

Smart Cities and the Role of IS Research in Improving Urban Life

Panel

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Abstract

With two thirds of the world's population soon residing in cities, the question of how information technology affects urban life and global urbanization trends becomes more relevant than ever. Due to the interplay of economic, social, organizational, and technological dimensions, the IS discipline is in an excellent position to contribute to solving this grand societal challenge. This panel will explore various issues in this context, such as e-government, emergency response, and sustainable energy and mobility, to derive implications for future IS research directions and for successful collaborations with industry and municipal partners.

Keywords: Smart Cities, Panel, E-government, Emergency response, Sustainability

Introduction

By 2050, two thirds of the world's population is expected to reside in cities (United Nations Department of Economic and Social Affairs 2014). Cities are the foci of life, culture, art, and education; at the same time, they are drivers of global emissions and pollution and places where social segregation and exclusion manifest the most. Information systems can enable city administrations, residents, and businesses to leverage the knowledge and skills that are already present to tackle these fundamental challenges that our planet and society face. As Dirks and Keeling (2009) succinctly state, cities are "being empowered technologically" and to "build sustainable prosperity, cities need to become 'smarter'" (p.1).

Initiatives for *smart cities* are ubiquitous and can be observed in industry with programs launched by global players, such as Intel (Intel Corporation 2016), IBM (IBM 2016), or GE (General Electric 2016), but also in public administrations from New York (Mayor's Office of Technology and Innovation 2015) to London (Smart London Board 2014) and Singapore (Infocomm Development Authority of Singapore 2015). Transforming cities into smart cities merges various technological, economic, social, and organizational challenges, resulting in a complex *grand challenge* the Information Systems discipline is well-equipped to contribute to solving. Nevertheless, while issues such as e-governance (Belanger and Carter 2012; Tan et al.

2013), smart mobility (Teubner and Flath 2015; Wagner et al. 2016), and intelligent energy systems (Ketter et al. 2016a; Watson et al. 2010) have gained traction in recent years, the IS discipline currently lacks a unifying perspective, research agenda, and an open discussion on how to effectively and efficiently contribute to smart city transformations.

Issues and Positions

The objective of this panel is to stimulate such a discussion, bringing IS scholars as well as city and industry representatives together to identify the role of academic research and of the IS discipline in particular in shaping digitized urban life. We will dissect recent research efforts on smart city topics and discuss experiences with joint municipal and industry projects. As a result, we seek to derive a framework outlining critical challenges IS scholars should investigate over the next decade and to provide guidelines for successful cooperation with municipal and industry partners in smart city projects. The discussion will start out with the necessary environment to generate innovative smart city ideas and follow a loose story arc through electronic government, public management of climate-change-induced disasters, and the causes of climate change, to eventually examine best practices and surface critical problems for sustaining successful collaborations in a smart city context. As outlined in the next section, this basic agenda will be adapted based on audience feedback and contributions.

Smart Cities and Dynamic Public Administrations (Tobias Brandt and Jamie Cudden)

The digital revolution of the private sector is significantly driven by the *start-up culture*, the ability of small, dynamic firms to innovate, to scale-up digital products, and—frequently—to fail (or go through the roof) at amazing speed and relatively manageable costs. To capture this creativity and dynamism, established companies set up venture capital funds to incubate and eventually secure start-ups that align with their business strategy (Hirt and Willmott 2014). For the public sector—and public administrations, to no surprise, play a critical role in smart city initiatives—there is often no equivalent. Public administrations are not known for their eagerness to experiment, they are designed to be a source of reliability and stability for the community they serve. Similarly, the admiration of risk taking and persistence, even after failure, that is pervasive to the start-up culture (Donohue 2015) is likely to be less well-received in the context of taxpayer-funded investments.

In this part of the panel, we discuss whether agility, flexibility, and innovativeness are desired qualities in city administrations on the one hand and required qualities for smart city transformations on the other. Building upon these insights, we further inquire how academia and industry can support cities in creating an innovation-friendly environment and how cities can, in turn, enable the private sector to contribute to smart city transformations (e.g. open data approaches).

