12-7-2022

Low Code Development Platform Adoption: A Research Model

Sebastian Kaess
TU Dresden, sebastian.kaess@mailbox.tu-dresden.de

Low Code Development Platform Adoption: A Research Model

Research-in-progress

Sebastian Käss
TU Dresden
Dresden, Germany
Email: sebastian.kaess@mailbox.tu-dresden.de

Abstract

Although Low Code Development Platforms (LCDP) promise efficiency and effectiveness improvements for organisations when adopted, research on LCDP adoption lacks a theoretical foundation. This research-in-progress paper proposes a research model to explain LCDP adoption. The research model combines two theoretical lenses, including social and technical factors referring to the socio-technical systems theory, complementing the environmental factors captured in the Technology – Environment – Organisation model. As single factors may not be sufficient to explain LCDP adoption, this paper introduces combinations of factors that balance social, technical, and environmental factors. In this stage, the paper's contribution to research is the first theoretically grounded but tentative model to explain LCDP adoption. The expected results of this study provide combinations of factors to indicate one or more paths for LCDP adoption.

Keywords: Low code development platform, adoption, TOE, socio-technical system theory, low code

1 Introduction

Organisations face increasing competitive pressure to digitalise their business models and internal processes (Yoo et al. 2010). For this purpose, organisations must increase their speed in developing applications within budget and time constraints at high quality (Käss et al. 2022; Richardson and Rymer 2014). However, a significant market gap exists in skilled IT developers for application development (Sahinaslan et al. 2021). One option to fill this gap is to rely on non-professional developers i.e., developers in business departments or regular business employees who develop applications with little to no programming experience (often referred to as citizen developers) (Al Alamin et al. 2021). Low Code Development Platforms (LCDP) simplify application development for non-professional developers by reducing manual coding. Thus, LCDP adoption leads to higher efficiency and effectiveness in application development (Al Alamin et al. 2021).

To understand LCDP adoption, a focus on technical factors only, such as LCDP security (Heuer et al. 2022; Prinz et al. 2021, 2022), is too narrow. LCDP adoption also affects social factors of the application development, as it significantly transforms how and by whom applications are developed (Bock and Frank 2021; Heuer et al. 2022; Käss et al. 2022). Hence, technical, social, and environmental factors must be considered to understand LCDP adoption. To my knowledge, only the paper by Käss et al. (2022) systematically researches drivers and inhibitors for LCDP adoption in organizations. Although the paper is a good starting point it neither provides a theoretical grounding nor an empirical test. Therefore, the paper at hand introduces a research model that provides a theoretical foundation to explain LCDP adoption. Further, it suggests steps to test the research model empirically. Consequently, the paper at hand addresses the following research question:

RQ: What determines Low Code Development Platform adoption?

In this research, the units of analysis are work systems, i.e., “systems in which human participants and/or machines perform work [...] using information, technology and other resources” (Alter 2013, p. 75). For LCDP adoption, I focus on work systems where groups of non-professional developers use LCDPs as information systems to carry out low code development (LCD) (Alter 2013; Prinz et al. 2022). The work systems perspective helps to explain the adoption at a level between an individual developer and an organisational level. Moreover, the adoption model focuses on LCDPs that use Platform-as-a-Service (PaaS) cloud platforms, which is the majority of LCDPs (Prinz et al. 2021). The paper is structured into three parts. First, I outline the conceptual similarities of LCDP adoption with cloud computing (CC, especially PaaS) and agile software development methodology (SDM) adoption. Further, the theoretical foundation is presented by combining the Technology – Environment – Organisation (TOE) model with socio-technical systems (STS) theory. Second, I derive a research model to explain LCDP adoption. The paper concludes with the contributions and next steps for model testing.

2 Research Background

2.1 Specifics of Low Code Development Platforms

Forrester Research coined the term LCD in 2014, describing software development with minimal source code using interactive graphical interfaces to reduce complexity (Al Alamin et al. 2021; Sanchis et al. 2020). However, LCD is not new (Bock and Frank 2021): it combines previous concepts, e.g., rapid application development and computer-aided software engineering (Di Sipio et al. 2020; Totterdale 2018). LCD changes the application development process significantly – from an IT-driven process with manual coding to a business-driven process using visual drag-and-drop functions (Al Alamin et al. 2021; Beranic et al. 2020). This development can be done by non-professional developers with little training time by using LCDPs. The LCDPs are “products and/or cloud services” (Rymer 2017, p. 4), offering a PaaS model (Prinz et al. 2021) that foster a visual development with declarative techniques to define an application’s user interface, business logic, and data model (Totterdale 2018). Existing research on CC adoption highlights the environment’s importance when analysing platform adoption (Wulf 2020). Hence, the technology (e.g., the LCDP), the organisation (e.g., the non-professional developers), and the environment (e.g., the competitors) need to be considered when researching LCDP adoption.

