Digital Maturity:
Conceptualization and Measurement Model

Short Paper

Alexander Rossmann

Reutlingen University

Alteburgstr 150, 72762 Reutlingen, Germany

alexander.rossmann@reutlingen-university.de

Abstract

The rise of digital technologies has become an important driver for change in multiple industries. Therefore, firms need to develop digital capabilities to manage the transformation process successfully. Prior research assumes that the development of a specific set of digital capabilities leads to higher digital maturity. However, a measurement framework for digital maturity does not exist in scholarly work. Therefore, this paper develops a conceptualization and measurement model for digital maturity with focus on three research questions: (1) How is the construct of digital maturity conceptually defined? (2) Which capabilities are incorporated in the concept of digital maturity? and (3) How can firms measure digital maturity? The findings indicate that digital maturity incorporates eight capability dimensions dealing with strategy, leadership, business and operating model, people, culture, governance, and technology. Firms can use the developed model to measure their current status quo and to target their strategies along digital transformation.

Keywords: Digital Maturity, Digital Capabilities, Measurement

Introduction

The rise of digital technologies has become an important driver for change in multiple industries. Digital technologies affect all levels of the firm, including business model frameworks, customer interfaces, customer experience, and internal processes (Sugathan et al. 2018). Therefore, firms need to develop digital capabilities to manage the transformation process successfully (Kane et al. 2017; Perakslis 2017). Prior research assumes that the development of a specific set of digital capabilities leads to higher digital maturity (Westerman et al. 2014). Moreover, the degree of digital maturity can have an impact on corporate performance. However, a measurement framework for digital maturity does not exist in scholarly work.

To close this research gap, this paper develops a conceptualization and measurement model for the construct of digital maturity and provides insights into the most important capability dimensions of digital maturity. In doing so, this paper focuses on three research questions: (1) How is the construct of digital maturity conceptually defined? (2) Which capabilities are incorporated in the concept of digital maturity? and (3) How can firms measure digital maturity?

After a systematic review of related research, we conducted six independent studies to answer these research questions. The first four studies follow mainstream psychometric scale development and validation procedures (Gerbing and Anderson 1988) to develop a well-grounded set of items for the construct of digital maturity. The final two studies define a reflective and formative measurement model for digital maturity (Gudergan et al. 2008). We test the corresponding measurement models among a sample of 240 executives responsible for digital transformation initiatives in Germany, Austria, and Switzerland.

The findings indicate that the concept of digital maturity incorporates eight capability dimensions dealing with strategy, leadership, business and operating model, people, culture, governance, and technology. Firms can use the developed measurement model for digital maturity to measure their current status quo and to target their strategies along digital transformation.

Theoretical Foundation

The term "digital maturity" receives particular attention in the work of Westerman et al. (2014). Westerman et al. provide evidence that firms with higher digital maturity earn superior corporate performance. This research stream separates the concept of digital maturity into digital capabilities (e.g., strategy, technological expertise, business models, customer experience) and leadership capabilities (e.g., governance, change management, culture). Firms with mature digital capabilities and weak leadership capabilities are coined *Fashionistas*, while firms with mature leadership capabilities and weak digital capabilities are coined *Conservatives*. Corresponding to Westerman et al., firms need to develop both capability dimensions to achieve *digital mastery*. Firms that do so show superior corporate performance, measured by indicators such as revenue per employee, earnings before interest and taxes, and product margins. Management practice has heavily adopted Westerman et al.'s (2014) model. Multiple consultancy companies have developed a corresponding framework to measure digital maturity, including KPMG,[1] McKinsey,[2] and Boston Consulting Group.[3] Capgemini Consulting (2012) disseminates corresponding measurement models to estimate its clients' digital maturity. Thus, a tremendous number of corporate transformation projects have been inspired by frameworks and models for digital maturity.

As such, it is of major interest to evaluate whether the practical discussion around digital maturity and the implementation of corresponding measurement models are supported by research. Therefore, in preparation for the development of a well-grounded measurement model, we conducted a systematic literature analysis. To ensure reliable identification of the conceptual body of related research, we executed the review approach of Webster and Watson (2002) in three corresponding steps: (1) search strategy, to identify relevant search strings and databases; (2) evaluation, to remove duplicate and irrelevant articles through a title and abstract review; and (3) full text reading and backward search.