Climate Change and Urban Disaster Management (Mihoko Sakurai and David Prendergast)

The number of natural disasters in the world is increasing. There were three times as many natural disasters between 2000 and 2009 as there were between 1980 and 1989. Disasters are often unexpected, so that many organizational routines and processes are severely impaired or even suspended. Conventional disaster management starts from drawing up a plan intending to mitigate damage from a devastating disaster by making people, facilities, and organizations robust. The plan defines the chain of command and the tasks to be performed (Gebbie and Qureshi 2002). However, plans are often effective only in anticipated situations, in other words, for expected events. Plans fail to deal with departures from predictable outcomes. In reality, unexpected calamities require an adaptive capability that recognizes new opportunities in any given situation (Dynes and Quarantelli 1976; Mintzberg and Waters 1985).

An agenda here is how information systems research deals with unexpected calamities which guides us to the way of recovering after the disasters. This can be discussed in short-term perspective. IS research trends on disaster management is mainly divided into three categories which are discussing design principles (Chen et al. 2008; Day et al. 2009; McKinney 2009; Ng and Kankanhalli 2012; Turoff et al. 2004; Xue and Liang 2004), prototype development (Chen et al. 2013; Thomas et al. 2009; Yang et al. 2009) and usage of

social media (Ahmed and Sinnappan 2013; Leong et al. 2015). Improvisation in response (Mendonça 2007), and intuitive procedures for disasters (Perrow 1983, 1984) are submitted as important theoretical topics in the disaster management field. However, we find only a little discussion on these topics. We need to develop bridge between IS research categories and disaster management theories.

E-government Solutions at the Municipal Level (Jamie Cudden and Mihoko Sakurai)

Research on the design, implementation, and adoption of e-government initiatives and applications has received increasing attention during the past decade (Belanger and Carter 2012). This includes, for instance, studies on the relationship between e-government policies and IS choice (Cordella and Iannacci 2010), the design of e-government websites (Tan et al. 2013), or on success measurements for e-government implementations (Scott et al. 2015). Nevertheless, this reflects just a small fraction of e-government projects that have been implemented in municipalities around the world.

In this part of the panel, we juxtapose research efforts within the IS discipline on e-government to insights from practitioners from public administration and industry. We critically investigate whether e-government research relates to crucial questions and challenges the implementation and adoption of those systems face in practice. We discuss how smart city administrations – supported by e-government solutions – are a part and a necessary antecedent of smart city transformations. Furthermore, we explore how e-government research streams fit into a broader IS research agenda for smart cities.

Sustainable Energy and Mobility (Wolfgang Ketter and Tobias Brandt)

Cities contribute between 60 and 80 percent to global CO₂ emissions, substantially driven by “lighting, heating and cooling, appliance use, electronics use, and mobility” (Kamal-Chaoui and Robert 2009, p. 9). Naturally, the idea of smart cities is intertwined with the concepts of renewable energy, smart grids, and sustainable urban mobility. Over the past years, these topics have started to be addressed by IS scholars through Energy Informatics research (Watson et al. 2010). Some exemplars applicable to a smart city context include research on energy markets (Feuerriegel and Neumann 2014, Ketter et al. 2016a, 2016b), microgrids (Brandt et al. 2014; Fridgen et al. 2015), electric vehicles (Brandt et al. 2013; Kahlen et al. 2014), and mobility sharing systems (Teubner and Flath 2015; Wagner et al. 2016).

Building upon the discussion on mitigating the urban impact of climate change from the previous topic, we turn to the role of IS research in addressing the root causes of climate change. We critically examine the state of Energy Informatics research, its relevance to smart city initiatives, and whether research agendas should be better aligned to produce impactful research on IT-supported urban energy and mobility management.

Managing Successful Collaborations for Smart City Transformations (David Prendergast and Wolfgang Ketter)

Cities are ecosystems that contain a wide range of different stakeholders, including residents, businesses, administrations, tourists, and commuters. Smart city transformations cannot be realized by city governments alone; instead, they require collaboration between all of these stakeholders and the comprehensive inclusion within the transformation process. We are convinced that the IS discipline, with its experience in analyzing and shaping socio-technical systems, can provide a valuable contribution to smart city efforts.

