Toward the Enhancement of Marketing Intelligence Capability: The Role of Internet of Things

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Abstract

Studies have suggested that Internet of Things (IoT) not only serves as an innovative tool for enterprise operations, but also could trigger impacts on business performance. As researchers increasingly raise interests about the business values of IoT, this study examines its managerial effects by investigating the link between IoT and marketing. Referring to the organizational capability perspective, this study constructed a research hypothesis in which IoT capability affects marketing intelligence capability. An empirical survey was performed and an analysis of the data was conducted to test the hypothesis. The results confirmed the role of IoT capability on enhancing marketing intelligence capability. Discussions with managerial implications are then elaborated.

Keywords: Internet of Things, marketing intelligence, organizational capability

1. Introduction

Recent development of the extensive globalization, the meticulosity of enterprise internationalization and business integration, and the rapid development of innovative technologies have caused business environments to change rapidly and enormously. For enterprises, customers require an increasingly fast response and personalized fulfillment. To respond effectively to changing internal situations and external environments, a firm must interact closely with changes through its distinctive capabilities to form a highly robust competitive strategy. This makes a firm's organizational capabilities especially critical facing competitions, because organizational capabilities are the source of competitive advantage [1-6].

To many organizations worldwide, the evolution of Internet of Things (IoT) is considered as "the next big thing" [7, 8] of information technology. The development of various IoT related technologies is expected to affect enterprises' managerial paradigm, including business strategy. IoT attracted attention as a possible source of strategic advantage for firms [9]. It may provide business opportunities for companies, and may even change the future market [10]. Therefore, aligning with the development of IoT has become critical for the formulation and execution of a firm's business strategy.

The perceived capability of IoT implies that firms make strategic decisions more efficiently. By employing IoT, firms should be able to recognize new business opportunities, identify possible threats, and maintain competitiveness. However, so far studies of the relationship between IoT and firms' capability are rare in the literature. To fill this gap, this study intent to investigate the role of IoT in organizational capability.

In addition, a firm is a value chain assembled with various value activities [11]. These value activities include primary functional operations such as productions, marketing, sales and services, as well as supportive functional operations such as human resource management, research and development (R&D), and information systems. In order to use IoT, a firm needs to integrate IoT with these functional operations. Among these functional operations, this research focuses on marketing for several reasons. First, marketing strategy plays a key role in shaping overall business strategy of a firm [12, 13]. Second, marketing is tightly related to many other functional operations of a firm, such as production, sales and customer service [14-19]. Finally, IoT enabled products are expected to transform future marketing paradigm [9, 20, 21].

Furthermore, in a firm's marketing operations, marketing intelligence is the foundation of overall marketing activities, because marketing decisions rely on the capability of acquiring and interpreting accurate marketing intelligence [22]. Therefore, the objective of this research is to investigate the linkage between IoT and marketing intelligence.

The paper begins with a review of the relevant literature about the relationships between Internet of Things and marketing intelligence. Then it proposes a hypothesis which links these variables. Following that, the hypothesis is tested using a sample of Taiwanese companies with global operations. Finally, the findings are presented along with the managerial implications of the study and recommendations for future work.

2. Hypotheses

2.1 Internet of Things and Organizational Capability

Several researchers have elaborated the technological features of Internet of Things [7, 8, 23-28]. These features are classified and summarized as follows.

