Does Growing Demand for Data Science Create New Opportunities for Information Systems?

Panel

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Abstract

Many employers expect to face a significant shortfall of workers with data science skills in the coming decade. This panel focuses on the opportunities and challenges this poses for the Information Systems (IS) community. Specifically, the panel focuses on three key questions at the nexus of data science, skills, and IS: a) characterizing the changes in skill demand from industry in a variety of international contexts, b) evaluating the role of IS departments in educating the next generation of these workers, and c) identifying how IS research should adjust to complement new educational initiatives. These questions are provocative because they are rooted in a debate about whether industry investment in modern data technologies requires new workers and skills, new courses and faculty, and a new knowledge base, or whether data science is best understood as a rebranded phenomenon that will be rapidly and effectively absorbed into existing infrastructure.

Keywords: big data, data science, information systems, IS skills, IS education

Introduction

The potential for significant "big data" driven productivity growth in the coming decade has captured the attention of both managers and the business press. A potential impediment to this growth, and a key concern for policy makers, however, is a shortage of workers with the skills that employers need to realize productivity improvements from these technologies (Rooney 2012; Tambe 2014). By some estimates, US firms will, by 2020, expect to face a shortfall of 190,000 "data scientists" and 1.5 million workers in managerial and analytic occupations with the required levels of data and statistical skills (Mckinsey 2011). The evolving market for skills complementary to big data investment is, therefore, likely to continue to command significant attention from managers, educators, and policy makers in the coming years.

This panel focuses on the opportunities and challenges facing the Information Systems (IS) community in the wake of these changes in industry demand. The IS community is likely to be impacted in at least two notable ways by rising demand for workers who are more proficient with statistics and data analysis. First, in many universities around the world, faculty in Information Systems departments find themselves at the center of discussions around the development of new programs, centers, and educational initiatives aimed to meet industry demand for new skills complementary to big data technologies. Even though considerable debate still remains about how the spread of data science will alter the demand for skills, questions are already emerging about which courses and programs are best suited to produce these workers, and what changes must be made to all departments—and especially IS departments—to effectively provide data science education. A second and closely related question is how IS research may need to adjust to generate a body of knowledge that can support effective teaching in this area.

These questions are *provocative* because they are rooted in a fundamental debate about whether investment in modern data technologies requires new workers and skills, new courses and faculty, and a new knowledge base, or whether data science is best understood as a rebranded phenomenon that will be rapidly and effectively absorbed into existing infrastructure. This has significant implications for how well poised the IS community is to capitalize on the emergence of data science as a focal point for universities and organizations, and what opportunities and obstacles this implies for the IS community. This tension, related to whether growing demand for data science skills represents a new opportunity or is simply 'old wine in new bottles', is a key theme that runs through the proposed panel. Specifically, the panel focuses on three key questions at the nexus of data science, skills, and IS: a) characterizing the changes in skill demand from industry, b) evaluating the role of IS departments in educating the next generation of these workers, and c) identifying how IS research should adjust to complement new educational initiatives.

Issues

1.What skills does industry need? Do the workforce challenges differ across geographic regions?
The first question characterizes how new data science technologies are changing industry demand for skills. Although new job titles, such as 'data scientist', have emerged in the past few years, many of the tools, technologies, and techniques associated with this work have a long history in the data mining and machine learning fields. Does the growth in demand for these workers primarily reflect an increase in demand for skills that are already well understood, or are there fundamental differences between data science skills and the skills complementary to earlier generations of data technologies? Second, how does the demand for data science skills differ globally? Panelists will discuss how industry demand differs in Singapore, China, India, and the US. The panelists listed next to each question will be asked to issue initial responses to the statement, after which the discussion will be opened to the broader panel.

- · *Data science is "old wine in new bottles". (Ritu Agarwal and Galit Shmueli)*
- · *How do the workforce challenges compare across different countries? (Khim Yong Goh, Anindya Ghose, and Sandra Slaughter)*

2. How should these skills be supplied?
The second question the panel will address is what the best channels might be through which to impart skills and training to students or workers, including universities, on-the-job learning, courses in

traditional business schools, departments of information systems, computer science departments, and alternative specialist programs (such as Masters programs in Business Analytics). First, the panelists, who represent six different, leading IS departments, will share how their schools are adjusting to address this demand, how their experiences in data science education differ across geographic regions, and they will share some lessons learned. We will discuss the relative advantages of different schools within the university for providing these skills, and we will consider the possibility that the emergence of big data has had negative effects on pedagogy and curriculum development. This segment will focus on the particular role of IS departments in this evolution, and will characterize some of the educational threats and opportunities facing IS departments during this transition period. The discussion will be framed around the following two questions. The panelists listed next to each question will be asked to issue first responses to the statement, after which the discussion will be opened to the broader panel.