In this part of the panel, we debate how IS researchers can strike the balance between rigor and impact in smart city collaborations with industry, municipalities, and citizens. We elaborate on IS theories that can influence the design and implementation of smart city concepts on the one hand and how insights from these project can refine and validate theory on the other hand. Furthermore, we discuss how the IS discipline can benefit from collaborations beyond theory development and seek to identify best practices to achieve successful collaborations and projects.

Panel Structure

The transformation towards smart, livable, and sustainable cities is a major global challenge that requires experience and wisdom on the one hand and creativity and energy on the other. It demands a joint effort by public agencies, the private sector, and academia. To reflect this, as the discussion moves between topics, we will focus diverse opinions on each topic by a pairing of researchers with different backgrounds or by a pairing of a researcher and a panelist from outside academia.

During the first ten minutes of the panel, each panelist will briefly introduce him/herself. After that, the first topic is introduced by the first pairing. There is no clear cut distinction between each topic since each naturally links to its subsequent one. When the discussion moves to a new topic, the moderator will address the respective pairing to provide their introductory opinions as part of the flow of the discussion.

While each topic should roughly be discussed for 10 to 15 minutes, the topics covered can be adapted depending on questions and experience reports from the audience. Initially, the moderator will encourage audience members to actively join the discussion and provide feedback. In addition, an interactive tool, such as pollyeverywhere.com, will be used to enable attendees to post questions to the panel and suggest relevant topics using a computer or mobile device. This will allow topics the audience seems relevant to the concept of smart cities to dynamically emerge and be discussed. The moderator will produce a brief summary of the core insights from the panel discussion at its end, with the intention of creating the impetus for an IS research agenda on smart cities.

Participation Statement

All participants are committed to attend the conference and serve on the panel if the panel is accepted.

Participants

Reflecting the broad relevance of the topic, the panel includes participants with a variety of backgrounds—senior scholars, junior researchers, as well as industry and city representatives.

Tobias Brandt (Panelist)

Tobias Brandt is head of the Smart Cities and Industries research group at the University of Freiburg, Germany. He is also co-founder of Geospin, a start-up specialized in urban data science that advises cities and companies on spatial planning, location-based services, and urban analytics. Tobias received his diploma degree in economics and his Ph.D. from the University of Freiburg, the latter with a dissertation on IT solutions for smart power systems. In his research, he investigates the benefit data ubiquity and analytics can bring to urban mobility and energy systems, but also to the explanation and prediction of social phenomena such as crime. He regularly gives talks on urban analytics and open data to industry and government stakeholders. His research has received best paper awards at both ICIS and HICSS and has been published in, e.g., the *Journal of Management Information Systems*, the *European Journal of Operational Research*, and *Omega*.

Jamie Cudden (Panelist)

Jamie leads the development and implementation of Dublin City Council's Smart City strategy. He reports directly to the Chief Executive to ensure that the council takes advantage of the opportunity of technology innovation such as Internet of Things and Big/Open Data to drive better quality services and address priority city challenges in areas such as mobility/transport, environment and energy efficiency. He manages key relationships across industry, academia and government to promote and build out smart city solutions and demonstrators. He is currently leading on the rollout of a 'Smart Dublin' city region collaboration model (www.smartdublin.ie). He has extensive experience working across industry, local and central government to deliver projects that enhance Dublin's economic competitiveness. Jamie currently holds the position of Company Secretary with ECO-UNESCO, a leading Irish environmental education charity that works with young people across Ireland.

Jamie's qualifications include a science degree from Trinity College Dublin and a Masters in Geographic Information Science (GIS) from University College London. He previously worked in policy and technical advisory roles with Kensington and Chelsea Borough in London, Government office for London, the Home Office, Met Police and the Jill Dando Institute of Crime Science in the UK.

