INTERNATIONAL JOURNAL OF APPLIED MANAGEMENT & TECHNOLOGY

International Journal of Applied Management and Technology
2021, Volume 20, Issue 1, Pages 183–193
DOI: 10.5590/IJAMT.2021.20.1.10

Original Research

WALDEN UNIVERSITY

Exploring the Influential Determinants of IoT Adoption in the U.S. Manufacturing Sector

Ronville D. Savoury, DIT
Walden University, Minneapolis, Minnesota, United States
https://orcid.org/0000-0002-6716-7433

Jodine M. Burchell, PhD
Walden University, Minneapolis, Minnesota, United States
https://orcid.org/0000-0003-4927-5489

Contact: *Jodine.burchell2@mail.waldenu.edu*

Abstract

Manufacturers have been hesitant to adopt the Internet of Things (IoT) due to a lack of understanding of factors related to IoT adoption. This correlational study uses a combination of diffusion of innovation theory and technology–organization–environment framework to examine if a relationship exists between relative advantage, complexity, compatibility, technology readiness, top management support, firm size, competitive pressure, and regulatory support and intent to adopt IoT in U.S. manufacturing organizations. A sample of 168 IT leaders was used. Multiple regression analysis indicated significant relationships between intent to adopt IoT and three variables: technology readiness, top management support, and competitive pressure. The model was able to predict approximately 44% of the variation of IT leaders' intent to adopt IoT. The results can help IT leaders in the U.S. manufacturing sectors understand the factors that influence IoT adoption.

Keywords: *IoT adoption, diffusion of innovation, technology–organization–environment framework, technology adoption, Internet of Things, manufacturing organizations, DOI, TOE, DOI-TOE*

Date Submitted: March 21, 2021 | **Date Published:** December 16, 2021

Recommended Citation

Savoury, R. D., & Burchell, J. M. (2021). Exploring the influential determinants of IoT adoption in the U.S. manufacturing sector. *International Journal of Applied Management and Technology, 20*, 183–193. https://doi.org/10.5590/IJAMT.2021.20.1.10

Introduction

In today's highly competitive market environment, business agility, flexibility, innovation, competitive advantage, lower upfront costs, and economic gains increases are essential to business profitability and long-term survival. Internet of Things (IoT) has the potential to increase value and efficiencies across many sectors via the vast network of smart things (Voas, 2016). Because IoT is a new information technology (IT) paradigm, factors such as technological, organization individualistic, environmental context, and others could influence the likelihood of adoption. But It is necessary to understand better the relationship between these factors and an organization's perceptions before deciding to adopt IoT solutions.

IoT is a critical enabler to spur growth within the manufacturing sector. Understanding the determinants of IoT is fundamental as organizations consider the adoption of IoT for business process transformation or to facilitate rapid application development to support business verticals. Few researchers have addressed IoT adoption at the organization level (Hwang et al., 2016; Tu, 2018). Even fewer researchers have utilized a combination of the diffusion of innovation (DOI) and the technology–organization–environment framework (TOE) to conduct studies within the manufacturing sector (Alkhalil et al., 2017; Shaltoni, 2017). This discovery indicates a gap in the literature, which can be characterized by a lack of research evaluating the factors influencing IoT adoption in the manufacturing sector.

Via a review of the literature, we provide background on IoT. We then describe the theoretical foundations for the research model and the hypotheses. The research methodology and the results are presented, followed by a discussion of the significant findings. We conclude by highlighting the implications of the findings and summarized options for future study.

Summary of the Literature

The concept of IoT has existed since the early 1990s when Weiser envisioned that technologies would merge with the environment (Mavropoulos et al., 2017). In recent years, IoT has become more integrated into our lives, which is made clear by all the connected devices within the commercial and consumer spaces.

