

Editorial

Special Issue: Design Science Research in Information Systems and Technology

I. INTRODUCTION

THE rapid digital transformation of businesses and society creates new challenges and opportunities for information systems (IS) research, with the designing of system becoming a strong focus. Technologies, such as blockchain, cloud computing, and wearable devices, have spawned a paradigmatic shift in the design of IS. Thus, design science research in IS has evolved to become a mature yet thriving area of research. Design science seeks to extend the boundaries of human and organizational capabilities by designing new and innovative constructs, models, methods, processes, and systems. Scholars having diverse backgrounds in fields, such as IS, computer science, software engineering, energy informatics, and medical informatics, are actively engaged in generating novel solutions to interesting design problems in IS.

As digitization grows from its current initial roots, so will the range and complexity of IS-based theories and problems pertaining to design. The wide scope of design science has a natural engineering-management orientation, which covers a range of topics from creative system building to the management of innovative resources that can benefit an organization. At a conceptual level, these aspects are well aligned to the different phases of design science research in IS, such as problem identification, artifact development, design evaluation, and communication.

Ever since early papers [1], [2] outlining the process, scientific basis, and outcomes of designing IS based on the seminal research works, such as Simon's *The Science of the Artificial* [3], the area has seen a number of noteworthy advances in terms of practitioner involvement and abstracting of the learnings for generalizability. This has led to, for example, the action design research (ADR) and processes [4], papers on design-science theorizing [5], [6], and guidelines for making design-science contributions in the current context [7], [8].

Papers were invited through an open call that was widely circulated, as well as through announcements at related conferences. In all, 23 papers were received, of which nine were accepted, typically after undergoing two rounds of revision. The papers abstracted below cover different aspects of the aforementioned advances.

A. Special Issue Papers

Ge et al. [A1], positioned at the firm level, consider a key element to evaluate a firm's competitive strategy, namely the

value of its human capital with respect to its competitors. The authors develop a page-rank method for this element, based on constructing a graph/network of firms and the movement of employees within this graph. In comparison to time-consuming and expensive surveys, the page-rank method can potentially provide a real-time solution, allowing an organization to take proactive steps aimed at employee retention.

The next two papers [A2] and [A3] are relevant to the industry level. Car sharing is an emerging ecologically friendly service that can disrupt the transportation industry within the digital economy. One obstacle inhibiting its mainstream acceptance is the lack of ready availability of cars, owing to difficulties in supply and demand management of vehicles. Brendel et al. [A2] propose a pricing approach to mitigate this issue and evaluate their algorithm using real-life data. Tao and Zhou [A3] leverage social media data to predict the closure of businesses. This topic is important in the face of many entrepreneurs/businesses failing before they succeed. A combination of machine learning approaches is adapted to analyze data from Yelp and TripAdvisor to predict closures.

In comparison with the abovementioned, a different element of blockchain and mobile wallet and remittance (MWR) features a different application of design science—to mitigate technology-adoption barriers and facilitate adoption. Even though trust is implicitly built into blockchain technology from a computer science perspective, it may not translate to the user/application level. Trust has been a well-known barrier for the usage of many online systems and is likely to inhibit blockchain usage. Therefore, by using a mixed-mode study, Zavolokina et al. [A4] examine how trust-supporting design elements can be infused by designers when developing blockchain applications that can get the user's trust. Another well-known barrier to digital-technology use is privacy. Despite the passage of data-privacy laws by many nations, privacy violations are periodically reported to have occurred in a number of systems and technologies. Akanfe et al. [A5] take up digital payment and specifically mobile wallet and remittance. By setting general data protection regulation (GDPR) as a benchmark, MWR use a machine learning methodology (e.g., featuring latent Dirichlet allocation, among others) to assess the privacy policy of MWR service providers and assign a privacy score to them indicating the level of compliance of a policy with respect to GDPR standards.

Given the growth and proliferation of IS within organizations, identification, authentication, and authorization of end users are

critical to protect the information assets of an organization. Merritt and Yoon [A6] consider the authorization process. The paper derives ontology of how disparate ISs perform authorization. This artifact is used as a basis to instantiate a system (Onto-IAA) that is evaluated in a global retail chain.

The three papers, [A7], [A8], and [A9], deal with various aspect of the growing healthcare domain. Tarpey et al. [A9] uses the recently proposed eADR [9] methodology to involve healthcare practitioners for addressing labor planning and allocation issues that are difficult to address and also critical for a hospital's success. The authors use complex adaptive systems to understand the dynamic behavior of the concerned actors, and then co-design, coevaluate, and coinstantiate a solution and a system that is shown to provide improved labor utilization and patient outcomes.

Strong et al. [A8] focus on a specific health issue that may affect a number of patients, namely, the management of chronic wounds. The paper details an eight-year design-science research program for this problem. An ethnographic approach is used to understand and analyze this design process and uncover the coevolution of the problem and solution spaces during the course of the project. An important outcome of this analysis is that it augments the current DSR methods by providing design knowledge that can be used by managers of such research-oriented projects.