In step 1, we conducted a structured query in three relevant databases for scholarly work: Web of Science Core Collection (to adopt a broad analysis on different research areas), EBSCO Business Source Complete, and IEEE Xplore (to adopt focused research in the business and IT domain). The search was restricted to research published between 2006 and 2018. A search on the term 'digital maturity' on a topic level resulted in 363 hits in the three databases (340 in Web of Science, 14 in EBSCO, and 9 in IEEE). The quota of published articles per year shows a growing interest in the topic of digital maturity, with a top quote of 62 research results in 2017. After step 2, which included the removal of duplicates and an evaluation of relevant articles based on an analysis of title and abstract, 25 search results built the database for full-text analysis (Anand et al. 2016; Andersen et al. 2011; Balaban et al. 2018; Burke 2018; Chaffey 2010; Chen 2017; Đurek et al. 2018; Dwivedi et al. 2011; Gonzalez-Rojas et al. 2016; Gottschalk 2009; Hanaei and Rashid 2014; Heberle et al. 2017; Isaev et al. 2018; Kane et al. 2017; Kerrigan 2013; Maemura et al. 2017; Mettler and Pinto 2018; Morais et al. 2011; Perakslis 2017; Pflaum and Gölzer 2018; Poruban 2017; Seitz and Burosch 2018; Tarhan et al. 2016; Valdez-de-Leon 2016; Whelan et al. 2015).

The focus of current literature is on how to achieve digital maturity (Kane et al. 2015, 2017; Pflaum and Gölzer 2018; Seitz and Burosch 2018), digital maturity of specific sectors and functions (Andersen et al. 2011; Chaffey 2010; Đurek et al. 2018; Gottschalk 2009; Hanaei and Rashid 2014), specific tools (Anand et al. 2016; Burke 2018; Heberle et al. 2017), or general and conceptual models (Isaev et al. 2018; Poruban 2017; Valdez-de-Leon 2016).

---

[1] https://assets.kpmg.com/content/dam/kpmg/pdf/2016/04/ch-digital-readiness-assessment-en.pdf.

[2] https://www.mckinsey.com/solutions/digital-quotient.

[3] https://www.bcg.com/de-de/capabilities/technology-digital/digital-acceleration-index.aspx.

Overall, however, the scientific foundation for the construct of digital maturity remains vague. Although the concept of digital maturity clearly refers to the formation of specific capabilities to manage digital transformation, a measurement framework for digital maturity is not available.

Methods and Results

This research follows well-accepted, mainstream psychometric scale development and validation procedures (Gerbing and Anderson 1988). The research process is based on a construct working definition; in this case, *digital maturity* represents the *degree of adoption and application of digital technologies in corporate business models*. Table 1 summarizes the research process.

The first stage of research involves four qualitative studies to develop a comprehensive item pool for digital maturity. These studies include self-descriptions from firms about their digital maturity and qualitative surveys with internal executives and external experts. Studies 1 and 2 focus on detailed descriptions of firms, and study 3 includes a larger sample to integrate executive perspectives in the process of item exploration. Study 4 aims to validate the proposed item pool conducted by experts.

The second stage involves quantitative research methods to explore the dimensional space and refine scales for digital maturity. In particular, exploratory factor analysis (EFA) provides insights into the dimensional structure of the item pool based on a reflective measurement model (study 5). Finally, study 6 carries out a confirmatory tetrad analysis (CTA) to test the appropriateness of using formative measurement models versus reflective models.

Study 1: Self-description of Digital Maturity

Study 1 identifies items firms use to describe their current or intended digital maturity. Annual reports, websites, and external publications from firms commonly contain self-descriptions that encompass current or intended digital maturity. The inspection process included annual reports and corporate websites of 30 firms listed in the German DAX stock index. During analysis of these 30 firms, data collection reached theoretical saturation (Guest et al. 2006). Therefore, the marginal return on examining more firms diminished. In total, the process yielded 56 firm-related descriptions of digital maturity. The research process was supported by an analysis of three publications in German newspapers about the competition on digital maturity. However, the articles discuss this competition among firms on a subjective level without clear academic rigor. Despite this, the description of firms with a relatively high digital maturity provides additional impetus to the discussion of potential facets of digital maturity. Finally, self-descriptions and external publications yielded 42 firm-related descriptions for digital maturity.

