The increasing digitization of the economy presents both opportunities and challenges for firms. On one hand, digitization can enable more degrees of freedom and sophisticated strategies that target each customer segment or even each customer individually with efficiency. For example, firms can now create rich and customized advertisements with almost laser precision without sacrificing tremendous reach. In addition, many firms are devising their digital strategies such that they not only directly sell to customers through their linear value chain or pipeline (as with Walmart) but also facilitate interactions among their consumers and complementors/suppliers (for example, Amazon Marketplace or Google’s Android platform).¹ Think of Walmart acquiring Jet.com or Amazon acquiring Whole Foods as exemplars of digital strategies that encompass elements of pipelines as well as platforms.

On the other hand, digitization requires firms to become more nimble and innovate with high quality and velocity. Tech firms such as Apple, Google, and Amazon constantly introduce novel, high-quality products and services that meet or even create customer demands. These firms often appear to follow strategies that defy conventional guidelines emphasizing the pursuit of binary “either-or” strategies, such as either efficiency or innovation and either exploitation of current resources or exploring and embracing new opportunities.

However, pursuing dual strategies, especially those that deliver on both efficiency and innovation, is not easy, as firms such as 3M have discovered.² Therefore, it is worth considering how managerial and IT practices can contribute to the success of dual-focused and ambidextrous strategies. Based on our research and observations, we argue that successful firms often deploy and demonstrate what we call disciplined autonomy to more fully leverage opportunities presented by digitization. We also suggest how executives and IT professionals can foster disciplined autonomy.

Balancing Discipline and Autonomy

Historically, IT strategy and IT management decisions were often driven by a focus on discipline that manifests in alignment or compliance with ISO or CMM standards. The focus on such discipline might have been appropriate when the economy was much less digitized in the 1960s but might not be enough when customer expectations change quickly and competitors move faster or new players enter the market.³

In recent years, faced with digitization and the need for fast and high-quality innovation, IT organizations are increasingly providing more autonomy to teams and turning to more autonomous organizational arrangements. For example, Google tries to reduce hierarchies and create structures that empower employees to solve problems for themselves, come up with new ideas, and execute those ideas without lengthy approval
processes. Google, 3M, and other tech firms even allow employees to use a certain share of their work time to pursue projects that they personally find interesting. The idea is that employees with “psychological safety” and freedom regarding the steps they take to produce outcomes are more likely to be creative and develop frequent and high-quality innovations, as revealed by Google’s “Project Aristotle.”

However, autonomy comes at a price, and if unfettered, it can bypass IT departments completely, a problem that most IT professionals are familiar with. We argue that creating sustainable value in the digital age requires a careful and appropriate emphasis on both discipline and autonomy (see the “About the Discipline-Autonomy Matrix” sidebar). We conceptualize this combination of discipline with autonomy as disciplined autonomy.

Disciplined autonomy is the extent to which an organization or team adopts work templates or standards while providing sufficient autonomy to business units, teams, or individuals. Because teams are expected to align their behavior with general principles, the risks created by unfettered autonomy can be reduced. Because the decision or discretion as to when and how to apply such work templates or standards remains with autonomous actors, organizations can benefit from the virtues of autonomy.

The notion of disciplined autonomy to achieve ambidexterity is different from other notions that focus on structural solutions (two-speed IT in which two separate units are responsible for efficiency versus adaptation) or temporal solutions (discipline in one period and autonomy in another period). It bears some resemblance to contextual solutions proposed in other contexts, where culture and processes empower individuals to make appropriate tradeoffs in the context of their work.

Disciplined Autonomy in IT Projects

The traditional focus of IT project management was on discipline, evident in a waterfall approach that relies on extensive upfront planning, sequential project phases with clearly defined quality gates, and the assignment of tasks to specific individuals with clear roles. Process maturity frameworks also
Successful IT organizations counteract these risks through creating disciplined autonomy. Given the team focus of modern IT project management, establishing disciplined autonomy requires coupling team autonomy with microlevel best practices that can be situationally applied. Some of these techniques to achieve disciplined autonomy include peer feedback, as in pair programming or code reviews from peers, and automated testing.6,7 Because forcing teams to apply these techniques can counteract the benefits of autonomy, investing in training on best practices while giving employees discretion when to apply the techniques seems to be a reasonable strategy. Recent research shows that disciplined autonomy techniques have positive effects on team confidence and innovation effectiveness, particularly in uncertain environments.8

Disciplined Autonomy Across Organizational Boundaries

The notion of disciplined autonomy goes beyond firm boundaries and applies equally to newly emerging platform ecosystems. Some of the dominant firms such as Alphabet, Amazon, Facebook, Apple, and GE today compete with a platform strategy. Enterprise software firms, such as SAP and Oracle, increasingly market their enterprise software solutions as platforms, allowing third-party developers to provide complementary solutions as opposed to offering monolithic systems.9 Platforms provide the technological basis for large-scale innovation to occur outside the firm, thereby granting third parties considerable autonomy. Importantly, however, while granting autonomy to third parties, successful platforms also encourage desirable behavior and foster high quality. For example, app developers in the context of smartphone platforms can use various APIs offered by platform owners such as Google or Apple.