- Ubiquitous sensing: This is the mechanism that the "things" or devices in IoT perceive the surrounding physical environment, detect and record the changes in the environment, and respond to the changes. Ubiquitous sensing is enabled by wireless sensor network (WSN) technologies [7, 24, 25].
- Pervasive connectivity: IoT contains multiple layers of communication networking infrastructure to provide the pervasive communications between people and people, people and things, and things and things, to form a smart environment [23, 24].
- Embedded computing: IoT devices contain embedded hardware and software to work intelligently within the environment. The embedded hardware includes processor chips, data storage units and power units. The embedded software includes embedded operating systems, mobile apps and middleware. In particular, IoT devices can be embedded further in other devices [24, 26].
- Real-time analytics: IoT monitored and detected information are invisibly embedded in the environment around users, results in the generation of big data in real-time which are distributed, stored, processed, presented and interpreted in a seamless, efficient, and easily understandable form [24, 26, 29, 30].
- Cloud support: Cloud services are deployed to assist the processing and storage of IoT analytics, and provide IoT users ubiquitous access of supporting services initiated by IoT devices around the smart environment [23-25, 31].
- Interactive user interface: Visualization, touching and voice are critical for an IoT application as this allows the awareness and interaction of IoT users with the environment. 3D viewing and printing technologies, personal mobile assistants, wearable devices, and augmented-reality devices provide novel interface for users to interact with the smart environment [24, 25, 32].
- Interconnected smart products: IoT enables evolution of various products such as smart home appliances, robots, drones, unmanned cars, automated factory machines and business equipment, and many other innovative devices [8, 26, 28, 33].
- Cyber-physical convergence: The convergence of computer network, telecom network and IoT triggers further convergence of cyber space and physical space,

and results in various smart spaces, such as smart home, smart office, smart factory, smart laboratory, smart store, smart marketplace, smart hospital, smart museum and smart city [8, 24, 25, 27].

With these technological features, IoT has been asserted as essential for organizational innovation and adaptation in a changing environment [34, 35], especially for firms with high amounts of connectivity and data. However, so far few studies have examined the capabilities needed to adopt IoT in an organization, and how these relate to other capabilities, particularly from the perspective of an innovative and market-oriented organization. Therefore, to contribute with a required research framework of IoT and organizational capability, this study examines the role of IoT capability further in marketing activities.

IoT capability refers to the firms' ability to integrate firm resources and skills arising from IoT to align with the firms' strategic directions [2, 36]. IoT capability enables an organization to exploit and incorporate the above IoT technological features for business value. By using IoT, firms are able to identify new business opportunities and potential threats, and maintain competitiveness, thus establishing the IoT capability to be a source of competitive advantage [37]. Depending on different industry sectors and business models, a firm with IoT capability could be competent in developing or deploying IoT core components for business applications, in making or using IoT connected products for business benefits, or in implementing or operating IoT enabled environments for business value [9, 28].

2.2 Internet of Things and Marketing Intelligence

Effective marketing requires adequate information for planning and allocating resources properly to different markets, products, territories, and marketing tools [38]. Marketing intelligence is the systematically collected and extracted information for making marketing decisions. Marketing intelligence is a critical component for overall marketing activities of a firm. Acquisition and effective use of marketing intelligence is vital in shaping the firm's sustainable competitive advantage [39, 40]. Marketing intelligence capability concerns a firm's ability to learn about customers, competitors, channel members and the broader market environment in which it operates [1, 41].

IoT capability is expected to enhance marketing intelligence capability, because IoT capability enables a firm with better ability to sense and collect information from customers and competitors [37]. IoT capability indicates the ability in merging of the digital world with the world of things. It involves the ability of convergence of the industrial systems with the power of advanced computing, analytics, low-cost sensing, and new levels of connectivity provided by the internet [27]. For a firm with IoT capability, large scale real-time customer surveys can be conducted with the assistance of sensing and recognition technology. Augmented reality enhanced user interface allows users to view and test products and services using their smartphones, tablets or 3D viewing glasses. The big data from IoT connected products provides a clear picture of product use, showing the features customers prefer. By comparing usage patterns, firms can identify finer market segmentation information [28]. Firms can then apply this knowledge to generate more valuable intelligence, and develop more sophisticated pricing strategies that better match price and value at the market segment.