Study 2: Identification of Items Executives Use to Describe Digital Maturity

Study 1 focuses on firms' current or intended perception of digital maturity, but the findings do not indicate how such descriptions correspond to executive perceptions. Therefore, we undertook semi-structured, in-depth interviews with eight executives responsible for digital transformation programs in German, Austrian, and Swiss firms. We selected the executives on the basis of the industry of their firms and their role in managing digital transformation projects. Finally, we arrived at a sample of eight different industries (i.e., automotive, manufacturing, banking, insurance, retail, pharmaceutical, consulting, and utilities). The main purpose of the interviews was to describe the digital maturity of the firms and determine the different elements of digital maturity. After interpreting the results, we added 63 additional firm-related descriptions for digital maturity to the pool, which brought the total to 105 items.

Study 3: Supplementation of the Items

Study 3 involves a larger sample than study 2. Here, 143 respondents of an international program in professional education completed an online survey. The respondents of the education program (age$_{AVE}$: 33.4; male: 54%; female: 46%) described the digital maturity of their firms in a well-designed survey that included an open-ended questionnaire (Smyth et al. 2009). Study 3 compiled another 88 new items.

Study	Objective	Sample/Method	Findings
1	Identification of items	Content analyses of annual reports and corporate websites of 30 firms listed in the German DAX	42 items
2	Identification of items	Eight semi-structured qualitative interviews with executives responsible for digital transformation in firms	63+ items
3	Identification of items	Online survey with 143 respondents of an international program in professional education. Qualitative analysis of responses to open-ended survey questions.	88+ items (in total: 193 items)
4	Reduction of items	Item-reduction based on rating from multiple stakeholders and groups.	Reduced: 78 items
5	Definition of reflective measurement model	EFA/CFA among 253 respondents of a professional education program in Germany.	8 dimensions; 32 items
6	Definition of formative measurement model	Online survey with 240 executives responsible for digital transformation from firms in Germany, Austria, and Switzerland; CTA.	Preference for formative measurement models

Table 1. Research Overview

Study 4: Item Reduction

Studies 1–3 yielded 193 items in total. Thus, we took several steps to reduce the initial items. The goal of the process is first to eliminate items not used in everyday language (Rossiter 2002). To do so, two scholars rated the frequency of each word in everyday language (1 = very rarely, 7 = very frequently), and two scholars rated the appropriateness of items in describing a firm (1 = not qualified at all, 7 = very qualified). Then, expert judges rated face and content validity (Diamantopoulos 2005; Rossiter 2002). Two executives from digital departments of firms rated item appropriateness based on the digital maturity concept. Mean scores for each step (i.e., for appropriateness of use, to describe a firm, and to measure a firm's digital maturity) provided a screening mechanism. The resulting pool retained only items with an average appropriateness of at least 5 across each respondent group. For further validation of these preliminary items, an academic scholar familiar with digital transformation programs compared the complete and reduced list of items. This led to the inclusion of seven previously deleted items, providing a final pool of 78 items.

Study 5: Identification of Digital Maturity Dimensions in a Reflective Measurement Model

Study 5 identifies the potential factor structure of digital maturity in a *reflective measurement model* by applying calibration procedures. In total, 253 respondents of professional education programs (age$_{AVE}$: 35.6; male: 58%; female: 42%) participated in a survey titled "digital maturity of firms." Respondents answered the following question: "We are interested in the characteristics that come to mind when thinking about your firm. To what extent do the following items describe the digital maturity of your firm?" Items were evaluated with 7-point Likert-type scales (1 = does not apply, 7 = totally applies).

Results. Principal component analysis (PCA) followed by oblimin rotation allows examination of dimensionality and suggests items for deletion. An eight-factor solution was the most appropriate according to a variety of commonly applied criteria: inspection of scree plot, interpretability, and eigenvalues greater than unity. To improve and validate the factor structure, we deleted items with low factor loadings (<0.50) and/or high cross-loadings (>0.30) (Hair et al. 2006; Peterson 2000). The final eight-factor solution explains 72.1% of the total item variance, which is above the recommended threshold of 0.50.

