Editorial: Emerging Technologies
Chris McPhee, Editor-in-Chief

David Hudson, Guest Editor

From the Editor-in-Chief

Welcome to the March 2014 issue of the *Technology Innovation Management Review*. This month's editorial theme is Emerging Technologies, and it is my pleasure to introduce our guest editor, David Hudson, a lecturer in Carleton University's Sprott School of Business (sprott.carleton.co) in Ottawa, Canada, and Director of the Venus Cybersecurity Corporation (venuscyber.com) and the Lead To Win (leadtowin.ca) entrepreneurship program.

In April, the editorial theme will be Service and Innovation, and our guest editors will be Marja Toivonen (VTT Technical Research Centre of Finland), Risto Rajala (Aalto University), and Mika Westerlund (Carleton University).

Our May issue will be unthemed, and therefore represents a good opportunity to submit articles on any topic that fits within our scope. Please contact us (timreview.ca/contact) with article topics and submissions, suggestions for future themes, and any other feedback.

Finally, please note that Carleton University's TIM program and the TIM Review will be organizing a workshop on technology entrepreneurship and innovation for the first ISPIM Americas conference (americas.ispim.org), which will be held in Montreal, Canada, on October 5–8, 2014. I encourage you to read the call for papers (tinyurl.com/kqrp5od) and consider attending this unique conference.

We hope you enjoy this issue of the TIM Review and will share your comments online.

Chris McPhee
Editor-in-Chief

From the Guest Editor

In preparing to introduce this month's issue of the TIM Review, I was reflecting on emerging technology and the popular idea that the rate of technology change today is somehow greater today than it was in the past. I do not know whether the amount of change that businesses face today is more or less than in other eras, but I do know that the idea that emerging technologies can affect businesses and are often controversial – Do they matter? How can you know? What's wrong with the things that we do well today? – has long been studied.

In 1832, cholera epidemics were common, Darwin was sailing on the Beagle, Mendelssohn's music was found in new releases, Lewis Carroll and Charlotte Brontë were pop stars, the Rideau Canal between Kingston and Ottawa was newly completed, the source of the Mississippi was being discovered, and the practical production of electricity remained decades away. At the same time, coal-fired steam power had just moved into general commercial use and the method and value of turning iron into steel had also just been widely understood. This period is the heart of the Industrial Revolution and when the first World's Fair, "Great Exhibition of the Works of Industry of all Continents", took place in London a few years later, it was dominated by the fact as well as the hype of the application of steam-powered machinery to agricultural, manufacturing, transportation, military, utility, and other purposes (Grove, 1997; tinyurl.com/mlsk7ga).

In 1832, Charles Babbage also published *On the Economy of Machinery and Manufactures* (tinyurl.com/pq2v4zz). On the surface, Babbage writes about a range of significant and rapidly unfolding developments in manufacturing as steam-powered machines are put to diverse uses. Babbage describes many, then novel, applications of steam and how traditional manufacturing practices were inadequate compared to the new technology. He not only sees widespread industrial applications, he can imagine:

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• Computers: "The mechanical execution of such [a mathematical] engine … is not so far removed from that of ordinary machinery as might be conceived."

• Networks: "That the stretched wire might itself be available for a species of telegraphic communication yet more rapid."

• And even apps: "When the completion of a calculating engine [has taken place], the attention of analysts will naturally be directed to simplifying its application."

Despite Babbage's insight into technology and its potential uses, he makes a more significant contribution to discourse on how new technology disrupts business in the most general sense.

Babbage writes about a frame-breaking disruption to the manufacturing business practices of that day, a disruption that is no less significant than the arrival of the Internet at the end of the twentieth century. Consequently, although Babbage's exposition of all things mechanical as they relate to "manufactories" can be read as something of an *Industrial Revolution for Dummies* reference text, Babbage demonstrates a profound understanding that technology-driven change is significant to a wide variety of businesses and is likely to become more significant over time. In other words, Babbage writes as a consultant and provides sensible best practices for dealing with what is yet to come. He writes about the need for readiness for the change that can be expected even if it cannot be fully explained. He specifically compares the impact of machinery on factories to how steam inevitably makes sails obsolete and how it is necessary to see beyond the history, skills, infrastructure, and even romance associated with the old paradigm to embrace the new, noting: "It is the same engine that … weaves the canvas it may one day supersede" (Babbage, 1832; tinyurl.com/pq2v4zz).

Over a hundred years later, Schumpeter (1950; tinyurl.com/lmjcr5z) framed the advantage conveyed by technology as playing an essential role within the overall economic philosophy and practice of capitalism. In this view, new technology is not about optional or marginal improvement but is critical to competitiveness. His "creative destruction" is a process of imagination realized, with attendant risk of failure.

Later still, Rosenbloom and Christensen (1994; tinyurl.com/poqntys) would describe disruptive technology

in terms of normal paths of incremental technological progress. They argue that disruptive technology is so because it is evaluated differently from previous technology and introduces new dimensions of performance. Disruptive technology creates the "innovator's dilemma" where incumbents often fail to capture new and more valuable markets because the technology obviates previous industrial practice, structures, and membership (Christensen and Overdorf, 2000; tinyurl.com/k27k7gk).