Furthermore, it is easier in a smart environment such as a smart marketplace or a smart store to collect and disseminate user opinions and user experiences about competitors' products or services [24]. The ubiquitous sensing with intelligent pattern recognition and machine learning functionalities enables the analysis and simulation of competitors' products and services. Using this information, further realization of competitors' products or services can be accomplished digitally or physically in a smart laboratory using 3D animation or 3D printing technology. The big data of feedback opinions collected from customers and distributors can also be exploited to make more accurate analysis of competitors' situations. IoT embedded analytics can invoke corrective processes to address immediate operational issues or inform managers of discoveries regarding competitors' strategic moves that will impact their short-term and long-term business activities [35].

IoT capability also facilitates the collaborations between firms and business partners. Information sharing and collaboration in the IoT can occur between people, between people and things, and between things. Firms with IoT capability are easier to form virtual alliances or virtual groups with partners. These partners could be customers, suppliers, intermediaries, governments and competitors, all of which are important in IoT context [37]. Sensing a predefined event is usually the first step for information sharing and collaboration. Information sharing and collaboration enhance situational awareness and avoid information delay and distortion [35]. This is the essence of marketing intelligence.

As such, IoT capability can enhance firm's marketing intelligence acquisition efforts, representing the extent to which they can generate and disseminate marketing intelligence, and which may lead to novel interpretations and recombination of prompt responses to marketing situations. Thus with IoT capability, a firm is able to transform marketing intelligence capability and enhance marketing results. In summary, we propose the following hypothesis.

Hypothesis: IoT capability is positively associated with marketing intelligence capability.

3. Method

3.1 Survey Instrument

The survey instrument was developed using questions derived from the literature on information technology capabilities and marketing capabilities discussed previously. We operationalized the study variables by using multi-item reflective measures on a 7-point scale [42].

Following the definition of information technology capability by Bharadwaj [36], a firm's IoT capability is measured here by its ability to develop or deploy IoT based resources, which include the tangible IoT resources, the intangible IoT resources, and the human IoT resources. The tangible IoT resources are physical things such as IoT components, IoT connected products, and IoT enabled smart environments. The intangible IoT resources are assets such as knowledge, know-how, and synergy about IoT. The human IoT resources comprise technical and managerial IoT staffs. Thus we measure the core capability arising from IoT with three items according to the utilization of the three types of IoT based resources.

A firm's marketing intelligence capability concerns its competency in intelligence generation, intelligence dissemination, and responsiveness [39, 43]. Marketing intelligence capability is operationalized as the accessibility and utilization of resources and activities within a firm to collect and analyze market information, and utilize it to develop effective marketing programs. The ability to effectively gather and disseminate customer and competitor information is critical for marketing intelligence capability [43, 44]. This four-item scale was adapted from Vorhies, et al. [45] and Trainor, et al. [22].

All items for this study were assessed with a 7-point Likert scale ranging from "strongly disagree" to "strongly agree." Furthermore, firm size, IT department size and industry sector were used as control variables [46, 47]. Table 1 presents the items used to measure each of the independent and dependent construct variables.

Table 1 Constructs and items used in the survey

Construct and item description (1 – strongly disagree; 7 – strongly agree)	
IoT:	Internet of Things capability
IoT1:	My company is competent in developing or deploying IoT technologies such as IoT components, IoT connected products or IoT enabled environments.
IoT2:	We possess sophisticated IoT knowledge, intelligence and synergy.
IoT3:	Our employees are proficient in IoT technologies and related managerial topics.
MIC:	Marketing intelligence capability
MIC1:	My company is competent in collecting information about customers and competitors
MIC2:	We are proficient in tracking customer needs and wants
MIC3:	We are skillful in analyzing and disseminating marketing information
MIC4:	We are competent in developing effective marketing programs

Control Variables (rescaled)
Industry: Industry sectors of firms. 1 for service firms and 0 for manufacturing firms.
Firm Size: Total number of employees.
IT Size: Total numbers of IT staffs.