Scale inspection. Reliability analyses show alpha coefficients above the established threshold of 0.70 (Nunnally and Bernstein 1978) for each dimension. Through a meta-description for each dimension, the following eight facets of digital maturity evolved: (1) strategy (explicit, cross-functional, transformative, evaluated), (2) leadership (commitment, style, role, leadership adoption), (3) business model (customer value, innovation, digitalization, co-creation), (4) operating model (agility, integration, resources, cooperation), (5) people (expertise, learning, employee adoption, specialization), (6) culture (transparency, dynamic, empowerment, attitude toward chance), (7) governance (coordination, alignment, measurability, target orientation), and (8) technology (data, interaction, automation, workplace). Overall, this led to an eight-factor structure in the conceptualization of digital maturity with 32 items. Table 2 displays the full item formulation for each capability dimensions.

Robustness tests. Replications using different estimation (e.g., PCA, maximum likelihood) and rotation (e.g., varimax) methods led to similar solutions. A series of replications based on different sub-samples, such as gender, firm size, and age, confirmed the avoidance of biases caused by sample distribution. In addition, a confirmatory factor analysis on the eight-factor structure provided evidence of good psychometric characteristics. In summary, supplementary analyses confirm the robustness of the model. The Fornell and Larcker (1981) procedure examines discriminant validity. The average variance extracted (AVE) within each pair of dimensions is compared with the square of bivariate correlations between these two dimensions. Evidence of discriminant validity exists in this study, as AVE values are all above each squared construct correlation (Fornell and Larcker 1981; Hair et al. 2006).

Study 6: Evaluation of the Digital Maturity Scale in a Formative Measurement Model

Study 6 aims to develop and test a *formative measurement model* for digital maturity. Such models are appropriate when an explanatory combination of indicator variables underlies the latent construct (Diamantopoulos 2006). To test the appropriateness of using formative models versus reflective measurement models, Bollen and Ting's (1993) CTA can be applied. Within the context of CTA, it is common to analyze the homogeneity of correlations among manifest variables in the measurement models to decide between reflective and formative modeling (Gudergan et al. 2008).

Therefore, we conducted an additional study to apply CTA to a sample of respondents of a professional education program in Germany, Austria, and Switzerland. Overall, 240 executives responsible for digital transformation projects in their corresponding firms agreed to answer an online survey (age$_{AVE}$: 39.4; male: 62%; female: 38%). The scale for digital maturity was executed based on the 32 items derived in study 5. The corresponding items for digital maturity were measured with a 7-point Likert scale. The results of a CTA-PLS computation with 5,000 bootstrap subsamples show that for at least one model-implied non-redundant vanishing tetrad, the parameter value of H_0 ($\tau = 0$) is not in the bias-corrected 90% (two-tailed) Bonferroni-adjusted confidence interval. Thus, CTA-PLS rejects H_0 and gives evidence of a formative measurement model specification (Gudergan et al. 2008).

#	Capability	Items
1	**Strategic Capability**	Our firm has implemented a digital strategy. The digital strategy of our firm is documented and communicated. The digital strategy of our firm has a significant influence on existing business and operating models. The digital strategy is being continuously evaluated and adapted.
2	**Leadership Capability**	Our executives support the implementation of the digital strategy. The digital strategy is only implemented in individual functional areas (inverse). The culture of leadership in our firm is based on transparency, cooperation and decentralized decision-making processes. The digital strategy of our firm has an influence on the task and role profiles of executives.
3	**Market Capability**	Digital products and services are embedded in our business interfaces and business processes and create a perceptible impact on customer experience. There is a direct added value created by the progressive digitization of products and services of our firm (e.g., cost reductions, increased productivity, better customer experience, customer differentiation). Digital products and services have a large impact on the overall performance of our firm. Our firm is creating significant sales volume via digital channels.
4	**Operational Capability**	There are sufficient resources (time, people, budget) available to implement the digital strategy within our firm. We established a strong cross-functional cooperation and co-creation with stakeholders throughout our value chain. Digital and physical processes are fully integrated by holistic process models. The impetus of our digital strategy is leading to innovations in operations.
5	**People and Expertise Capability**	Within our firm, there are sufficient experts on digital core issues. Within our firm, further education opportunities for digital core topics are available. Within our firm, comprehensive measures to strengthen digital literacy development are implemented. Within our firm, new job profiles have been created for employees with expertise in digital core topics.
6	**Cultural Capability**	Decisions within our firm are transparent to our own employees. Digitization has an impact on the decision-making agility of our firm. In day-to-day business, employees and executives exchange information about the digital transformation of our firm. Continuous change is part of our corporate culture.
7	**Governance Capability**	Guidelines for the use of digital technologies are communicated and used by employees. Our firm implements a holistic management model for the digital strategy and corresponding key metrics. The key metrics for the digital strategy are fully integrated into controlling. The corporate strategy and the digital strategy are intensively networked and complement each other.