2.2 Theoretical Foundation

While there is some practice-oriented research on LCDP adoption (e.g., Sanchis et al. 2020), to the best of my knowledge, there is no research using a theoretical lens to explain LCDP adoption in work systems. Therefore, I suggest using factors from existing research about CC and agile SDM adoption to close this research gap. CC adoption research is relevant to LCDP adoption because most LCDPs are cloud services using a PaaS model (Prinz et al. 2021; Rymer 2017). As LCDPs apply a PaaS delivery model in the cloud, all factors which have been found to be influential for CC adoption in general must also influence LCDP adoption. Current CC adoption research rarely distinguishes between different delivery models (e.g., PaaS) (Wulf 2020), I chose to use findings from CC adoption in general. To account for changes in application development (e.g., business-driven process instead of IT-driven process), I also include previous findings from agile SDM adoption literature. I purposefully selected the adoption of agile SDM, as in agile application development also non-professional IT personnel (e.g., business employees) are involved in the development process. Moreover, LCD facilitates agile software development as it prioritizes agile principles (e.g., constant communication) (Sahay et al. 2020).

Multiple theories have been applied to research CC adoption (Wulf 2020). One research stream focusing on individual choice applies the Technology Acceptance Model or its extensions (Wulf 2020). As this paper researches the adoption on a higher level, the theories from a second research stream which suggests the TOE model (Hsu and Lin 2016; Wulf 2020) seem more promising. The TOE model considers technology, organisation, and environment as essential to explain an innovation's adoption (Depietro et al. 1990; Hsu et al. 2014). T*echnology* includes all relevant technical aspects (e.g., equipment and processes), o*rganisation* comprises an organisation's characteristics and e*nvironment* consists of all external factors (Depietro et al. 1990; Friedrich-Baasner et al. 2018; Hsu et al. 2014). The TOE model is criticised for its generic nature (Zhu and Kraemer 2005) but still can be used as a guiding framework for further analysis. Such a detailed analysis may rely on model extensions. Therefore, for this research, the technology and organisation components are further detailed with elements stemming from STS theory. Sumner and Ryan (1994) have already applied STS theory to analyse computer-aided software engineering adoption, which is conceptually similar to LCDPs (Di Sipio et al. 2020; Totterdale 2018). STS theory assumes that a work system comprises a *social sub-system* and a *technical sub-system* (Bostrom and Heinen 1977; Parker et al. 2017) and analyses the interaction between them (Schuch et al. 2020). The social sub-system comprises a *structure sub-system* and a *people sub-system*; the technical sub-system comprises a *technology sub-system* and a *task sub-system* (Bostrom and Heinen 1977). STS theory assumes that for work systems to achieve their goals (e.g., adopting a new technology), the social and technical sub-systems must be jointly optimised and balanced, with none being dominant (Malik and Orr 2022). Sub-systems must be open and responsive to the environment (Emery and Trist 1965). This aspect of sub-systems is essential as it implies that LCDP adoption is affected by technical, social, and environmental factors, as indicated in the TOE model.

3 Research Model

3.1 Overview

I propose explaining LCDP adoption in work systems based on the TOE model and STS theory. Following STS theory, LCDP adoption requires a balance between and within its sub-systems and the environment. Sub-systems are characterised by factors derived from CC and agile SDM adoption literature. For instance, the task sub-system is characterised by the factor expected efficiency improvements. To select the factors, I used the three steps proposed by Jeyarj et al. (2006): (1) literature retrieval and filtering, (2) factor extraction and aggregation, (3) factor selection. To retrieve the literature, I searched for review papers on CC and agile SDM adoption, as they already structure the findings from previous research. I created a list of all papers that were analysed by the review papers. To ensure that the papers' findings are comparable, I excluded all papers that followed other research approaches than regression-based empirical research, that researched adoption on an individual level, or focused on SaaS. From the remaining 30 papers (published between 1996 and 2019), I extracted the factors, their definition and the effect on the adoption. To account for different wordings, I iteratively went through the factor's definitions and aggregated factors with the same definition to master factors. To build the model, I only selected factors where multiple empirical studies have found a significant effect on the adoption, leading to thirteen factors. The online appendix provides a detailed overview.[1]