3.2 Sample and Data Collection

Enterprises operating in Taiwan were surveyed in order to test the hypotheses. A questionnaire designed in accordance with Table 1 above was implemented as the survey instrument. It was then pretested with 13 executives and managers. The pretesting focused on instrument clarity, question wording, and validity. Members of the testing sample were invited to comment on the questions and wording of the questionnaire. The comments of these respondents then provided a basis for revisions to the questionnaire to establish content validity.

A sample of 1,000 firms was randomly selected from the top 5,000 list of the largest companies in Taiwan published by a Taiwanese marketing research organization. Most of the companies in the list are public listed corporations with international operations.

The survey, which took three months to complete, was initially conducted by postal mail and e-mail, and then followed up with telephone calls and in-person visits. A total of 217 responses were received, of which 15 were unusable and eliminated. The remaining 202 responses were used in this study, for a response rate of 20.2%.

The mean differences between responding and non-responding firms were compared along firm attributes using t-tests and all statistics were non-significant ($p > 0.5$). Furthermore, the responses were classified into two groups to examine whether there was any response bias. The responses received during the first two months were classified as early returns, and those received during the last months as late returns. The two groups were then compared for any significant difference in responses using the chi-square test of independence. No significant difference was found between the two groups, supporting that response bias is not an issue in this study [48]. Table 2 shows the profile of the final sample list.

Table 2 Profile of the final sampling firms

	Sample size	Percentage
Industry		
Manufacturing	92	45.5%
Services	110	54.5%
Total	202	100.0%

Firm size		
Under 100	50	24.8%
100-199	53	26.2%
200-499	40	19.8%
500 and above	59	29.2%
Total	202	100.0%
IT department size		
Under 5	67	33.2%
5-19	62	30.7%
20 and above	73	36.1%
Total	202	100.0%

4. Results

4.1 Reliability and Validity

The reliability of the survey instrument was tested by using Cronbach's alpha [49] to assess the internal consistency of the proposed constructs listed in Table 1. Cronbach's alpha tests the interrelationship among the items composing a construct to determine if the items measure a single construct. Nunnally and Bernstein [50] recommended a threshold alpha value of .7. Cicchetti, et al. [51] further suggested the following reliability guidelines for determining significance: $\alpha < .70$ (unacceptable), $.70 \leq \alpha < .80$ (fair), $.80 \leq \alpha < .90$ (good), and $\alpha > .90$ (excellent).

Content validity [52] refers to the extent to which the instrument measures what it is designed to measure. Most of our measures used in the study were adopted from relevant studies. Although basing the study on the established literature provided a considerable level of validity, the study's validity was further improved by pre-testing the instrument on a panel of experts comprising 13 business executives and managers.

Table 3 summarizes the descriptive statistics and results of the reliability and validity tests. The reliability of the instrument was examined using composite reliability estimates by employing Cronbach's α. All the coefficients exceeded Nunnally's recommended level (0.70) of internal consistency [50, 51]. In addition, factor analysis was performed to confirm the construct validity. The results supported the constructs of our research model. The discriminant validity was confirmed since items for each constructs loaded on to single factors with all loadings greater than 0.8. These results confirmed that each of the construct in our hypothesized model is unidimensional and factorially distinct, and that all items used to operationalize a construct is loaded onto a single factor.

Table 3 Descriptive statistics and reliability and validity test

Construct	Item	Mean	SD	Cronbach's alpha	Cronbach's alpha if item deleted	Factor loading on single factor
IoT	IoT1	4.123	1.554	0.815	0.752	0.851
	IoT2	3.671	1.479		0.731	0.864
	IoT3	4.708	1.554		0.756	0.849
MIC	MIC1	4.755	1.022	0.920	0.922	0.854
	MIC2	4.787	.931		0.886	0.923
	MIC3	4.828	.931		0.901	0.890
	MIC4	4.764	.857		0.878	0.940

Table 4 summarizes the correlations among different factors. We also assessed discriminant validity on the basis of the construct correlation that Campbell and Fiske [53] proposed. The tests indicated acceptable results with respect to discriminant validity.