IoT continues to grow, and the proliferation of IoT devices has skyrocketed over the last few years (Del Giudice, 2016). There is enormous potential for organizations to capitalize on this rapid expansion of IoT devices by harnessing and utilizing data gathered from these "smart" devices (Zhong et al., 2017); however, organizations need to consider the impact on their business strategy, infrastructure, and security posture (Ahlmeyer & Chircu, 2016)

Organizations have been slow to adopt IoT (Ives et al., 2016). Thirty-seven percent of U.S. organizations have IoT initiatives, yet only 10% have successfully integrated IoT systems (Ives et al., 2016). Much of the growth of IoT is expected to occur in the manufacturing sector (Farooq et al., 2015) and is a critical enabler to spur growth within the manufacturing sector. Some manufacturing organizations lack knowledge of the determinants that influence IoT adoption, hence key factors need to be identified to enhance the probability of organizational IoT adoption. For the diffusion of IoT technologies and associated applications, limitations (such as cost, privacy, security issues, and others) need to be addressed so that potential of the IoT technology and their applications can be realized.

Two significant innovation theories frame this study: Rogers' (2003) diffusion of innovation theory (DOI) and DePietro et al.'s (1990) technology–organization–environment framework (TOE). Current publications were used to critically examine the extent to which the determinants discussed in this study influence the adoption of IoT technologies.

Diffusion of Innovation Theory (DOI).
Rogers developed DOI theory in 1962, and researchers have extensively used it to study IT innovation at both the individual and organizational levels (Tu, 2018). Rogers argued that the four main elements of DOI theory are innovation, communications channels, time, and social systems (see Figure 1). Rogers claimed that five attributes of innovation, namely relative advantage, compatibility, complexity, trialability, and observability, could explain 49–87% of innovation adoption. Each attribute and its subdimension affect adoption differently and are influenced by the adopter's perception of importance (Rogers, 2003).

Technology–Organization–Environment Framework (TOE).
For organizational-level analysis to be meaningful, the characteristics of the organization should be included as part of the research model (Hameed et al., 2012; Tornatzky & Fleischer, 1990). Developed by DePietro et al. in 1990, the TOE framework embodies three aspects that influence technology adoption and innovation within the organization, namely the organizational context, technological context, and the environmental context (Martins et al., 2016; Tornatzky & Fleischer, 1990).

Combining DOI and TOE.
For this research, the authors were interested in how the technical context and organizational context influence IoT adoption, so a combination of DOI Theory and TOE framework was used—henceforth known as the DOI–TOE theoretical framework. Thus, three technical attributes were adopted from the DOI theory (relative advantage, compatibility, and complexity) and five organizational attributes from the TOE framework (technology readiness, top management support, firm size, competitive pressure, and regulatory support) were adapted for incorporation into the integrative DOI–TOE theoretical framework used in this study.

Some fundamental differences between DOI and TOE theories must be considered. Because of DOI's shortcomings, the TOE framework helps to provide a more comprehensive perspective for understanding IT adoption by including the technology, organization, and environmental contexts (Lee & Cheung, 2004). Similarly, TOE does not specify the role of individual characteristics (e.g., top management support), while DOI suggests their inclusion (Gangwar et al., 2014). Although there are shortcomings in both DOI and TOE, there is also an overlap, which results in both theories complementing each other. According to Ji and Liang (2016), combining DOI and TOE allows researchers to identify factors from inside and outside an organization along with technological characteristics.

Researchers posited that combining multiple frameworks overcomes the limitations inherent in each model, while enhancing the understanding of innovation adoption by enhancing explanatory power (Alkhalil et al., 2017; Awa et al., 2017). Combining multiple frameworks enhances the understanding of innovation adoption, thus it was sutiable to inegrate TOE with DOI. Combining DOI and TOE complement each other and provide a better understanding of innovation adoption (Alkhalil et al., 2017; Awa et al., 2017).

Research Question

What is the relationship between corporate IT leadership perceptions of (a) relative advantage, (b) complexity, (c) compatibility, (d) technology readiness, (e) top management support, (f) firm size, (g) competitive pressure, and (h) regulatory support and intent to adopt IoT?

Hypotheses

$H1_0$: There is no statistically significant relationship between corporate IT leadership perceptions of (a) relative advantage, (b) complexity, (c) compatibility (d) technology readiness, (e) top management support, (f) firm size, (g) competitive pressure, and (h) regulatory support and intent to adopt IoT.