Viljoen et al. [A7] contextualized within rural Kenya, detail how community health workers (CHW) can assist potential patients in tracking health-related vital metrics concerning diabetes and hypertension. A mobile health app was developed to record these vitals and to provide nonmedical socio-technical CHW support aimed at nudging patients to increase their health-seeking behavior. In addition to this app artifact, design principles are enunciated for the design of such mobile apps in rural areas.

II. SUMMARY

In summary, the accepted papers feature contributions to novel specific applications, contributions to making avant-garde (or emerging) technologies more accessible, contributions that apply the latest design-science methodologies, and also papers that feature nascent design theories. The papers consider the disruptive digital economy and the fast-growing healthcare industry, use methodologies ranging from algorithmic ones, such as machine learning to ethnography, and are positioned in different geographies, all of which indicate the diversity of design science in approaching wicked IS issues.

Thus, although papers on design science are seen regularly in the literature, a compendium of papers addressing cutting-edge topics/approaches in a single volume serves as an important point of reference for researchers in the area.

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APPENDIX: RELATED ARTICLES

- [A1] C. Ge, H. Shi, X. Xu, and J. Jiang, "Assessing firm human capital based on labor mobility network," *IEEE Trans. Eng. Manag.*, early access, Jun. 10, 2020, doi: 10.1109/TEM.2020.2996644.
- [A2] A. B. Brendel, J. T. Brennecke, B. M. Hillmann, and L. M. Kolbe, "The design of a decision support system for computation of carsharing pricing areas and its influence on vehicle distribution," *IEEE Trans. Eng. Manag.*, early access, Oct. 27, 2020, doi: 10.1109/TEM.2020.3028997.
- [A3] J. Tao and L. Zhou, "Can online consumer reviews signal restaurant closure: A deep learning-based time-series analysis," *IEEE Trans. Eng. Manag.*, early access, Sep. 2, 2020, doi: 10.1109/TEM.2020.3016329.
- [A4] L. Zavolokina, N. Zani, and G. Schwabe, "Designing for trust in blockchain platforms," *IEEE Trans. Eng. Manag.*, early access, Sep. 16, 2020, doi: 10.1109/TEM.2020.3015359.
- [A5] [A5] O. Akanfe, R. Valecha, and H. R. Rao, "Design of a compliance index for privacy policies: A study of mobile wallet and remittance services," *IEEE Trans. Eng. Manag.*, early access, Sep. 16, 2020, doi: 10.1109/TEM.2020.3015222.
- [A6] C. Merritt and V. Y. Yoon, "The employer perspective of managing access to federated systems and the need for an ontological approach," *IEEE Trans. Eng. Manag.*, early access, Jul. 14, 2020, doi: 10.1109/TEM.2020.2998741.
- [A7] A. Viljoen, K. Klinker, M. Wiesche, F. Uebernickel, and H. Krcmar, "Design principles for mHealth application development in rural parts of developing countries: The case of noncommunicable diseases in Kenya," *IEEE Trans. Eng. Manag.*, early access, Jun. 10, 2021, doi: 10.1109/TEM.2021.3072601.
- [A8] D. M. Strong, B. Tulu, E. Agu, and P. C. Pedersen, "Search and evaluation of coevolving problem and solution spaces in a complex healthcare design science research project," *IEEE Trans. Eng. Manag.*, early access, Aug. 28, 2020, doi: 10.1109/TEM.2020.3014811.
- [A9] R. J. Tarpey, and M. T. Mullarkey, "Engineering innovative clinical resource management by design: A guided emergent search through a complex adaptive system of systems," *IEEE Trans. Eng. Manag.*, early access, Mar. 31, 2021, doi: 10.1109/TEM.2021.3059590.

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- [3] H. A. Simon, *The Sciences of the Artificial*. Cambridge, MA, USA: MIT Press, 2019.
- [4] M. K. Sein, O. Henfridsson, S. Purao, M. Rossi, and R. Lindgren, "Action design research," *MIS Quart.*, vol. 35, pp. 37–56, 2011.
- [5] S. Gregor, "The nature of theory in information systems," *MIS Quart.*, vol. 30, pp. 611–642, 2006.
- [6] D. Jones and S. Gregor, "The anatomy of a design theory," *J. Assoc. Inf. Syst.*, vol. 8, no. 5, 2007, Art. no. 1.
- [7] S. Gregor and A. R. Hevner, "Positioning and presenting design science research for maximum impact," *MIS Quart.*, vol. 37, pp. 337–355, 2013.
- [8] A. Hevner and S. Gregor, "Envisioning entrepreneurship and digital innovation through a design science research lens: A matrix approach," *Inf. Manage.*, vol. 59, 2020, Art. no. 103350.
- [9] M. T. Mullarkey and A. R. Hevner, "An elaborated action design research process model," *Eur. J. Inf. Syst.*, vol. 28, no. 1, pp. 6–20, 2019.