Wolfgang Ketter (Panelist)

Wolfgang Ketter is Professor of Next Generation Information Systems and chair of the Information Systems section, Department of Technology and Operations Management, Rotterdam School of Management of Erasmus University. In addition, he is director of the Learning Agents Research Group at Erasmus (LARGE) and the Erasmus Center for Future Energy Business. Wolfgang is also the founder and chair of the Erasmus Forum for Future Energy Business. In 2010, he became president of the Association for Trading Agent Research (ATAR). ATAR organizes the annual Trading Agent Competition (TAC). Wolf is leading Power TAC, a new TAC challenge on energy retail markets. He has served as general chair or program chair of more than 20 international conferences and workshops. His research has been published in various top energy, information systems, and computer science journals such as Decision Sciences, Energy Economics, Information Systems Research, Machine Learning, and MIS Quarterly. He serves on the editorial boards of Information Systems Research and MIS Quarterly. In December 2012, he received the prestigious INFORMS Design Science Award, and in June 2013, he received the runner-up award for the best European Information Systems research paper of the year.

David Prendergast (Panelist)

David Prendergast is a social anthropologist and User Experience Lead at Intel Labs Europe. He was a founder and PI of the Intel Collaborative Research Institute for Sustainable Connected Cities with Imperial College and University College London and also holds the position of Visiting Professor of Healthcare Innovation at Trinity College Dublin. Prior to his career at Intel, David has been involved in numerous major research projects including: a multi-year ethnography of intergenerational relationships and family change in South Korea; the provision of paid home care services in Ireland; and a three year ESRC study into death, dying and bereavement in England and Scotland.

David began working with Intel in 2006 attracted by the opportunity to utilize social research to design, develop, and evaluate culturally appropriate technologies to help enable older people to live independently. In recent years, David has set up large scale urban 'Internet of Things' research test beds across London, Dublin and San Jose. The latter showcased at the White House as part of the Smart America Challenge. More recently he has also worked on environmental monitoring with respect to flooding issues and air quality.

Fortune Magazine named David a 'hero of the Fortune 500' in 2014 for his involvement in setting up LauraLynn House, Ireland's first children's hospice. His third book, an edited collection entitled 'Ageing and the Digital Life Course' was published by Berghahn Books in June 2015.

Mihoko Sakurai (Panelist)

Mihoko Sakurai is Postdoctoral Research Fellow at the University of Agder, Norway. Her academic background is Information Systems and Policy Design. She received her Ph.D. from the Keio University's Graduate School of Media and Governance in Japan. She has studied effective ways of using Information Communication Technology in Japan's municipal governments. After the devastating Great East Japan Earthquake in 2011, she conducted field research and designed information systems to enhance the handling of future and unexpected disasters, especially for municipalities which have to deliver disaster relief operations to their residents. Currently she is working on the notion of resilience, case studies of smart city in Japan and how information systems can support it. Her works related to the earthquake won the Best paper award at ITU Kaleidoscope conference (2013) and HICSS (2016). Her works has also been published in IEEE communications magazine and the proceedings of ICIS and ISCRAM (International Conference on Information Systems for Crisis Response and Management).

Richard Watson (Moderator)

Richard Watson is a Regents Professor and the J. Rex Fuqua Distinguished Chair for Internet Strategy in the Terry College of Business at the University of Georgia. He is the current Research Director for the Advanced Practices Council of the Society of Information Management and a former President of the AIS. In 2011, he received the AIS' LEO award, which is given for exceptional lifetime achievement in Information Systems. As a visiting researcher at Viktoria Swedish ICT, he is engaged in establishing and applying Maritime Informatics to the European shipping industry. He is an Honorary Visiting Professor at Xi'an Jiaotong University.

Professor Watson has published over 170 journal articles and written books on electronic commerce, data management, and energy informatics. His work has been accepted by leading academic and practitioner journals and has been translated into several languages. He has made contribution on themes such as Group Support Systems, information service quality, web site quality, U-constructs, frugal IS, energy informatics, dominant logic, digital data streams, and episodic tight coupling. Dr. Watson has given invited presentations to practitioners and academics in more than 30 countries. He had moderated panels at multiple conferences, including ICIS.