$H1_A$: There is a statistically significant relationship between corporate IT leadership perceptions of (a) relative advantage, (b) complexity, (c) compatibility (d) technology readiness, (e) top management support, (f) firm size, (g) competitive pressure, and (h) regulatory support and intent to adopt IoT.

Method

Correlational research was used to examine the relationships between (a) relative advantage, (b) complexity, (c) compatibility, (d) technology readiness, (e) top management support, (f) firm size, (g) competitive pressure, and (h) regulatory support and intent to adopt IoT in the U.S. manufacturing sector. The independent variables were (a) relative advantage, (b) complexity, (c) compatibility, (d) technology readiness, (e) top management support, (f) firm size, (g) competitive pressure, and (h) regulatory support. The dependent variable was intent to adopt IoT. The G*Power 3.19 software was used to calculate the minimum sample size needed for conclusive research results. With the power and strength at 0.80, a median effect size equal to $f2 = .15$, and an alpha level of $\alpha = .05$, the sample size required was 109 participants. For this research, 168 participants provided usable responses. Rogers' (2003) diffusion of innovation theory (DOI) and DePietro et al.'s (1990) technology-organization-environment framework (TOE) provided the theoretical lens for this study.

Data Collection and Analysis

A 38-question anonymous, online survey was used to collect data from 168 IT employees in the U.S. manufacturing sector. There were four demographic questions. Another 32 questions used a 5-point Likert scale and were based on the DOI–TOE survey instrument created by Oliveira et al. (2014), which was based on a combination of the DOI theory and TOE frameworks. The DOI constructs were relative advantage, compatibility, complexity, trialability, and observability. The TOE constructs include the organizational context, the technological context, and the environmental context. The final two questions were based on intent to adopt IoT.

Data were analyzed using multiple regression. The Cronbach's alpha coefficient for each survey instrument indicated acceptable levels of internal reliability ($a > .70$). A bivariate scatterplot indicated that the data met the assumption of linearity. Using the Durbin–Watson statistic, the data met the independence of observations assumption. The Variance Inflation Factor (VIF) for independent variables indicated that the data met the assumption of the lack of multicollinearity. Residual scatter plots indicated no univariate outliers. P-P scatter plots indicated acceptable levels of normality. The Durbin–Watson statistic and plotting the residuals indicated that the data meet the assumption of homoscedasticity. Since there was no violation, bootstrapping was not used.

Findings

Demographic Frequencies and Percentages

Table 1 displays the frequency and percentages from the survey results for gender and age.

Table 1. *Descriptive Statistics*

Variable	Category	*n*	%
Gender	Female	73	43.4
	Male	94	56
	Unknown	1	0.6
Age	18–24	11	6.5
	25–34	49	29.2
	35–44	36	21.4
	45–54	47	28
	55–65	25	14.9
Job Title	Analyst/Associate	44	26.2
	Manager	44	26.2
	Senior Manager	12	7.1
	Director	19	11.3
	Vice President	4	2.4
	Senior Vice President	2	1.2
	C-level executive (CIO, CTO, etc.)	13	8.9
	President or CEO	1	0.6
	Owner	8	4.8
	Other	19	11.3
Employees	1–10 employees	9	5.4
	11–249 employees	39	23.2
	250–499 employees	25	14.9
	500–999 employees	29	17.3
	1,000–2,499 employees	28	16.7
	2,499–4,999 employees	13	7.7
	5,000–9,999 employees	13	7.7
	10,000 employees or more	12	7.1
Annual Business Volume in U.S. Dollars			
	Less than $10,000	2	1.2
	$10,000–$49,999	2	1.2
	$50,000–$99,999	6	3.6
	$100,000–$499,000	15	8.9
	$500,000–$999,999	37	22.0
	$1 million or more	106	63.1
U.S. Region			
	New England	10	6.0
	Mid-Atlantic	24	14.3
	East North Central	37	22.0
	West North Central	22	13.1
	South Atlantic	33	19.6
	East South Central	6	3.6
	West South Central	11	6.5
	Mountain	7	4.2
	Pacific	18	10.7

Note. Total $N = 168$

Descriptive Statistics for Dependent Variables

Table 2 displays the frequency and percentages for the dependent variable.