When combining the factors introduced in the next section, it is critical to understand that existing literature has been ambiguous in terms of the effect of individual factors: Existing CC adoption literature shows asymmetric effects of certain factors, e.g., high security concerns leading to low CC adoption (Hsu and Lin 2016), with other studies showing the opposite (Kinuthia 2015). Moreover, Laut et al. (2021) show that factors might influence themselves as a form of conjunctural causation for IT innovation adoption. Therefore, I suggest a conceptual approach where combinations of multiple factors cause the outcome. The factors are characterised by possible values (e.g., minor concerns or major concerns), and typically a joint occurrence of numerous factors produces an outcome - not the single occurrence of one

[1] The online appendix can be found here: https://doi.org/10.6084/m9.figshare.20462940

factor. Therefore, the outcome (i.e., LCDP adoption in work systems) is the consequence of an interplay between the factors.

Table 1 provides an overview of the suggested sub-systems, the thirteen factors to capture LCDP adoption, their possible values, and the effect on the adoption found in previous CC and agile SDM adoption research. For factors where existing research finds positive and negative effects, I used mixed effects in addition to positive or negative. However, as previous research on CC and agile SDM adoption does not use a combinatorial logic, I can only suggest that these factors are essential to explain LCDP adoption, but not how they combine or affect (positively or negatively) LCDP adoption. For this purpose, I will empirically validate this research model in a second step.

TOE	STS	Factor	Possible values	Effect from previous research
Technology	Technology sub-system	Security and data privacy concerns	Minor concerns Major concerns	Mixed
		Compatibility	Low compatibility High compatibility	Positive
		Vendor lock-in	No vendor lock-in Vendor lock-in	Negative
	Task sub-system	Expected efficiency improvements	Low expected improvements High expected improvements	Positive
Organisation	People sub-system	Complexity	Low complexity High complexity	Negative
		Previous experience	Low previous experience High previous experience	Positive
		Training opportunities	No availability of training opportunities Availability of training opportunities	Positive
		Organisational culture	Closedness for LCDP adoption Openness for LCDP adoption	Positive
		Usefulness	Low usefulness High usefulness	Positive
	Structure sub-system	Expected working mode improvements	Low expected improvements High expected improvements	Mixed
		Top management support	Low support High support	Positive
		Internal IT capabilities	Low IT capabilities High IT capabilities	Positive
Environ-ment	n/a	External pressure	Low external pressure High external pressure	Mixed

Table 1. Research model for combinatorial analysis

3.2 Technology

Security and data privacy concerns are well discussed in the CC adoption literature (Wulf et al. 2021). Decision makers in the CC context are concerned by the virtualised and shared resources, data transfer over the Internet, and the potential disclosure of data by the CC provider (Loske et al. 2014). Hence, this factor is usually seen as having a negative effect on CC adoption, i.e., high security concerns leading to low CC adoption (e.g., Asatiani 2015). However, Kinuthia (2015) showed that this factor could also positively affect CC adoption. *Compatibility* comprises how innovations fit into an organisation's values, experience, and needs (Rogers 2010) and is seen as having a positive effect on CC and agile SDM adoption (Al-Isma 'ili et al. 2016; Chan and Thong 2009; Wulf et al. 2021). As LCDP us (Käss et al. 2022), this factor also applies to LCDPs. A significant concern for CC adoption is the fear of *vendor lock-in* (Siepermann et al. 2016; Wulf et al. 2021) as CC providers use proprietary systems, impeding the move between providers. Hence, vendor lock-in negatively affects CC adoption (Siepermann et al. 2016). As LCDPs also use proprietary development languages and practices and PaaS delivery models (Käss et al. 2022), this factor also applies to LCDPs. CC and agile SDM adoption literature see *expected efficiency* *improvements*, e.g., cost savings, reduced time to market, reduction of required resources, and overall business performance improvements, as having a positive influence on the adoption (Chan and Thong 2009; Wulf et al. 2021).

