online Information Review,* 35, 5.

128. Warr, W. A. (2008) Social software: Fun and games, or business tools?, *Journal of Information Science,* 34, 4, 591 - 604.

129. Webster, J. and Watson, R. (2002) Analyzing the past to prepare for the future: writing a literature review, *MIS Quarterly*, 26, 2, pp. xiii-xxiii.

130. Whelan, E. (2007) Exploring knowledge exchange in electronic networks of practice, *Journal of Information Technology (Palgrave Macmillan),* 22, 1, 5-12.

131. Wiggins, A. and Crowston, K. (2012) Goals and tasks: Two typologies of citizen science projects, *Proceedings of the 45th Annual Hawaii International Conference on System Sciences*, Maui, HI, USA, 3426-3435.

132. Willett, W., Heer, J. and Agrawala, M. (2012) Strategies for crowdsourcing social data analysis, *Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems*, ACM, 227-236.

133. www.crowdsourcing.org/, accessed January 24, 2013.

134. Youngjin, Y., Boland Jr, R. J., Lyytinen, K. and Majchrzak, A. (2012) Organizing for innovation in the digitized world, *Organization Science,* 23, 5, 1398-1408.

135. Yu, L. and Nickerson, J. (2011) Generating creative ideas through crowds: An experimental study of combination, *Proceedings of the Thirty Second International Conference on Information Systems*, Shanghai, China, Paper 21.

136. Zhang, H., Horvitz, E., Miller, R. C. and Parkes, D. C. (2011) Crowdsourcing general computation, *CHI 2011 Workshop on Crowdsourcing and Human Computation*, 5 pages.

137. Zhang, Q., Wang, F. Y., Zeng, D. and Wang, T. (2012) Understanding crowd-powered search groups: A social network perspective, *PloS one,* 7, 6, e39749.

138. Zhao, Y. and Zhu, Q. (2012) Exploring the motivation of participants in crowdsourcing contest, *Proceedings of the Thirty Third International Conference on Information Systems*, Orlando, FL, USA, 13 pages.

139. Zheng, H. C., Li, D. H. and Hou, W. H. (2011) Task design, motivation, and participation in crowdsourcing contests, *International Journal of Electronic Commerce,* 15, 4, 57-88.

140. Zhi, Z., Hachen, D., Kijewski-Correa, T., Feng, S. and Madey, G. (2012) Citizen engineering: Methods for "crowdsourcing" highly trustworthy results, *Proceedings of the 45th Annual Hawaii International Conference on System Sciences*, Maui, HI, USA, 3406-3415.

141. Zwass, V. (2010) Co-creation: Toward a taxonomy and an integrated research perspective, *International Journal of Electronic Commerce,* 15, 1, 11-48.