The topic of recognizing technology disruption as a business opportunity attracts ongoing inquiry and publication, in part, because it is far easier to identify disruptive technologies after the fact than before (Brynjolfsson and Hitt, 1998: tinyurl.com/k9ef54p; Danneels, 2004: tinyurl.com/n8wgfn7; Rosenberg, 1994: tinyurl.com/l3cgqmo; Tushman and Anderson, 1986: tinyurl.com/krgrrgn; Utterback, 2003: tinyurl.com/mpppw6l; Utterback and Abernathy, 1975: tinyurl.com/ncognj7). Babbage (1832; tinyurl.com/pq2v4zz) tackled the subject and argued for disruption of the established order at a time when Great Britain was the absolute global superpower in economic as well as military terms. He provides practical advice that can be applied today and is not dissimilar from contemporary advice.

For example, Babbage illustrated his treatise with examples of technology impact using descriptions of familiar products and processes for "easy access to the reader". His examples include books, bricks, machine parts, bolts, leather working, sheet music, boilers, mathematical tables, porcelain, jewelry, cutlery, bottles, watches, seismographs, and millwork. In other words, he takes an applied view and dwells little on the details of the technology. He is far more interested in the potential impact of technology. A modern example of similar advice is Monroe (2010; tinyurl.com/mokanur).

In considering the technology impact, Babbage argues for taking the broadest possible view of business operations. Chapter 12 of his book addresses the need to look at the complete operation and supply chain of the business: "The maker of an article [as] a manufacturer, in the more extended sense of the term, … must attend to other principles besides those mechanical ones on which the successful execution of his work depends". Keeley and colleagues (2013; tinyurl.com/mqzso5y) also explore how innovation potential exists throughout the entire operations of any firm and emphasize the importance of taking the broad view.

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Finally, Babbage uses first-hand experiences to understand technology impact and describes experiment after experiment. His exploration of technology potential involves working through implementations in the field. Deloitte (2013; tinyurl.com/cxjlq9o) also emphasizes the importance of experiments, trials, and prototypes in assessing technology impact. Babbage believes that hands-on field research leads to best practices by applying rigorous and forward-looking observational, data collection, and survey methods that consider business output and impact to employees. Babbage also encourages sharing within a community of practice to advance business practices using new technologies, noting that, "… many of these new … inventions, when their success is once established, become general amongst the whole body of manufacturers".

The articles in this issue provide a diverse set of examples of examining the impact of arguably disruptive technologies and how individuals and organizations can realize value from their use.

- **Chelsea Young's** article on HarrassMap considers how crowdsourcing technology can be applied to improve social services delivery at a very micro level and even social policy at a more macro level. Crowdsourcing has been applied for a variety of revenue-generating purposes, but this article highlights its potential to create other types of value.

- **Sarah Marshall's** article on IT consumerization in healthcare describes technology that is not necessarily disruptive in terms of its software and hardware but in terms of who chooses it and brings it into the workplace. The technology that people used when they BYOD ("bring your own devices") may or may not be emerging in the sense of being at the leading edge but they are disrupting workflows, business practices, and IT management, particularly in organizations that have a tradition of top-down control of IT.

- **Rebecca Neu's** article looks at innovation in biomedical technology that provides new approaches to treating serious medical conditions using 3D printing. The article suggests that this technology will do more than just revolutionize how hard-to-find or hard-to-produce industrial parts are sourced, it may bring the revolution to fields that never manufactured parts before.

- **GK Palem's** article examines what is, in fact, a broad set of technologies under the label of "big data analytics" and how companies can approach their use in a systematic manner. In an approach that Babbage would like, this article recommends building competence early by getting experience with the technology in use.

- The summary of **Arnold Kwong's** lecture highlights how cybersecurity is an opportunity space that has seen enormous technological innovation already. However, the growing rate and variety of threats argues that different approaches – that focus on different dimensions of performance and possibly disruptive technologies – are required.

- Finally, the summary of **John F. Tyson's** lecture on his experiences of the rise and fall of Nortel Networks illustrates the lessons companies can learn from past attempts to discover and commercialize emerging technologies.

Technology hype is not new, nor are some essential techniques for examining what technology can mean to business. It is possible that, as technology becomes more pervasive, the techniques for assessing potential impact need to be applied more broadly within organizations, particularly large ones with the greatest tendency to be caught in the innovator's dilemma. A critical eye is required but application understanding, a wide view of value creation potential, and hands-on experimentation may be as or more usefully applied by employees at large than by a small group charged with innovation and disruption.

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About the Editors

Chris McPhee is Editor-in-Chief of the *Technology Innovation Management Review*. Chris holds an MASc degree in Technology Innovation Management from Carleton University in Ottawa and BScH and MSc degrees in Biology from Queen's University in Kingston. He has over 15 years of management, design, and content-development experience in Canada and Scotland, primarily in the science, health, and education sectors. As an advisor and editor, he helps entrepreneurs, executives, and researchers develop and express their ideas.

David Hudson is a lecturer in information technology and innovation in the MBA program at Carleton University's Sprott School of Business in Ottawa, Canada. He is a Director of the Venus Cybersecurity Corporation and the Lead To Win entrepreneurship program, and he is the Chair of the Advisory Board for the Province of Ontario Centres of Excellence Information, Communication, and Digital Media Sector. David also consults with F500 firms on innovation management. David's doctoral research at Carleton focused on IT consumerization and how employees create value for themselves and their firms when they "BYOD". Previously, he was the Vice President for advanced research and development at a large technology firm and has received Bachelor's and Master's degrees in Systems Design Engineering from the University of Waterloo, Canada.