#	Capability	Items
8	**Technology Capability**	Our firm uses large amounts of data to optimize strategies, processes and products. Within our firm, we use tools for digital modeling, automation and control of business processes. Our firm has implemented enterprise-wide digital workplace concepts. Digital platforms are used for day-to-day collaboration. Digital technologies are the mainspring for the further development of products and services.

Table 2. Digital Maturity, Capability Dimensions, and Items

Discussion, Limitations, and Conclusion

The aim of this research was to provide a conceptualization for the construct of digital maturity and a corresponding measurement model. To do so, we carried out a systematic review of related research and different empirical studies to develop a well-grounded conceptual definition and measurement model for digital maturity. As the results indicate, the construct of digital maturity contains eight dimensions and 32 items along *strategy* (explicitness of strategy formulation, cross-functional implementation, transformative impact, degree of evaluation), *leadership* (commitment, style, role, adoption of digital strategy by executives), *business model* (generated customer value, relative innovativeness, degree of digitalization, implemented value co-creation), *operating model* (degree of agility, level of process integration, quality of resources, quality of cooperation), *people* (degree of expertise, implementation of learning routines, employee adoption of digital strategy, specialization on digital assets), *culture* (level of transparency, agility, empowerment, attitude toward change), *governance* (coordination mechanisms, level of alignment, measurability, target orientation), and *technology* (adoption and usage of technologies for data management, customer interaction, process automation, digital workplace).

The results contribute to the theoretical understanding of digital maturity as a construct and the different factors driving digital transformation initiatives in firms. Currently, a clear conceptual definition and measurement framework for digital maturity and for the corresponding capabilities is not available in scholarly work. Therefore, this paper provides a clear theoretical contribution in the field of construct conceptualization and operationalization and leads to an extension of the work of Westerman et al. (2014) and others (Isaev et al. 2018; Poruban 2017; Valdez-de-Leon 2016). Moreover, the results provide executives with practical recommendations on what to focus on and how to proceed in the digital transformation of their firms. The developed scale for digital maturity can also serve as a framework in the analysis of the current state of digital transformation and for continuous controlling.

In addition, the formative measurement model for digital maturity aligns with further theoretical evaluations of the relationship of digital maturity with other constructs. The current research provides the basis for further research on the relationship between digital maturity and other constructs. In particular, further research projects might explore the causal effects between digital maturity and corporate performance, evaluating the general hypotheses of Westerman et al. (2014). Limitations of the presented research include the empirical foundation of the measurement model, which was constrained by empirical findings from Central Europe. Future research might use the defined measurement model for item testing in a different cultural context.

In conclusion, this research provides a conceptual foundation and a defined measurement model for digital maturity. This might be viewed as an important basis for a large array of corresponding research initiatives. Practitioners can immediately adopt the measurement framework and use the defined metrics to evaluate the current state and progress of their digital transformation efforts.

References

Anand, A., Sharma, R., and Coltman, T. 2016. "Four Steps to Realizing Business Value from Digital Data Streams," *MIS Quarterly Executive* (15:4), pp. 259–277.

Andersen, K. N., Medaglia, R., Vatrapu, R., Henriksen, H. Z., and Gauld, R. 2011. "The Forgotten Promise of E-Government Maturity: Assessing Responsiveness in the Digital Public Sector.," *Government Information Quarterly* (28:4), pp. 439–445. (http://10.0.3.248/j.giq.2010.12.006).