Table 4 Construct correlation

Construct	1	2	3	4	5
1. IoT	1				
2. MIC	0.254**	1			
3. Industry	0.131	-0.062	1		
4. Firm Size	0.150	0.006	-0.100	1	
5. IT Size	0.148	0.068	-2.790**	0.402**	1

*p < 0.05, **p < 0.01

4.2 Tests of the Hypothesis

To test our hypothesis, multiple regression analysis was performed using SPSS version 21. We examined the degree to which our data met appropriate statistical assumptions in the case of multiple regression analysis such as normality and linearity, and our data met the requisite assumptions.

Table 5 summarizes the test results regarding the parameter estimates and p-values of the hypothesis. We also included industry, firm size and IT department size as control variables in the analysis.

Table 5 Tests results of the hypothesized model

Dependent variable	Explanatory variable		Control variable						
	IoT		Industry		Firm Size		IT Size		
	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	R^2
MIC	0.271	0.000***	-0.097	0.184	-0.054	0.476	0.023	0.774	0.076

*p < 0.05, **p < 0.01, ***p < 0.001

The results in Table 5 supported our hypotheses.

5. Discussion

5.1 Research Implications

This study investigated the impact of a firm's IoT capability on marketing intelligence capability. By supporting the research hypothesis, this study could be directed toward helping managers and practitioners realize the links between organizational capabilities.

First, the cultivation of organizational capabilities, in general, is expected to enhance an organization's other capabilities and further elevate its competitive advantage [1, 3, 54]. This study substantiates the positive correlation between a firm's organizational capabilities. In particular, our results support the positive correlations between two different organizational capabilities, one with technology resources and the other with marketing functions.

Second, from the literature contribution perspective, few of the extant literature refer to what happens to the inside of a firm when IoT is introduced. Most of the present research draws more attention to the analysis of how IoT could influence business performance than to the discussion of how IoT could affect marketing. Our findings support not only the marketing orientation concept of Jaworski and Kohli [40], but also the hierarchy model of capabilities of Grant [2]. From the managerial implication perspective, the marketing department in a firm is skillful at sensing and understanding the outside environment. If a business strategy of a firm can fit into its surroundings, its performance is usually enhanced. Thus, a marketing department in a firm becomes critical for a firm to make its business strategies fit with its surroundings. Our findings suggest that IoT capability can facilitate the marketing department of a firm for the generation, dissemination and analysis of marketing intelligence, so as to help shaping the firm's business strategy for competitive advantage.

In essence, IoT capability and its output, pervasive sensing and connectivity with embedded analytics, enable firms to deploy and operate in smart environments, and thus could enhance the functional level operations with efficiency and flexibility to achieve cost leadership or differentiation, or a combination of both. In addition, it is also because of the cross-functional nature of pervasive sensing and connectivity with embedded analytics, IoT capability can have a positive influence on some other organizational capabilities, such as marketing intelligence capability. Marketing intelligence capability and its output, marketing intelligence, enable firms to anticipate and understand better the customer needs and the competitive situation, to process this information faster and to develop products and services with lower cost or with differentiated features, which empower firms to sustain a competitive advantage.

5.2 Study Limitations and Further Research

Although this study reported meaningful implications regarding the development of multidimensional measures of constructs in our hypothesized framework, it should be realized that the validity of an instrument cannot be firmly established on the basis of a single study. In this study, all data used for tests were collected from firms based in Taiwan. Therefore, practitioners and academics are suggested to interpret our findings as a reference model rather than generalizing our measures to different research context.

Further research efforts which focus on accumulating more empirical evidence for assessing and validating empirical data are recommended to overcome the limitations of the present study. Such research is suggested to address how other emerging technologies relate to organizational capabilities and functional operations. For example, wearable interface technology [55-57] and augmented reality technology [58-60] have received inadequate attention from strategic considerations and organizational capability theories. These efforts should involve studies identifying the organizational capabilities which affect business operation, information processing, and decision support. The analysis of these data may enable conclusions to be drawn about more generalized relationships among business level strategy, functional level strategy, and technology based organizational capability.