Table 2. *Frequency and Percent Statistics of Participants' Organizations Current IoT engagement and Future Plan to Adopt IoT*

Variable	Category	*n*	%
Current IoT Engagement			
	Not considering	18	10.7
	Currently evaluating, e.g., in a pilot study	42	25.0
	Have evaluated; do not plan to adopt	18	10.7
	Have evaluated; plan to adopt	50	29.8
	Have already adopted IoT	40	23.8
Future Plan to Adopt IoT			
	Not considering	13	7.7
	Less than 1 year	26	15.5
	Between 1 and 2 years	38	22.6
	Between 2 and 5 years	43	25.6
	More than 5 years	5	8.9
	Have already adopted IoT	33	19.6

Descriptive Statistics for Dependent and Independent Variables

Table 3. *Descriptive Statistics for Dependent and Independent Variables*

Variable	*M*	*SD*	*n*	SE_m	Skewness	Kurtosis
Relative advantage	4.04	.65	166	0.05	-0.38	-0.52
Complexity	2.71	0.82	168	0.06	0.18	-0.45
Compatibility	3.73	0.78	167	0.06	-0.35	-0.38
Technology readiness	3.54	0.93	168	0.07	-0.69	0.25
Top management support	3.75	0.87	168	0.07	-0.74	0.26
Firm size	4.73	1.22	168	0.09	-0.22	0.17
Competitive pressure	3.49	0.81	168	0.06	-0.24	-0.15
Regulatory support	3.47	0.83	168	0.06	0.02	-0.21
Intent to adopt IoT	3.60	1.33	168	0.10	-0.19	-0.82

Regression Analysis

Table 4 shows the results of the linear regression model. They were significant, $F(8,157) = 15.22$, $p < .001$, $R^2 = 0.44$, indicating that approximately 44% of the variance in intent to adopt IoT could be explain by (a) relative advantage, (b) complexity, (c) compatibility, (d) technology readiness, (e) top management support, (f) firm size, (g) competitive pressure, and (h) regulatory support. The results of the multiple linear regression analysis revealed relative advantage, complexity, compatibility, firm size, and regulatory support not to be statistically significant predictors to the model (p > .05). However, the results of the multiple linear regression revealed a statistically significant association between technology readiness ($\beta = .41$, $p < .004$), top management support ($\beta = .29$, $p < .034$), competitive pressure ($\beta = .33$, $p < .016$) and were significantly at .05 level as predictors of IT leadership's intent to adopt IoT. Thus, we rejected the null hypothesis.

Table 4. *Regression Modeling Predicting Intent to Adopt IoT Based on Relative Advantage, Complexity, Compatibility, Technology Readiness, Top Management Support, Firm Size, Competitive Pressure, and Regulatory Support*

Variable	B	SE	95% CI	β	t	p
(Intercept)	-0.02	0.72	[-1.45, 1.41]	0.00	-0.02	.981
Relative advantage	0.04	0.18	[-0.33, 0.40]	0.02	0.21	.831
Complexity	-0.21	0.11	[-0.42, 0.00]	-0.13	-1.93	.055
Compatibility	0.07	0.17	[-0.27, 0.42]	0.04	0.41	.683
Technology readiness	0.41	0.14	[0.13, 0.68]	0.28	2.93	.004
Top management support	0.29	0.14	[0.02, 0.56]	0.19	2.14	.034
Firm size	-0.05	0.07	[-0.18, 0.09]	-0.04	-0.66	.509
Competitive pressure	0.33	0.13	[0.06, 0.60]	0.19	2.44	.016
Regulatory support	0.08	0.12	[-0.16, 0.31]	0.05	0.63	.530

Note. Results: $F(8,157) = 15.22$, $p < .001$, $R2 = 0.44$
a. Dependent Variable: Intent to Adopt IoT