References

- Ahmed, A., and Sinnappan, S. 2013. "The role of Social media during Queensland floods: An Empirical Investigation on the Existence of Multiple Communities of Practice (MCoPs)," *Pacific Asia Journal of the Association for Information Systems* (5:2), pp. 1–22.
- Belanger, F., and Carter, L. 2012. "Digitizing Government Interactions with Constituents: An Historical Review of E-Government Research in Information Systems," *Journal of the Association for Information Systems* (13:5), pp. 363–394.
- Brandt, T., DeForest, N., Stadler, M., and Neumann, D. 2014. "Power Systems 2.0: Designing an Energy Information System for Microgrid Operation," in *ICIS 2014 Proceedings*, Paper 8.
- Brandt, T., Feuerriegel, S., and Neumann, D. 2013. "Shaping a Sustainable Society: How Information Systems Utilize Hidden Synergies between Green Technologies," in *ICIS 2013 Proceedings*, Paper 7.
- Chen, R., Sharman, R., Chakravarti, N., Rao, H. R., and Upadhyaya, S. 2008. "Emergency Response Information System Interoperability: Development of Chemical Incident Response Data Model," *Journal of the Association for Information Systems* (9:3), pp. 200–230.
- Chen, R., Sharman, R., Rao, R., and Upadhyaya, S. 2013. "Data Model Development for Fire Related Extreme Events: An Activity Theory Approach," *Management Information Systems Quarterly* (37:1), pp. 125–147.
- Cordella, A., and Iannacci, F. 2010. "Information systems in the public sector: The e-Government enactment framework," *The Journal of Strategic Information Systems* (19:1), pp. 52–66.
- Day, J., Junglas, I., and Silva, L. 2009. "Information Flow Impediments in Disaster Relief Supply Chains," *Journal of the Association for Information Systems* (10:8), pp. 637–660.
- Dirks, S., and Keeling, M. 2009. *A vision of smarter cities: How cities can lead the way into a prosperous and sustainable future*: IBM Institute for Business Value.
- Donohue, J. 2015. *Fail Fast, Fail Often, Fail Everywhere*.
<http://www.newyorker.com/business/currency/fail-fast-fail-often-fail-everywhere>.
- Dynes, R. R., and Quarantelli, E. L. 1976. "Organizational Communications and Decision Making in Crises," Report Series 17, University of Delaware, Disaster Research Center, Newark, DE.
- Feuerriegel, S., and Neumann, D. 2014. "Measuring the financial impact of demand response for electricity retailers," *Energy Policy* (65), pp. 359–368.
- Fridgen, G., Gründler, A., and Rusic, M. 2015. "Energy Cooperatives as an Application of Microgrids: Multi-Criteria Investment Decision Support," in *ICIS 2015 Proceedings*, Paper 5.
- Gebbie, K. M., and Qureshi, K. 2002. "Emergency and Disaster Preparedness: Core Competencies for Nurses: What every nurse should but may not know," *The American Journal of Nursing* (102:1), pp. 46–51.
- General Electric 2016. *Intelligent Cities*. <https://www.ge.com/digital/products/intelligent-cities>.
- Hirt, M., and Willmott, P. 2014. "Strategic principles for competing in the digital age," *McKinsey Quarterly* (May 2014).