References

[1] G. S. Day, "The Capabilities of Market-Driven Organizations," *Journal of Marketing,* vol. 58, pp. 37-52, 1994.

[2] R. M. Grant, "Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration," *Organization Science,* vol. 7, pp. 375-387, 1996.

[3] R. M. Grant, "The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation," *California Management Review,* vol. 33, pp. 114-135, Spring91 1991.

[4] J. B. Barney, "Looking inside for competitive advantage," *The Academy of*

Management Executive, vol. 9, pp. 49-61, 1995.
[5] D. J. Teece, G. Pisano, and A. Shuen, "Dynamic Capabilities and Strategic Management," *Strategic Management Journal,* vol. 18, pp. 509-533, 1997.
[6] G. S. Day, "Closing the Marketing Capabilities Gap," *Journal of Marketing,* vol. 75, pp. 183-195, Jul 2011.
[7] E. Borgia, "The Internet of Things vision: Key features, applications and open issues," *Computer Communications,* vol. 54, pp. 1-31, 2014.
[8] D. Miorandi, S. Sicari, F. De Pellegrini, and I. Chlamtac, "Internet of things: Vision, applications and research challenges," *Ad Hoc Networks,* vol. 10, pp. 1497-1516, 2012.
[9] M. E. Porter and J. E. Heppelmann, "How smart, connected products are transforming competition," *Harvard Business Review,* vol. 92, pp. 64-88, November 2014.
[10] M. Iansiti and K. R. Lakhani, "Digital Ubiquity - How Connections, Sensors, and Data Are Revolutionizing Business," *Harvard Business Review,* vol. November, pp. 91-99, November 2014.
[11] M. E. Porter, *Competitive advantage*. New York: Free Press, 1985.
[12] C. B. Dobni and G. Luffman, "Determining the scope and impact of market orientation profiles on strategy implementation and performance," *Strategic management journal,* vol. 24, pp. 577-585, 2003.
[13] G. S. Day and R. Wensley, "Marketing Theory with a Strategic Orientation," *Journal of Marketing,* vol. 47, pp. 79-89, 1983.
[14] P. Guenzi and G. Troilo, "Developing marketing capabilities for customer value creation through Marketing–Sales integration," *Industrial Marketing Management,* vol. 35, pp. 974-988, 2006/11/01/ 2006.
[15] D. Rouziès and J. Hulland, "Does marketing and sales integration always pay off? Evidence from a social capital perspective," *Journal of the Academy of Marketing Science,* vol. 42, pp. 511-527, September 01 2014.
[16] Y. Wang and H. Feng, "Customer relationship management capabilities," *Management Decision,* vol. 50, pp. 115-129, 2012 2012.
[17] S.-M. Tseng, "Knowledge management capability, customer relationship management, and service quality," *Journal of Enterprise Information Management,* vol. 29, pp. 202-221, 2016 2016.
[18] A. Respício and M. E. Captivo, "Marketing-production Interface through an Integrated DSS," *Journal of Decision Systems,* vol. 17, pp. 119-132, 2008 2008.
[19] W. Chang, J. E. Park, and S. Chaiy, "How does CRM technology transform into organizational performance? A mediating role of marketing capability," *Journal of Business Research,* vol. 63, pp. 849-855, 2010/08/01/ 2010.
[20] E. d. S. Zancul, S. M. Takey, A. P. B. Barquet, L. H. Kuwabara, P. A. Cauchick

Miguel, and H. Rozenfeld, "Business process support for IoT based product-service systems (PSS)," *Business Process Management Journal,* vol. 22, pp. 305-323, 2016 2016.

[21] M. Bulearca and D. Tamarjan, "Augmented Reality: A Sustainable Marketing Tool?," *Global Business and Management Research,* vol. 2, pp. 237-252, 2010 2010.