Discussion

Conclusions and Recommendations

A multiple linear regression analysis was conducted to assess the relationship between the independent and dependent variables, as there was no violation of the data assumption: normality, linearity, multicollinearity, and homoscedasticity. Cronbach's alpha was calculated to evaluate the reliability of the instrument. All items of the DOI–TOE survey instrument were above .7 except for firm size, which indicated the instrument was reliable for all scales except firm size. Validity test indicated that all constructs were valid except for firm size and showed that the first item on the firm size scale (i.e., number of employees) was a more useful measure of the size of a firm than the second item (i.e., business volume in USD). We kept firm size as one of the constructs in the multiple linear regression analysis. Overall the nine constructs of the DOI–TOE model predicted IT leadership's intention to adopt IoT in the manufacturing sector within the U.S. $F(8,157) = 15.22$, $p < .001$, $R^2 = 0.44$. By accessing the beta (β) we found that technology readiness, top management support, and competitive pressure tend to be the most influential factor influencing IT leadership intention to adopt IoT.

Adoption of IoT in the manufacturing sector is relatively new with limited guidance or studies providing best-practices approaches or strategies to evaluate determinants for IoT adopters in the manufacturing sectors. Because this study is one of only a few that examined the determinants that influence the intent to adopt IoT in the manufacturing sector, it is recommended that further studies be conducted in this area. Because this study is limited to the U.S. manufacturing sector, there may also be the need to further conduct similar studies in other countries to validate the study of hypothesis and to compare results.

Significance of the Research

Significance to the Body of IT Research

Adoption of IoT in the manufacturing sector is relatively new with limited guidance or studies providing best-practice approaches or strategies to evaluate determinants for IoT adopters in the manufacturing sectors. This study is significant to researchers looking to combine more than one theoretical perspective to understand IT adoption involving disruptive technologies (Ebersold & Glass, 2015).

Significance to IT Practice
Understanding the determinants of IoT is fundamental as organizations consider the adoption of IoT for business process transformation or to facilitate rapid application development to support business verticals, such as agriculture, health care, and manufacturing. This study is significant to IT practice in that it may give a practical model for understanding the determinants influencing the adoption of IoT technologies

Social Significance
Implications of this study for social change can be voiced in terms of operational efficiency for manufacturing organizations and the area of cost improvements for consumers. IoT adoption creates a significant opportunity for manufacturing organizations to improve or optimize their legacy technologies resulting in increased efficiency in key business areas. The efficiencies gained may create cost savings in manufacturing processes, thereby resulting in cost savings of goods and services offered to consumers. As profits increase, socially responsible organizations will provide increased wages and benefits to their employees, thus contributing to increased consumer spending powers.

Limitations, Criticisms, and Possible Future Research

There were several limitations identified in the study. First, participants were limited to IT leaders working in the manufacturing sector in the United States. According to Oliveira et al. (2014), different sectors have different determinants, which influence technology adoption. Future studies could expand the sample population by including IT leaders in other industries within and outside the United States.

All participants were obtained via Qualtrics panels. Participants were incentivized to take the survey; as such, these participants may not adequately represent the views of all manufacturing sector IT leaders. The generalizability of results is restricted only to IT leaders with demographics similar to participants from this study. Future studies could target participants responses via other voluntary collection methods, such as LinkedIn, who are not incentivized for participation.

Another limitation is the possibility the DOI–TOE model used excluded factors that could influence IoT adoption. While the analysis supported the use of the integrative DOI–TOE framework at predicting the intent to adopt IoT, the study revealed that three constructs were main contributors. Future researchers can conduct research by incorporating additional independent, such as security (Kumar & Patel, 2014; Whitmore et al., 2014), privacy (Kumar & Patel, 2014; Whitmore et al., 2014) and cost (Lin et al., 2016; Tu, 2018). Another alternative could be to include other dependent variables, such as firm size and data complexity, like the model used by Kim et al. (2018). It is possible that using additional factors, in an integrative model, could lead to greater insights on if there are other factors that influence IoT adoption in the U.S. manufacturing sector.