- *Which schools within universities are best positioned to supply these skills? (Ravi Bapna and Sandra Slaughter)*
- *What are the strengths and weaknesses of the specialist business analytics programs that are being newly offered at many universities? (Khim Yong Goh and Anindya Ghose)*

3. What new research streams are needed to support these educational initiatives?
The third and final segment will focus on whether the changes described above require the addition of new research and knowledge bases for IS. The panelists represent the senior leadership of many of the most respected IS journals. They will discuss the extent to which the research programs represented in IS departments, by existing IS faculty, make them well equipped to drive data science-related educational initiatives, or alternatively, whether growing interest in data science may necessitate adjustments to what has traditionally been seen as the core IS knowledge base. The discussion will be framed around the following provocative statement. The panelist listed next to the question will be asked to issue a first response to the statement, after which the discussion will be opened to the broader panel.

- *IS must undergo significant transformation (e.g. new course development, new faculty hiring) to be well positioned to provide data science education. (Ritu Agarwal and Ravi Bapna)*

Panelists

Ritu Agarwal, Robert H. Smith Dean's Chair of Information Systems at the Robert H. Smith School of Business, University of Maryland.

Ravi Bapna, Board of Overseers Professor of Information and Decision Sciences Department at the Carlson School of Management, University of Minnesota.

Anindya Ghose, Professor of Information, Operations and Management Sciences and a Professor of Marketing at New York University's Leonard N. Stern School of Business.

Khim Yong Goh, Associate Professor, Department of Information Systems at the National University of Singapore.

Sandra Slaughter, Alton M. Costley Chair at the Georgia Institute of Technology, Scheller College of Business.

Galit Shmueli, Distinguished Professor at the College of Technology Management's Institute of Service Science (ISS) at National Tsing Hua University.

Session Moderator

Prasanna Tambe, Associate Professor of Information, Operations, and Management Sciences at New York University's Leonard N. Stern School of Business.

Panel Structure

In accordance with ICIS guidelines, the panel will be ninety minutes. The organizer will use three minutes at the beginning of the panel to introduce the topic and the panelists. The remaining ninety minutes will be divided into three segments of just under thirty minutes each. Each of these segments will be dedicated to one of the three topics described above.

For each segment, the moderator will issue one of the statements described above and request that a specific panelist use about three minutes to respond to the statement. After that panelist has responded, all other panelists will have about ten to fifteen minutes to respond to the statement or to the previous panelists' statements. Covering the statements and related sub-questions in each segment using this format is expected to take about twenty minutes.

The remaining ten minutes of each of the sections will be dedicated to audience questions. To facilitate participation, we are hoping for access to a microphone that can be passed around the audience. Alternatively, we will request that the audience pass notecards to the moderator, or perhaps submit questions by text message in which cases the moderator will ask questions on behalf of audience members. The moderator will be responsible for ensuring that the panel stays on schedule, with enough time to cover the three topics described above.

Participation Statement

All participants have confirmed that they will be attending the conference and are willing to serve on the panel if the panel is accepted.

Biographies

Ritu Agarwal is Professor and the Robert H. Smith Dean's Chair of Information Systems at the Robert H. Smith School of Business, University of Maryland, College Park. She is also the founder and Director of the Center for Health Information and Decision Systems at the Smith School. Dr. Agarwal has published over 80 papers on information technology management topics in journals such as Information Systems Research, MIS Quarterly, Management Science, Communications of the ACM, Journal of Management Information Systems, Decision Sciences, IEEE Transactions, and Decision Support Systems, and has made presentations at a variety of national and international conferences. Her current research is focused on the use of IT in healthcare settings, technology-enabled strategic transformations in various industrial sectors, and consumer behavior in technology-mediated settings. Her research has been sponsored by the Agency for Healthcare Research and Quality, Society for Information Management, US Department of Labor, NSF, and DARPA.