Broadly speaking, the reorganization of Google as a subsidiary of Alphabet can be construed as an attempt to provide autonomy to business units like Google within the overall organizing logic that Alphabet provides. Other conglomerates, such as GE and the Tata group, also demonstrate the notion of disciplined autonomy in which the parent company provides an overarching discipline while allowing business units sufficient autonomy in respective businesses.

For example, the Tata group uses the Tata Business Excellence Model (TBEM), a variant of the Baldrige criteria, to provide discipline through a coherent framework and autonomy by allowing companies to interpret the framework based on their competitive needs. In a way, TBEM is an organizational operating system and platform for integrating various organizational initiatives, similar to how an operating system allows a variety of software applications to leverage a common platform.10,11 Ratan Tata, former chairman of the Tata group, notes that “the true power of TBEM arises because of the discipline that it provides in the form of a framework, while leaving sufficient autonomy to each individual company within the group, which face very different markets.”12

Note that the notion of creating value across firm boundaries is not confined to born-platform businesses or conglomerates only. Other firms have also transformed the way they interact with customers. For example, the Lego group involves customers in developing
new products, and Sony designed its PlayStation in collaboration with customers.

Successful IT organizations can support such initiatives by providing systems for information processing and relationship building that enhance firms’ absorptive capacity. These systems enable disciplined autonomy because they provide freedom to individuals and business units to source outside information for innovation efforts while also suggesting templates for how co-innovation with customers should occur.13

Companies are experimenting with various approaches for achieving what we call disciplined autonomy by creating a “Palo Alto” culture in Kentucky, as with Humana,14 using relatively autonomous squads arranged in circles or subcircles, as with Zappos;15 and using squads, chapters, tribes, and guilds in Spotify.16

Implications of Disciplined Autonomy

How should executives and IT professionals foster disciplined autonomy? Executives should focus on defining the overarching goals and providing vision but allow latitude to business units to figure out the exact details of how to solve problems and execution details. For example, they should provide focus by articulating which problems the organization should solve (which rivers it should cross, as Spotify articulates it), but let the responsibility for problem-solving and finding the exact solution (whether to build a bridge or a boat) remain with the front line. The discipline part can be addressed through strategic clarity, and rewards and metrics by investing in centralized standards, continuous quality assurance, or using models such as the Baldrige criteria. IT professionals should consider creating artifacts that provide sufficient flexibility to users to customize, adapt, or evolve IT solutions within the broad parameters of the overall architecture.

Importantly, senior executives and IT professionals should work together closely, and senior managers should be involved in technical decisions to consider strategic and customers’ viewpoints in adopting, diffusing, and exploiting appropriate IT platforms and applications. Of course, doing so could require senior executives to invest in their own digital intelligence. Managers and IT professionals should not choose discipline at the cost of autonomy or vice versa; it is possible to choose both and be successful. Of course, they should avoid low levels of both discipline and autonomy because that can be even more harmful than choosing high levels of one versus the other.

To conclude, IT professionals and IT organizations can shape their organization’s digital strategy by leveraging the power of disciplined autonomy. To the extent that disciplined autonomy helps to reap the benefits of autonomy while mitigating the associated challenges, disciplined autonomy can be seen as a way to achieve the ambidexterity that many firms may need to succeed in today’s economy.17

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References


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COMPSAC 2017: Highlights
Sorel Reisman, California State University

Here’s a brief highlight if you missed it. The 41st annual Computers, Software, and Applications (COMPSAC) Conference, hosted by Politecnico di Torino from 4–8 July, was a great meeting. This year’s conference theme, “Building Digital Autonomy for a Sustainable World,” along with the venue of Torino, Italy—the center of automobile excellence in Europe—were an appropriate and relevant forum for focusing on emerging autonomous automotive and related technologies. The conference gala banquet held at the Museo Nazionale dell’Automobile, a must-see attraction for anyone visiting Torino, was a special event that
highlighted the messages of the five-day conference.

About COMPSAC
If you aren’t aware of it, COMP-SAC is the IEEE Computer Society’s signature conference—the international forum for academia, industry, and government to discuss research results and advancements, emerging problems, and future trends in computers, software technologies, and applications. Its mission is to serve the professional interests of all our members, both young and old, those new to the profession and well-established researchers and practitioners.

The conference program revolves around 10 symposia (tracks), and includes keynote addresses, research papers, industrial case studies, plenary and specialized panels, fast abstracts, a doctoral symposium, poster sessions, and workshops and tutorials on emerging and important technology and technology-related topics. The conference moves its annual venue from Asia, to the Americas, to Europe, and then cycles back. This year’s conference was in Europe, and sponsors were the IEEE CS, the IEEE Big Data Initiative, IEEE Green ICT, the Associazione Italiana per l’Informatica (AICA), and the special platinum supporter, Reply (www.reply.com).