3.3 Organisation

Complexity is an essential factor for adopting technology (Chan and Thong 2009). Various research papers agree that complexity has a negative effect on agile SDM and CC adoption (Chan and Thong 2009; Wulf et al. 2021). LCDPs are advertised to be less complex (compared to traditional development) for non-professional developers due to their pre-configured components and intuitive drag-and-drop development methodology (Käss et al. 2022). *Previous experience* is essential in CC and agile SDM adoption literature (Chan and Thong 2009; Wulf et al. 2021). It is argued that testing before the adoption and having experience with pilot applications or similar tools positively influence the adoption (Chan and Thong 2009; Wulf et al. 2021). The same mechanics are expected to hold for LCDPs. *Training opportunities* are the formal procedure of an organisation to facilitate learning (Chan and Thong 2009). Academic literature on agile SDM adoption agrees that internal and external training or other external support positively influences adoption (Chan and Thong 2009). In the case of LCDPs, training is usually provided by LCDP vendors or external consultants. *Organisational culture* and openness towards new technologies are seen as having a positive effect on CC and agile SDM adoption (Chan and Thong 2009; Wulf et al. 2021). LCD leads to a significant shift in the development approach because non-professional developers in business departments develop applications with pre-configured components. This shift leads to a change in the relationship between IT and business, which could result in a refusal of adoption if the organisational culture is not open to LCDP adoption (Käss et al. 2022). *Usefulness* is the degree to which adopting a LCDP would be useful in performing application development (Hardgrave and Johnson 2003). In general, usefulness is perceived as having a significant positive effect on the adoption decision (Chan and Thong 2009).

LCDPs foster the empowerment of non-professional developers, a shared understanding between business and IT, and facilitate teamwork in cross-functional settings (Käss et al. 2022), leading to *working mode improvements*. This aims to reduce unstable and inconsistent requirements, to create better integration of tacit domain knowledge, and to yield faster development cycles, thus leading to a more efficient working mode (Käss et al. 2022). In their review paper on adopting agile methodologies, Chan and Thong (2009) state that working mode-related factors like teamwork, communication, and a shared understanding are essential for adopting agile SDMs and have a significant positive effect. However, one publication from Senyo et al. (2016) also finds that expected working mode improvements can negatively affect CC adoption. *Top management support* is executives' active and enthusiastic approval of an innovation (Chan and Thong 2009). The literature agrees that top management support positively affects innovation adoption (Chan and Thong 2009). This also holds for LCDPs, as the adoption induces technical (e.g., new technology and development paradigm) and social changes (e.g., the changed relationship between business and IT) throughout the application lifecycle. *Internal IT capabilities* are mainly related to the availability and expertise of internal resources and the technical infrastructure within the organisation (Wulf et al. 2021). Previous CC research agrees that this factor positively affects technology adoption.

3.4 Environment

External pressure refers to an organisation's pressure from industry competitors, industry trends, trading partners, and the regulatory environment (Oliveira et al. 2014). Most CC adoption literature sees external pressure as having a positive effect on CC adoption (Oliveira et al. 2014; Wulf et al. 2021). However, Senyo et al. (2016) find that in the context of CC adoption in developing countries, external pressure from trading partners can also negatively affect the adoption. By adopting LCDPs, organisations can achieve a competitive advantage through efficiency improvements, reduced dependency on IT developers, and faster time to markets (Käss et al. 2022).

4 Next steps

This research-in-progress paper introduces a research model for adopting LCDPs that will be empirically tested in later stages. At this stage, this paper has two contributions: First, it introduces a research model that reflects the multifaceted nature of LCDP adoption as a CC platform with agile SDM aspects. The theoretical foundation is grounded in the TOE model and STS theory to explain LCDP adoption. Second, the paper states thirteen empirically testable factors which may interplay with each other to lead to LCDP adoption. I propose to test the research model using qualitative data in the following steps. I plan to collect multiple case studies using semi-structured interviews as a primary source of evidence. I have already recruited several adopters and non-adopters of LCDPs as interview partners. Until the conference, the data is planned to be collected, so I can present tentative results about factors and how they are balanced as combinations to explain LCDP adoption.