Another identified limitation of this study was related to potential sampling bias, resulting from poorly worded research questions and a limited ability of participants to ask for clarification, as well as the occasional influence of participant answers to the survey questions. Although we used an existing survey instrument, it was modified to focus on IoT adoption; We did not conduct a pilot study. Results from this study indicated that firm size might not be a reasonable measure of the actual size of firms in the sample, as firm size should theoretically be related to the intent to adopt IoT (Rogers, 2003). Future researchers could conduct a pilot study using this instrument and review the results to ensure there are no concerns about structure, wording, or sequence of the questions—thus mitigating this limitation. Also, conducting a pilot study could further develop an understanding of whether additional factors should be considered, leading to a possible expansion of the model.

Future researchers can also use this study as a source that would allow them to research technologies other than IoT and possibly include other independent variables that could help in predicting the intention to use a specific technology. Researchers could apply this model to investigate the determinant for IoT adoption in different industries within the U.S., or different industries in other countries.

Conclusions

A quantitative, correlational study was conducted to examine the relationship between corporate IT leadership perceptions of (a) relative advantage, (b) complexity, (c) compatibility, (d) technology readiness, (e) top management support, (f) firm size, (g) competitive pressure, and (h) regulatory support and intent to adopt IoT in manufacturing organizations. Data was from 168 IT leaders via a Qualtrics panel, which satisfied the sample size requirement. The response rate was 12%. SPSS was used to perform descriptive statistics; the instrument reliability and validity analysis; and standard multiple regression analysis to test the hypothesis derived from the question.

The analysis of the statistical results supported the alternative hypothesis. Three of the eight independent variable—technology readiness, top management support, and competitive pressure—contributed to predicting intention to adopt. Despite some limitations, IT leaders in U.S. manufacturing organizations can use these findings to make an informed decision on what determinants most influence IoT adoption. This study makes significant contributions to the body of research on the adoption of new technologies and IoT.

References

Ahlmeyer, M., & Chircu, A. M. (2016). Securing the internet of things: A review. *Issues in Information Systems, 17*(4), 21–28. https://doi.org/10.48009/4_iis_2016_21-28

Alkhalil, A., Sahandi, R., & John, D. (2017). An exploration of the determinants for decision to migrate existing resources to cloud computing using an integrated TOE–DOI model. *Journal of Cloud Computing*, *6*(1), Article 2. https://doi.org/10.1186/s13677-016-0072-x

Awa, H. O., Ojiabo, O. U., & Orokor, L. E. (2017). Integrated technology–organization–environment (T–O–E) taxonomies for technology adoption. *Journal of Enterprise Information Management, 30*(6), 893–921. https://doi.org/10.1108/jeim-03-2016-0079

Del Giudice, M. (2016). Discovering the internet of things (IoT) within the business process management: A literature review on technological revitalization. *Business Process Management*, *22*(2), 263–270. https://doi.org/10.1108/BPMJ-12-2015-0173

DePietro, R., Wiarda, E., & Fleischer, M. (1990). The context for change: Organization, technology, and environment. In L. G. Tornatzky & M. Fleischer (Eds.), *The processes of technological innovation* (pp. 151–175). Lexington Books.

Ebersold, K., & Glass, R. (2015). The impact of disruptive technology: The internet of things. *Issues in Information Systems, 1*6(4), 194–201. https://doi.org/10.48009/4_iis_2015_194-201

Farooq, M. U., Waseem, M., Khairi, A., & Mazhar, S. (2015). A critical analysis on the security concerns of internet of things (IoT). *International Journal of Computer Applications*, *111*(7), 1–6. https://doi.org/10.5120/19547-1280

Gangwar, H., Date, H., & Raoot, A. (2014). Review on IT adoption: Insights from recent technologies. *Journal of Enterprise Information Management*, *27*(4), 488–502. https://doi.org/10.1108/jeim-08-2012-0047

Hameed, M. A., Counsell, S., & Swift, S. (2012). A conceptual model for the process of IT innovation adoption in organizations. *Journal of Engineering and Technology Management*, *29*(3), 358–390. https://doi.org/10.1016/j.jengtecman.2012.03.007

Hwang, Y.-M., Kim, M. G., & Rho, J.-J. (2016). Understanding internet of things (IoT) diffusion: Focusing on value configuration of RFID and sensors in business cases (2008–2012). *Information Development*, *32*(4), 969–985. https://doi.org/10.1177/0266666915578201

Ives, B., Palese, B., & Rodriguez, J. A. (2016). Enhancing customer service through the Internet of Things and digital data streams. *MIS Quarterly Executive, 15*(4), 279–297.