- IBM 2016. *IBM Smarter Cities - Future Cities*.
http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/.
- Infocomm Development Authority of Singapore 2015. *Smart Nation Singapore*.
<http://www.smartnation-forbes.com/>.
- Intel Corporation 2016. *Sustainable Cities: Citywide Pilot Project with Intel*.
<http://www.intel.com/content/www/us/en/internet-of-things/smart-city-initiative.html>.
- Kahlen, M., Ketter, W., and van Jan Dalen 2014. "Balancing with Electric Vehicles: A Profitable Business Model," in *ECIS 2014 Proceedings*, Paper 11.
- Kamal-Chaoui, L., and Robert, A. (eds.) 2009. *Competitive Cities and Climate Change*. OECD Regional Development Working Papers No. 2, Paris: OECD Publishing.
- Ketter, W., Peters, M., Collins, J., and Gupta, A. 2016a. "A Multiagent Competitive Gaming Platform to Address Societal Challenges," *Management Information Systems Quarterly* (40:2), pp. 447–460.
- Ketter, W., Peters, M., Collins, J., and Gupta, A. 2016b. "Competitive Benchmarking: An IS Research Approach to Address Wicked Problems with Big Data and Analytics," *Management Information Systems Quarterly* (forthcoming).
- Leong, C., Pan, S., Ractham, P., and Kaewkitipong, L. 2015. "ICT-Enabled Community Empowerment in Crisis Response: Social Media in Thailand Flooding 2011," *Journal of the Association for Information Systems* (16:3), pp. 174–212.
- Mayor's Office of Technology and Innovation 2015. *Building a Smart + Equitable City*.
<http://www1.nyc.gov/assets/forward/documents/NYC-Smart-Equitable-City-Final.pdf>.
- McKinney, E. 2009. "Supporting Pre-Existing Teams in Crisis with IT: A Preliminary Organizational-Team Collaboration Framework," *Journal of Information Technology Theory and Application* (9:3), pp. 39–59.
- Mendonça, D. 2007. "Decision support for improvisation in response to extreme events: Learning from the response to the 2001 World Trade Center attack," *Decision Support Systems* (43:3), pp. 952–967.
- Mintzberg, H., and Waters, J. A. 1985. "Of strategies, deliberate and emergent," *Strategic Management Journal* (6:3), pp. 257–272.
- Ng, B.-Y., and Kankanhalli, A. 2012. "Information Systems for Large-Scale Event Management: A Case Study," *Pacific Asia Journal of the Association for Information Systems* (4:3), pp. 15–44.
- Perrow, C. 1983. "The Organizational Context of Human Factors Engineering," *Administrative Science Quarterly* (28:4), pp. 521–541.
- Perrow, C. 1984. *Normal Accidents: Living with High-Risk Technologies*, New York: Basic Books.
- Scott, M., DeLone, W., and Golden, W. 2015. "Measuring eGovernment success: a public value approach," *European Journal of Information Systems* (advance online publication).
- Smart London Board 2014. *Smart London Plan: Using the creative power of new technologies to serve London and improve Londoners' lives*.
http://www.london.gov.uk/sites/default/files/smart_london_plan.pdf.
- Tan, C.-W., Benbasat, I., and Cenfetelli, R. T. 2013. "IT-Mediated Customer Service Content and Delivery in Electronic Governments: An Empirical Investigation of the Antecedents of Service Quality," *Management Information Systems Quarterly* (37:1), pp. 77–109.
- Teubner, T., and Flath, C. 2015. "The Economics of Multi-Hop Ride Sharing - Creating New Mobility Networks Through IS," *Business & Information Systems Engineering* (57:5), pp. 311–324.
- Thomas, M., Andoh-Baidoo, F. K., Redmond, R., and Yoon, V. 2009. "Moving Beyond Traditional Emergency Response Notification with VoiceXML," *Journal of Information Technology Theory and Application* (10:1), pp. 28–40.
- Turoff, M., Chumer, M., Walle, B. d., and Yao, X. 2004. "The Design of a Dynamic Emergency Response Management Information System (DERMIS)," *Journal of Information Technology Theory and Application* (5:4), pp. 1–35.
- United Nations Department of Economic and Social Affairs 2014. *World Urbanization Prospects: The 2014 Revision, Highlights*, New York: United Nations.
- Wagner, S., Brandt, T., and Neumann, D. 2016. "In free float: Developing Business Analytics support for carsharing providers," *Omega* (59, Part A), pp. 4–14.
- Watson, R., Boudreau, M.-C., and Chen, A. 2010. "Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community," *Management Information Systems Quarterly* (34:1), pp. 23–38.

- Xue, Y., and Liang, H. 2004. "IS-Driven Process Reengineering: China's Public Health Emergency Response to the SARS Crisis," *Journal of Information Technology Theory and Application* (6:3), pp. 41–58.
- Yang, L., Prasanna, R., and King, M. 2009. "On-Site Information Systems Design for Emergency First Responders," *Journal of Information Technology Theory and Application* (10:1), pp. 5–27.