Professor Agarwal is the Editor-in-Chief of Information Systems Research. Previously she served three-year terms as Senior Editor at MIS Quarterly and Associate Editor for Management Science. Dr. Agarwal was a member of the INFORMS board as Vice President for Subdivisions from 2004 to 2006, and served as a Vice President in the Association for Information Systems from 2002 to 2005. In 2010 Professor Agarwal initiated and chaired the first annual Workshop on Health Information Technology and Economics (WHITE 2010), a multi-disciplinary research conference to engage the research, policy and practice communities in understanding the role of digital technologies in healthcare transformation. She has been appointed a Standing Member of the Agency for Healthcare Research and Quality's expert review panel on Healthcare Effectiveness and Outcomes Research for the period 2010-2012. She has served in leadership roles in a number of major professional conferences during her career, including Program Chair for the International Conference on Information Systems. In 2011 she was appointed as a Fellow of the Association for Information Systems.

Ravi Bapna is the Board of Overseers Professor of Information and Decision Sciences Department at the Carlson School of Management, University of Minnesota. Bapna is the founding academic co-director of University of Minnesota's Social Media and Business Analytics Collaborative (SOBACO), an inter-disciplinary research center that views the billion strong, online social-graph as a giant global laboratory, a sandbox to gain a deeper causal understanding of how consumers, firms, industries and societies are

being reshaped by the social media and big-data revolution. He teaches graduate students, executives, CIOs and CMOs on how to leverage the digital revolution for competitive advantage. His professional interests have resulted in research, consulting and executive education engagements with a variety of leading US and Indian companies. He regularly delivers keynote addresses on the leveraging big-data and social media to industry bodies and corporations.

Prior to joining Carlson, Bapna was a tenured associate professor at the Indian School of Business and the University of Connecticut. He served as the Executive Director of the Srini Raju Centre for Information Technology and the Networked Economy (SRITNE) at the Indian School of Business, where he founded the CIO Academy. At UConn Bapna was an Associate Professor and Ackerman Scholar in the Operations and Information Management Department at the School of Business. His research has been extensively published in a wide array of journals. Bapna serves as a senior editor for *MIS Quarterly* and has been an associate editor for *Management Science* and *Information Systems Research*. He has served as the co-chair of the prestigious Workshop on Information Systems Economics (WISE) 2010, and the Conference on IS and Technology (CIST) 2009. He is one of the three founders of the Statistical Challenges in E-Commerce (SCECR) workshop.

Anindya Ghose is a Professor of Information, Operations and Management Sciences and a Professor of Marketing at New York University's Leonard N. Stern School of Business. He is the co-Director of the Center for Business Analytics at NYU Stern. He is the Robert L. & Dale Atkins Rosen Faculty Fellow and a Daniel P. Paduano Fellow of Business Ethics at NYU Stern. He has been a Visiting Associate Professor at the Wharton School of Business. He also serves as the main Scientific Advisor to 3TI . He was selected by Business Week as one of the "Top 40 Professors Under 40 Worldwide" and by Analytics Week as one the "Top 200 Thought Leaders in Big Data and Business Analytics".

His research analyzes the economic consequences of the Internet on industries and markets transformed by its shared technology infrastructure. He is an expert in quantifying the economic value from user-generated content in spaces mediated by social media; modeling and estimating the monetization of content through search engine advertising; modeling consumer behavior in mobile Internet based social networks; examining the drivers of crowdfunding, and measuring the welfare impact of the Internet and electronic markets. He has worked on product reviews, reputation and rating systems, sponsored search advertising, mobile commerce, mobile apps, mobile ads, crowdfunding, and online markets. He teaches courses on social media, digital marketing, business analytics and IT strategy at the undergraduate, MBA, EMBA, MSBA, and Executive Education level in various parts of the world including the US, India, and South Korea. He is on the Research Council of the Wharton Customer Analytics Institute, a faculty affiliate with the Marketing Science Institute and the Sloan Center for Internet Retailing at the University of California, Riverside. He serves as an Associate Editor of *Management Science* and a Senior Editor of *Information Systems Research*.

Khim Yong Goh is an Associate Professor in the Department of Information Systems at The National University of Singapore (NUS). He received his Ph.D. degree in Business Administration (Marketing: Economics and Quantitative Methods) from The University of Chicago, Booth School of Business. He holds a B.Sc. (First Class Honors) degree in Computer and Information Sciences and a M.Sc. degree in Information Systems from The National University of Singapore. Dr. Goh's research and teaching interests include consumer and firm behaviors in markets with network and social interaction effects, marketing and advertising in digital media environments, competitive product, pricing and promotional strategies in IT-mediated markets, and applied econometric and data analytic methods. In his research and consulting activities, Dr. Goh has worked on business analytics projects with businesses and organizations from Singapore, United States, China, Japan, Korea, and Australia. In his teaching engagements, Dr. Goh has instructed undergraduate, post-graduate and industry executive students in the NUS School of Computing, NUS Strategic Technology Management Institute, NUS Business Analytics Centre and the University of Chicago, Booth School of Business (Executive MBA program). He is involved in spearheading two new NUS bachelor and master degree programs in Business Analytics.