Ji, H., & Liang, Y. (2016). Exploring the determinants affecting e-government cloud adoption in China. *International Journal of Business and Management, 11*(4), 81–90. https://doi.org/10.5539/ijbm.v11n4p81

Kim, D. J., Hebeler, J., Yoon, V., & Davis, F. (2018). Exploring determinants of semantic web technology adoption from IT professionals' perspective: Industry competition, organization innovativeness, and data management capability. *Computers in Human Behavior, 86*, 18–33. https://doi.org/10.1016/j.chb.2018.04.014

Kumar, J. S., & Patel, D. R. (2014). A survey on internet of things: Security and privacy issues. *International Journal of Computer Applications, 90*(11), 20–26. https://doi.org/10.5120/15764-4454

Lee, M. K. O., & Cheung, C. M. K. (2004). Internet retailing adoption by small-to-medium sized enterprises (SMEs): A multiple-case study. *Information Systems Frontiers, 6*(4), 385–397. https://doi.org/10.1023/b:isfi.0000046379.58029.54

Lin, D., Lee, C. K. M., & Lin, K. (2016, December 4–7). *Research on effect factors evaluation of internet of things (IOT) adoption in Chinese agricultural supply chain* [Conference session]. 2016 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Bali, Indonesia. https://doi.org/10.1109/ieem.2016.7797948

Martins, R., Oliveira, T., & Thomas, M. A. (2016). An empirical analysis to assess the determinants of SaaS diffusion in firms. *Computers in Human Behavior*, *62*, 19–33. https://doi.org/10.1016/j.chb.2016.03.049

Mavropoulos, O., Mouratidis, H., Fish, A., Panaousis, E., & Kalloniatis, C. (2017). A conceptual model to support security analysis in the internet of things. *Computer Science and Information Systems, 14*(2), 557–578. https://doi.org/10.2298/CSIS160110016M

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information and Management*, *51*(5), 497–510. https://doi.org/10.1016/j.im.2014.03.006

Rogers, E. M. (1962). *Diffusion of innovations*. Free Press.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Shaltoni, A. M. (2017). From websites to social media: Eloring the adoption of internet marketing in emerging industrial markets. *Journal of Business and Industrial Marketing, 32*(7), 1009–1019. https://doi.org/10.1108/jbim-06-2016-0122

Tornatzky, L. G., & Fleischer, M. (1990). *The process of technology innovations*. Lexington Books.

Tu, M. (2018). An exploratory study of internet of things (IoT) adoption intention in logistics and supply chain management: A mixed research approach. *The International Journal of Logistics Management, 29*(1), 131–151. https://doi.org/10.1108/ijlm-11-2016-0274

Voas, J. (2016). *Networks of "things"* (NIST Special Publication 800-183). U.S. Department of Commerce. https://doi.org/10.6028/NIST.SP.800-183

Whitmore, A., Agarwal, A., & Xu, L. D. (2014). The internet of things—a survey of topics and trends. *Information Systems Frontiers, 17*(2), 261–274. https://doi.org/10.1007/s10796-014-9489-2

Zhong, R. Y., Xu, X., & Wang, L. (2017). IoT-enabled smart factory visibility and traceability using laser-scanners. *Procedia Manufacturing, 10*, 1–14. https://doi.org/10.1016/j.promfg.2017.07.103

IJAMT

The *International Journal of Applied Management and Technology* (*IJAMT*), sponsored by Walden University's College of Management and Technology, is a peer-reviewed, online journal that addresses contemporary national and international issues related to management and technology.