[22] K. J. Trainor, M. T. Krush, and R. Agnihotri, "Effects of relational proclivity and marketing intelligence on new product development," *Marketing Intelligence & Planning,* vol. 31, pp. 788-806, 2013 2013.

[23] L. Atzori, A. Iera, and G. Morabito, "The Internet of Things: A survey," *Computer Networks,* vol. 54, pp. 2787-2805, 2010.

[24] J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions," *Future Generation Computer Systems,* vol. 29, pp. 1645-1660, 2013.

[25] D. Bradley, D. Russell, I. Ferguson, J. Isaacs, A. MacLeod, and R. White, "The Internet of Things – The future or the end of mechatronics," *Mechatronics,* vol. 27, pp. 57-74, 2015.

[26] V. Krotov, "The Internet of Things and new business opportunities," *Business Horizons,* vol. 60, pp. 831-841, 2017/11/01/ 2017.

[27] N. Agarwal and A. Brem, "Strategic business transformation through technology convergence: implications from General Electrics industrial internet initiative," *International Journal of Technology Management,* vol. 67, pp. 196-214, 2015.

[28] M. E. Porter and J. E. Heppelmann, "How smart, connected products are transforming companies," *Harvard Business Review,* vol. 93, pp. 96-16, 2015.

[29] W. H. Weng and W. T. Lin, "A Big Data technology foresight study with scenario planning approach," *International Journal of Innovation in Management,* vol. 1, pp. 41-52, 2013.

[30] W. H. Weng and W. T. Lin, "Development trends and strategy planning in big data industry," *Contemporary Management Research,* vol. 10, 2014.

[31] W. H. Weng and W. T. Lin, "Development assessment and strategy planning in cloud computing industry," *International Journal of Electronic Commerce Studies,* vol. 5, pp. 257-266, 2014.

[32] W. H. Weng and W. T. Lin, "A scenario analysis of wearable interface technology foresight," in *The International Conference on Electronic Business (ICEB)*, Taipei, 2014, pp. 8-15.

[33] W. H. Weng and W. T. Lin, "Development assessment and strategy planning in mobile computing industry," in *2014 IEEE International Conference on Management of Innovation and Technology*, Singapore, 2014, pp. 453-457.

[34] Y. Li, M. Hou, H. Liu, and Y. Liu, "Towards a theoretical framework of strategic

decision, supporting capability and information sharing under the context of Internet of Things," *Information Technology and Management,* vol. 13, pp. 205-216, December 01 2012.

[35] I. Lee and K. Lee, "The Internet of Things (IoT): Applications, investments, and challenges for enterprises," *Business Horizons,* vol. 58, pp. 431-440, 2015.

[36] A. S. Bharadwaj, "A resource-based perspective on information technology capability and firm performance: an empirical investigation," *MIS Quarterly,* vol. 24, pp. 169-196, 2000.

[37] X. Yu, B. Nguyen, and Y. Chen, "Internet of things capability and alliance," *Internet Research,* vol. 26, pp. 402-434, 2016 2016.

[38] P. Kotler, "From sales obsession to marketing effectiveness," *Harvard Business Review,* vol. November-December, pp. 67-75, 1977.

[39] A. K. Kohli and B. J. Jaworski, "Market Orientation: The Construct, Research Propositions, and Managerial Implications," *Journal of Marketing,* vol. 54, pp. 1-18, 1990.

[40] B. J. Jaworski and A. K. Kohli, "Market Orientation: Antecedents and Consequences," *Journal of Marketing,* vol. 57, pp. 53-70, 1993.

[41] N. A. Morgan, R. J. Slotegraaf, and D. W. Vorhies, "Linking marketing capabilities with profit growth," *International Journal of Research in Marketing,* vol. 26, pp. 284-293, 2009.

[42] C. B. Jarvis, S. B. MacKenzie, and P. M. Podsakoff, "A critical review of construct indicators and measurement model misspecification in marketing and consumer research," *Journal of consumer research,* vol. 30, pp. 199-218, 2003.