Dr. Goh's research work has been published or accepted in top-ranked international academic journals such as *Management Science, Journal of Marketing Research, Information Systems Research, IEEE*

Transactions on Engineering Management, *Journal of the Association for Information Systems*, *Information and Management*, *Journal of Interactive Marketing*, and *Journal of Electronic Commerce Research*. He has also presented papers in the *International Conference on Information Systems*, *Annual Workshop on Information Technology and Systems*, *Marketing Science Conference*, *Workshop on Information Systems and Economics*, and *Hawaii International Conference on System Sciences*. He has also served in the program committees of the *International Conference on Information Systems* and the *Pacific Asia Conference on Information Systems* as an associate editor and track co-chair. His opinions on research findings and industry developments have been cited in news publications or channels such as *Straits Times*, *Channel NewsAsia*, *ZDNet Asia*, *Capital Ideas* and *Investor's Business Daily*.

Sandra Slaughter (Ph.D., University of Minnesota) is the Alton M. Costley Chair and Professor of Information Technology Management in the Scheller College of Business at the Georgia Institute of Technology. Before joining the College's faculty in 2007, she was a member of the information technology faculty in the David A. Tepper School of Business at Carnegie Mellon University, where she was a tenured Associate Professor. Prior to her academic career, Dr. Slaughter spent ten years working as an information technology (IT) analyst and project leader in companies including Hewlett-Packard, the Allen-Bradley division of Rockwell International, and Square D Corporation.

Her research builds upon her practical experience in IT development and focuses on productivity and quality issues and the effective management of IT projects and professionals. Her thesis won first place in the doctoral dissertation competition held by the International Conference on Information Systems (ICIS) in 1995. Since then, she has gone on to publish more than one hundred articles in leading research journals, conference proceedings, and edited books. She has written a book on the software industry, entitled A Profile of the Software Industry: Emergence, Ascendance, Risks and Rewards that will be published by Business Expert Press in 2014. Her work has received seven best paper awards at major conferences and a best published paper award from Information Systems Research. Her research has been supported by two million dollars in grants from the National Science Foundation, the Department of Defense, and Research Centers at Georgia Tech, Carnegie Mellon University, and the University of Minnesota. She was awarded the Xerox Research Chair at Carnegie Mellon University in 1998, and the Georgia Power Professor of Excellence at Georgia Tech in 2013.

Sandra currently serves as a Departmental Editor for Management Science (Information Systems Department), and has served as a Senior Editor or Associate Editor for other leading journals including MIS Quarterly, Information Systems Research and others. In 2009, she served as Program co-Chair of the International Conference on Information Systems. She is currently serving as the elected Association for Information Systems (AIS) Region 1 (Americas) Representative on the AIS Council.

Galit Shmueli is Distinguished Professor at the College of Technology Management's Institute of Service Science (ISS) at National Tsing Hua University. Dr. Shmueli's research focuses on statistical and data mining methodology with applications in information systems and healthcare. She has authored six books, including the popular textbook Data Mining for Business Intelligence and over 60 publications in peer-reviewed journals and books, including the top journals *Management Science, Journal of the American Statistical Association, Journal of the Royal Statistical Society, Information Systems Research, MISQ, Marketing Science, Statistical Science* and *Technometrics*.

In 2004, Dr. Shmueli co-founded the now annual symposium Statistical Challenges in eCommerce Research. Her research focuses on applying novel statistical methodology and adapting existing methods for modern data structures. Her papers "To Explain or To Predict?" and "Predictive Analytics in Information Systems Research" have attracted much attention and won several research and "best paper" awards. Professor Shmueli has been conducting research, teaching, and designing programs in data analytics as a tenured business school faculty member in three countries: USA, India and Taiwan. Dr. Shmueli teaches courses on data mining, forecasting analytics, interactive visualization, statistics, and other business analytics topics. She has experience in teaching engineers and business students, undergraduate and graduate students, teaching online and on-ground. Dr. Shmueli has won multiple teaching awards, and supervised several Masters and PhD students. Dr. Shmueli is associate editor for the top journals *Annals of Applied Statistics*, *JASA* & *The American Statistician Reviews* and was guest editor of a special issue of *Statistical Science*.

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