Balaban, I., Redjep, N. B., and Calopa, M. K. 2018. "The Analysis of Digital Maturity of Schools in Croatia," *International Journal of Emerging Technologies in Learning* (13:6), pp. 4–15. (https://doi.org/10.3991/ijet.v13i06.7844).

Burke, S. 2018. "HPE Launches Interactive Digital Marketing Maturity Assessment Tool.," *CRN* (1375), pp. 18–19.

Chaffey, D. 2010. "Applying Organisational Capability Models to Assess the Maturity of Digital-Marketing Governance.," *Journal of Marketing Management* (26:3–4), Routledge, pp. 187–196. (http://10.0.4.56/02672571003612192).

Chen, J. 2017. "Digitization to Gain Momentum: German Companies Leading Digital Maturity.," *Chemical Week* (179:15), pp. 22–24.

Diamantopoulos, A. 2005. "The C-OAR-SE Procedure for Scale Development in Marketing: A Comment," *International Journal of Research in Marketing* (22:1), Elsevier, pp. 1–9.

Diamantopoulos, A. 2006. "The Error Term in Formative Measurement Models: Interpretation and Modeling Implications," *Journal of Modelling in Management* (1:1), Emerald Group Publishing Limited, pp. 7–17.

Đurek, V., Kadoic, N., and Reðep, N. B. 2018. "Assessing the Digital Maturity Level of Higher Education Institutions," in *2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*, pp. 671–676. (https://doi.org/10.23919/MIPRO.2018.8400126).

Dwivedi, Y. K., Weerakkody, V., and Janssen, M. 2011. "Moving Towards Maturity: Challenges to Successful E-Government Implementation and Diffusion," *Data Base for Advanced in Information Systems* (42:4), pp. 11–22.

Fornell, C., and Larcker, D. F. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research*, JSTOR, pp. 39–50.

Gerbing, D. W., and Anderson, J. C. 1988. "An Updated Paradigm for Scale Development Incorporating Unidimensionality and Its Assessment," *Journal of Marketing Research*, JSTOR, pp. 186–192.

Gonzalez-Rojas, O., Correal, D., and Camargo, M. 2016. "ICT Capabilities for Supporting Collaborative Work on Business Processes within the Digital Content Industry," *Computers in Industry* (80), pp. 16–29. (https://doi.org/10.1016/j.compind.2016.04.004).

Gottschalk, P. 2009. "Maturity Levels for Interoperability in Digital Government," *Government Information Quarterly* (26:1), pp. 75–81. (http://10.0.3.248/j.giq.2008.03.003).

Gudergan, S. P., Ringle, C. M., Wende, S., and Will, A. 2008. "Confirmatory Tetrad Analysis in PLS Path Modeling," *Journal of Business Research* (61:12), Elsevier Inc., pp. 1238–1249. (https://doi.org/10.1016/j.jbusres.2008.01.012).

Guest, G., Bunce, A., and Johnson, L. 2006. "How Many Interviews Are Enough? An Experiment with Data Saturation and Variability," *Field Methods* (18:1), Sage Publications Sage CA: Thousand Oaks, CA, pp. 59–82.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., and Tatham, R. L. 2006. "Multivariate Data Analysis 6th Ed," *Uppersaddle River: Pearson Prentice Hall*.

Hanaei, E. H. A., and Rashid, A. 2014. "DF-C2M2: A Capability Maturity Model for Digital Forensics Organisations," in *2014 IEEE Security and Privacy Workshops*, pp. 57–60. (https://doi.org/10.1109/SPW.2014.17).

Heberle, A., Lowe, W., Gustafsson, A., and Vorrei, O. 2017. "Digitalization Canvas - Towards Identifying Digitalization Use Cases and Projects," *Journal of Universal Computer Science* (23:11), pp. 1070–1097.

Isaev, E. A., Korovkina, N. L., and Tabakova, M. S. 2018. "Evaluation of the Readiness of a Company's IT Department for Digital Business Transformation," *Business Informatics* (44:2), pp. 55–64. (https://doi.org/10.17323/1998-0663.2018.2.55.64).

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., and Buckley, N. 2017. "Achieving Digital Maturity.," *MIT*

Sloan Management Review (59:1), pp. 1–29.