[43] A. K. Kohli, B. J. Jaworski, and A. Kumar, "MARKOR: A Measure of Market Orientation," *Journal of Marketing Research,* vol. 30, pp. 467-477, 1993.

[44] J. C. Narver and S. F. Slater, "The Effect of a Market Orientation on Business Profitability," *Journal of Marketing,* vol. 54, pp. 20-35, 1990.

[45] D. W. Vorhies, R. E. Morgan, and C. W. Autry, "Product-market strategy and the marketing capabilities of the firm: impact on market effectiveness and cash flow performance," *Strategic Management Journal,* vol. 30, pp. 1310-1334, 2009.

[46] H. Liu, W. Ke, K. K. Wei, J. Gu, and H. Chen, "The role of institutional pressures and organizational culture in the firm's intention to adopt internet-enabled supply chain management systems," *Journal of Operations Management,* vol. 28, pp. 372-384, 2010.

[47] H. H. Teo, K. K. Wei, and I. Benbasat, "Predicting intention to adopt interganizaitonal linkages: an institutional perspective " *MIS Quarterly,* vol. 27, pp. 19-49, 2003.

[48] J. S. Armstron and T. S. Overton, "Estimating Nonresponse Bias in Mail Surveys," *JMR, Journal of Marketing Research (pre-1986),* vol. 14, p. 396, Aug 1977 1977.

[49] L. Cronbach, "Coefficient alpha and the internal structure of tests," *Psychometrika,* vol. 16, pp. 297-334, 1951.

[50] J. C. Nunnally and I. H. Bernstein, *Psychometric theory*, 3 ed. New York: McGraw-Hill, 1994.

[51] D. V. Cicchetti, K. Koenig, A. Klin, F. R. Volkmar, R. Paul, and S. Sparrow, "From Bayes through marginal utility to effect sizes: a guide to understanding the clinical and statistical significance of the results of autism research findings," *J Autism Dev Disord,* vol. 41, pp. 168-74, Feb 2011.

[52] D. W. Straub, "Validating instruments in MIS research," *MIS Quarterly,* vol. 13, pp. 147-169, 1989.

[53] D. Campbell, T. and D. Fiske, W., "Convergent and discriminant validation by the multitrait-multimethod matrix," *Psychological Bulletin,* vol. 56, pp. 81-105, 1959.

[54] T. Ravichandran and C. Lertwongsatien, "Effect of Information Systems Resources and Capabilities on Firm Performance: A Resource-Based Perspective," *Journal of Management Information Systems,* vol. 21, pp. 237-276, 2005.

[55] M. Chan, D. Esteve, J. Y. Fourniols, C. Escriba, and E. Campo, "Smart wearable systems: current status and future challenges," *Artif Intell Med,* vol. 56, pp. 137-56, Nov 2012.

[56] B. Chen, X. Wang, Y. Huang, K. Wei, and Q. Wang, "A foot-wearable interface for locomotion mode recognition based on discrete contact force distribution," *Mechatronics,* vol. 32, pp. 12-21, 2015.

[57] A. Gruebler, V. Berenz, and K. Suzuki, "Emotionally Assisted Human–Robot Interaction Using a Wearable Device for Reading Facial Expressions," *Advanced Robotics,* vol. 26, pp. 1143-1159, 2012.

[58] N. Chung, H. Han, and Y. Joun, "Tourists' intention to visit a destination: The role of augmented reality (AR) application for a heritage site," *Computers in Human Behavior,* vol. 50, pp. 588-599, 2015.

[59] S. Meža, Ž. Turk, and M. Dolenc, "Measuring the potential of augmented reality in civil engineering," *Advances in Engineering Software,* vol. 90, pp. 1-10, 2015.

[60] N. Petersen and D. Stricker, "Cognitive Augmented Reality," *Computers & Graphics,* vol. 53, pp. 82-91, 2015.