5 References

Al-Isma 'ili, S., Li, M., Shen, J., and He, Q. 2016. "Clearing the 'Cloud' Hanging Over the Adoption of Cloud Computing in Australian SMEs," in *Proc. DIGIT 2016*.

Al Alamin, M. A., Malakar, S., Uddin, G., Afroz, S., Haider, T. Bin, and Iqbal, A. 2021. "An Empirical Study of Developer Discussions on Low-Code Software Development Challenges," in *Proc. IEEE/ACM 18th Int. Conf. on Mining Software Repositories*, pp. 46–57.

Alter, S. 2013. "Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future," *Journal of the Association for Information Systems* (14:2), pp. 72–121.

Asatiani, A. 2015. "Why Cloud? A Review of Cloud Adoption Determinants in Orgnanizations," in *Proc. ECIS 2015*.

Beranic, T., Rek, P., and Hericko, M. 2020. "Adoption and Usability of Low-Code / No-Code Development Tools," in *Proc. of the Central European Conf. on Information and Intelligent Systems*, pp. 97–103.

Bock, A. C., and Frank, U. 2021. "Low-Code Platform," *Business & Information Systems Engineering* (63:6), pp. 733–740.

Bostrom, R. P., and Heinen, J. S. 1977. "MIS Problems and Failures: A Socio-Technical Perspective Part I: The Causes," *MIS Quarterly* (1:3), pp. 17–32.

Chan, F. K. Y., and Thong, J. Y. L. 2009. "Acceptance of Agile Methodologies: A Critical Review and Conceptual Framework," *Decision Support Systems* (46:4), pp. 803–814.

Depietro, R., Wiarda, E., and Fleischer, M. 1990. "The Context for Change: Organization, Technology and Environment," *The Processes of Technological Innovation* (199), Lexington Books Lexington, MA, pp. 151–175.

Emery, F. E., and Trist, E. L. 1965. "The Causal Texture of Organizational Environments," *Human Relations* (18:1), pp. 21–32.

Friedrich-Baasner, G., Fischer, M., and Winkelmann, A. 2018. "Cloud Computing in SMEs: A Qualitative Approach to Identify and Evaluate Influential Factors," in *Proc. HICSS 2018*, pp. 4681–4690.

Hardgrave, B. C., and Johnson, R. A. 2003. "Toward an Information Systems Development Acceptance Model: The Case of Object-Oriented Systems Development," *IEEE Transactions on Engineering Management* (50:3), pp. 322–336.

Heuer, M., Kurtz, C., and Böhmann, T. 2022. "Towards a Governance of Low-Code Development Platforms Using the Example of Microsoft PowerPlatform in a Multinational Company," in *Proc. HICSS 2022*.

Hsu, C. L., and Lin, J. C. C. 2016. "Factors Affecting the Adoption of Cloud Services in Enterprises," *Information Systems and E-Business Management* (14:4), pp. 791–822.

Hsu, P. F., Ray, S., and Li-Hsieh, Y. Y. 2014. "Examining Cloud Computing Adoption Intention, Pricing Mechanism, and Deployment Model," *International Journal of Information Management* (34:4), Elsevier Ltd, pp. 474–488.

Jeyaraj, A., Rottman, J. W., and Lacity, M. C. 2006. "A Review of the Predictors, Linkages, and Biases in IT Innovation Adoption Research," *Journal of Information Technology* (21:1), pp. 1–23.

Käss, S., Strahringer, S., and Westner, M. 2022. "Drivers and Inhibitors of Low Code Development Platform Adoption," in *Proc. IEEE Conf. on Business Informatics*, pp. 196–205.

Kinuthia, J. N. 2015. "Technological, Organizational, and Environmental Factors Affecting the Adoption of Cloud Enterprise Resource Planning (ERP) Systems," in *Proc. AMCIS 2015*.

Laut, P., Dumbach, P., and Eskofier, B. M. 2021. "Integration of Artificial Intelligence in the Organizational Adoption: A Configurational Perspective," in *Proc. ICIS 2021*.

Loske, A., Widjaja, T., Benlian, A., and Buxmann, P. 2014. "Perceived IT Security Risks in Cloud

Adoption: The Role of Perceptual Incongruence Between Users and Providers," in *Proc. ECIS 2014*.

Malik, M., and Orr, S. 2022. "A Configurational Examination of Agile Development as a Sociotechnical System," *Industrial Marketing Management* (104), pp. 325–339.