Kane, G., Palmer, D., Phillips, N., and Kiron, D. 2015. "Is Your Business Ready for a Digital Future?," *MIT Sloan Management Review* (56:4), pp. 37–44.

Kerrigan, M. 2013. "A Capability Maturity Model for Digital Investigations," *Digital Investigation* (10:1), pp. 19–33. (https://doi.org/10.1016/j.diin.2013.02.005).

Maemura, E., Moles, N., and Becker, C. 2017. "Organizational Assessment Frameworks for Digital Preservation: A Literature Review and Mapping," *Journal of the Association for Information Science and Technology* (68:7), pp. 1619–1637. (https://doi.org/10.1002/asi.23807).

Mettler, T., and Pinto, R. 2018. "Evolutionary Paths and Influencing Factors towards Digital Maturity: An Analysis of the Status Quo in Swiss Hospitals," *Technological Forcecasting and Social Change* (133), pp. 104–117. (https://doi.org/10.1016/j.techfore.2018.03.009).

Morais, E. P., Pires, J. A., and Gonçalves, R. 2011. "Suitability of E-Business Maturity Models for Digital Economy," in *6th Iberian Conference on Information Systems and Technologies (CISTI 2011)*, pp. 1–4.

Nunnally, J. C., and Bernstein, I. H. 1978. *Psychometric Theory*, McGraw-Hill New York.

Perakslis, C. 2017. "Digital Maturity: Perceiving the Digital-Panopticon [Last Word].," *IEEE Technology & Society Magazine* (36:4), p. 88. (http://10.0.4.85/MTS.2017.2770939).

Peterson, R. A. 2000. "A Meta-Analysis of Variance Accounted for and Factor Loadings in Exploratory Factor Analysis," *Marketing Letters* (11:3), Springer, pp. 261–275.

Pflaum, A. A., and Gölzer, P. 2018. "The IoT and Digital Transformation: Toward the Data-Driven Enterprise," *IEEE Pervasive Computing* (17:1), pp. 87–91. (https://doi.org/10.1109/MPRV.2018.011591066).

Poruban, S. 2017. "Achieving Digital Maturity," *OIL & GAS JOURNAL* (115:7), p. 14.

Rossiter, J. R. 2002. "The C-OAR-SE Procedure for Scale Development in Marketing," *International Journal of Research in Marketing* (19:4), Elsevier, pp. 305–335.

Seitz, J., and Burosch, A. 2018. "Digital Value Creation," in *2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, pp. 1–5. (https://doi.org/10.1109/ICE.2018.8436380).

Smyth, J. D., Dillman, D. A., Christian, L. M., and McBride, M. 2009. "Open-Ended Questions in Web Surveys: Can Increasing the Size of Answer Boxes and Providing Extra Verbal Instructions Improve Response Quality?," *Public Opinion Quarterly* (73:2), Oxford University Press, pp. 325–337.

Sugathan, P., Rossmann, A., and Ranjan, K. R. 2018. "Toward a Conceptualization of Perceived Complaint Handling Quality in Social Media and Traditional Service Channels," *European Journal of Marketing* (52:5–6), pp. 973–1006. (https://doi.org/10.1108/EJM-04-2016-0228).

Tarhan, A., Turetken, O., and Reijers, H. A. 2016. "Business Process Maturity Models: A Systematic Literature Review," *Information and Software Technology* (75), pp. 122–134. (https://doi.org/10.1016/j.infsof.2016.01.010).

Valdez-de-Leon, O. 2016. "A Digital Maturity Model for Telecommunications Service Providers," *Technology Innovation Management Review* (6:8), pp. 19–32.

Webster, J., and Watson, R. T. 2002. "Analyzing the Past to Prepare for the Future: Writing a Literature Review.," *MIS Quarterly* (26:2), Xiii–Xxiii. (https://doi.org/10.1.1.104.6570).

Westerman, G., Bonnet, D., and McAfee, A. 2014. *Leading Digital: Turning Technology Into Business Transformation*, Harvard Business Review Press.

Whelan, E., Anderson, J., van den Hooff, B., and Donnellan, B. 2015. "How IT and the Rest of the Business Can Innovate Together," *Communication of the Association for Information Systems* (36), 261+.