Conference Highlights
This year’s conference speakers, panels, and presentations, focusing on the theme, addressed the changing world emanating from autonomous technologies. Once the lore of science fiction, we now embrace billions of automated processes, functioning under the control of computer systems. As we enjoy the advantages they provide, we can’t help but wonder: What will be the next major technical innovations, and where might they lead us? We’ve seen conventional automobiles become self-driving cars, human-directed systems become adapted ones, and human services enhanced by robotic services. Clearly, the rate of movement from physical to cyber-enhanced domains is rapid and increasing, initiating ever-more exciting innovations in computers, software, and applications.

The conference provided a forum for in-depth presentations and discussions of the technical challenges, successes, and failures of moving from traditional, person-centered, and person-directed activities and services to those that are the focus of autonomous systems. Sessions included topics and issues related to autonomous computing, wearable computing, the Internet of Things, social networking, cross-domain data fusion, privacy, security and surveillance, cloud and fog computing, big data, physiological computing, self-aware and self-expressive systems, adaptive learning and teaching, and emerging architectures and network issues that affect all these developing, technology-driven innovations.

This year, almost 350 attendees from 35 different countries participated in more than 100 presentations, reviewed by more than 400 reviewers.

Keynotes
The program featured three internationally acclaimed keynote speakers: Francesco Profumo, former Italian Minister of Education; Alberto Sangiovanni Vincentelli, professor at the University of California, Berkley; and Flavio Bonomi, founder of Nebbiolo Technologies. These speakers presented their new perspectives on the cultural and social implications of autonomous systems, fog computing, and Internet technologies. (If you are unfamiliar with these people, google each for a fuller appreciation of their contributions to computer science, computer engineering, and IT.)

Panels
In addition to the general program (www.computer.org/cms/compsac/2017/Program_web.pdf) the conference featured special plenary sessions (visit www.computer.org/web/compsac2017/panels). These included:

- “Future Challenges in Security,” chaired by Elisa Bertino, Purdue University;
- “e-Health,” chaired by Sheikh Iqbal Ahamed, COMPSAC Steering Committee Chair, Marquette University;
- “Internet, Industry, and Society,” chaired by Juan Carlos De Martin, Politecnico di Torino, Italy;
- “Future of Computing,” chaired by Stephen S. Yau, Arizona State University; and

The 2017 conference was also notable for including other topics...
important to CS and IEEE members. As a follow-on to the first Young Professionals program started last year at COMPSAC in Atlanta, this year, about 75 Young Professionals were treated to a special plenary session entitled “Publication Etiquette and Ethics: Things You Should Know Before Submitting Your Next Paper.” Professor Gianluca Setti, past vice president of the IEEE Publications Services and Products Board, conducted the session.

The program also included a special panel session for younger participants by promoting IEEE’s Honor Society, Eta Kappa Nu (HKN). More than 30 undergraduate and graduate students attended a panel session organized by Professor Paolo Montuschi from Politecnico di Torino, led by yours truly. Participants were Nancy Ostin, director of IEEE-HKN, and professors Vin Piuri, University of Milan, Jean-Luc Gaudiot, president of the IEEE CS, and Claudio Demartini, head of Politecnico di Torino’s Department of Control and Computer Engineering and general cochair of the conference. Because of the popularity of these sessions, both will be included in next year’s Tokyo conference, with the HKN session directed toward organizing a new HKN Japan chapter.

**C1J2 Program**

This year, COMPSAC extended its efforts to assist presenters in having their work reach broader audiences and share their research for others to build on. Last year, we introduced the C1J2 program, wherein we recommended some conference papers for consideration for publication in journals of the IEEE CS and Information Processing Society of Japan (IPSJ). This year, in addition to continuing this program, we introduced the first-ever JIC2 presentations, in which authors presented extensions to previously published work. This new program gives those authors a friendly forum to explore with colleagues their plans, intentions, hopes, and so on for extending their previous research in new directions.

What are the technologies enabling these changes? How far can these partnerships go? What will be our future as we deploy more and more “things” on the IoT to create smart cities, smart vehicles, smart hospitals, smart homes, smart clothes, and so on? Will humans simply become IoT devices in these scenarios, and, if so, what will be the social, cultural, and economic challenges arising from these developments? What are the technical challenges to making this all happen—for example, in terms of technologies such as big data, cloud, fog, and edge computing, mobile computing, and pervasive computing? What will be the role of the “user” as the 21st century moves along?

**Humans are relinquishing their roles as masters of technology to partnerships wherein autonomous, computer-driven devices become our assistants.**

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**COMPSAC Next Year**

Next year, the conference theme is “Staying Smarter in a Smartening World.” This theme is an extension and continuation of the effects of autonomous technologies that are producing profound changes in society. Emerging developments in areas such as deep learning, supported by increasingly powerful and increasingly miniaturized hardware, are beginning to be deployed in architectures, systems, and applications that are redefining the relationships between humans and technology. As this happens, humans are relinquishing their roles as masters of technology to partnerships wherein autonomous, computer-driven devices become our assistants.

I hope you will be interested in participating in COMPSAC next year in Tokyo, 23–27 July, either as a presenter or an audience member. There is no doubt you will find your participation in the trip both enjoyable and worthwhile. For further details and submission deadlines, visit the conference website at www.compsac.org.

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