Oliveira, T., Thomas, M., and Espadanal, M. 2014. "Assessing the Determinants of Cloud Computing Adoption: An Analysis of the Manufacturing and Services Sectors," *Information and Management* (51:5), pp. 497–510.

Parker, S. K., Van Den Broeck, A., and Holman, D. 2017. "Work Design Influences: A Synthesis of Multilevel Factors That Affect the Design of Jobs," *Academy of Management Annals* (11:1), pp. 267–308.

Prinz, N., Huber, M., Riedinger, C., and Rentrop, C. 2022. "Two Perspectives of Low-Code Development Platform Challenges: An Exploratory Study," in *Proc. PACIS 2022*.

Prinz, N., Rentrop, C., and Huber, M. 2021. "Low-Code Development Platforms: A Literature Review," in *Proc. AMCIS 2021*.

Richardson, C., and Rymer, J. 2014. "New Development Platforms Emerge For Customer-Facing Applications." (https://www.forrester.com/report/New-Development-Platforms-Emerge-For-CustomerFacing-Applications/RES113411, accessed February 22, 2022).

Rogers, E. M. 2010. *Diffusion of Innovations*, (4th ed.), Free Press.

Rymer, J. 2017. "The Forrester Wave: Low-Code Development Platforms for AD&D," Cambridge, MA.

Sahay, A., Indamutsa, A., Di Ruscio, D., and Pierantonio, A. 2020. "Supporting the Understanding and Comparison of Low-Code Development Platforms," in *Proc. Euromicro Conf. on Software Engineering and Advanced Applications*, pp. 171–178.

Sahinaslan, E., Sahinaslan, O., and Sabancıoglu, M. 2021. "Low-Code Application Platform in Meeting Increasing Software Demands Quickly: SetXRM," in *Proc. AIP Conf.* (Vol. 2334).

Sanchis, R., García-Perales, Ó., Fraile, F., and Poler, R. 2020. "Low Code as Enabler of Digital Transformation in Manufacturing Industry," *Applied Sciences* (10:1), pp. 1–17.

Schuch, F., Gerster, D., Hein, D., and Benlian, A. 2020. "Implementing Scaled-Agile Frameworks at Non-Digital Born Companies: A Multiple Case Study," in *Proc. HICSS 2020*, pp. 4336–4345.

Senyo, P. K., Effah, J., and Addae, E. 2016. "Preliminary Insight into Cloud Computing Adoption in a Developing Country," *Journal of Enterprise Information Management* (29:4), pp. 505–524.

Siepermann, M., Sutaj, A., Lüebbecke, P., and Lackes, R. 2016. "Refuse to Walk on Clouds: Why Firms Still Do Not Use Cloud Computing: An Empirical Study of Barriers and Enhancers," in *Proc. HICSS 2016*, pp. 3969–3978.

Di Sipio, C., Di Ruscio, D., and Nguyen, P. T. 2020. "Democratizing the Development of Recommender Systems by Means of Low-Code Platforms," in *Proc. 23rd ACM/IEEE Int. Conf. on Model Driven Engineering Languages and Systems*, pp. 1–9.

Sumner, M., and Ryan, T. 1994. "The Impact of CASE: Can It Achieve Critical Success Factors?," *Journal of Systems Management* (45:6).

Totterdale, R. L. 2018. "Case Study: The Utilization of Low-Code Development Technology to Support Reserach Data Collection," *Issues In Information Systems* (19:2), pp. 132–139.

Wulf, F. 2020. "Platform-As-A-Service Post-Adoption by Large-Scale Organizations: A Research Model Design," in *Proc. ECIS 2020*.

Wulf, F., Westner, M., and Strahringer, S. 2021. "Cloud Computing Adoption: A Literature Review on What Is New and What Still Needs to Be Addressed," *Communications of the Association for Information Systems* (48:1), pp. 523–561.

Yoo, Y., Henfridsson, O., and Lyytinen, K. 2010. "The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research," *Information Systems Research* (21:4), pp. 724–735.

Zhu, K., and Kraemer, K. L. 2005. "Post-Adoption Variations in Usage and Value of e-Business by Organizations: Cross-Country Evidence from the Retail Industry," *Information Systems Research* (16:1), pp. 61–84.