Effect of Internet of Things on Business Strategy: The Mediating Role of Marketing Intelligence Capability

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Abstract

Innovative developments in Internet of Things (IoT) have invoked tremendous attention from both academics and industries. Studies suggest that IoT not only serves as an innovative tool for enterprise operations but also triggers impacts on business performance. As researchers increasingly raise interests about the business value of IoT, this study examines its direct and indirect managerial effects by investigating the link between IoT and business strategy. Referring to the organizational capability perspective, this study constructed a research framework in which marketing intelligence capability mediates the effect of IoT capability on business strategy formation. An empirical survey was performed and an analysis of the data was conducted to test the hypotheses. The results confirmed the mediating role of marketing intelligence capability in the link between IoT capability and business strategy formation. Discussions with managerial implications are then elaborated.

Keywords: Internet of Things, marketing intelligence, business strategy, organizational capability

1. Introduction

Recent development of the extensive globalization, the meticulousness 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 business strategy are rare in the literature. To fill this gap, this study intent to investigate the link between IoT and business strategy.

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. Therefore, these functional operations have influence on the link between IoT and business strategy. 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 business strategy, and the effect of marketing intelligence in this linkage.

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

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 different types of business strategy, particularly from the perspective of an innovative and market-oriented organization. Therefore, to contribute with a required research framework of IoT and business strategy, this study examines the role of IoT capability further in business strategy formation.

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, or it could be competent in making or using IoT connected products for business benefits, or it could be competent in implementing or operating IoT enabled environments for business value [9, 28].

2.2 Internet of Things and Business Strategy

From the strategic management perspective, cost leadership and differentiation are two important approaches to competitive advantage and basic choices of business strategy [38, 39]. Furthermore, researchers have argued that cost leadership and differentiation are not mutually exclusive, but rather are compatible approaches to dealing with external situations, and a combination of strategies could lead to success in various circumstances [40-42].

Cost leadership strategy requires organizational capabilities to achieve operational efficiency, including time efficiency, cost efficiency and flexibility. The functions of IoT enabled smart factory integrate technologies of many disciplines. IoT capability enables an enterprise to make extensive use of artificial intelligence, simulation, automation, robotics, sensors, data collection systems and networks towards advanced engineering and precision machining. These systems make possible the establishment of efficient, collaborative and sustainable industrial production to achieve cost leadership [43].

Differentiation strategy requires organizational capabilities to achieve product or service uniqueness for higher customer premium. Products or services differentiation are realized through innovation or customization. Sensor-based information collected through IoT embedded products covers actions of customer purchase and use, and can therefore be analyzed to obtain a much more precise and complete picture of the customer's characteristics and of their preferences [44]. Smart laboratories can provide test fields for innovative products and services before delivery to customers. Thus IoT capability could expand opportunities for product or service differentiation, moving competition away from cost alone.

Therefore, the following two hypotheses are proposed:

H1a. IoT capability is positively associated with cost leadership strategy formation.

H1b. IoT capability is positively associated with differentiation strategy formation.

2.3 Internet of Things and Marketing Intelligence

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 [45, 46]. 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, 47].

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].

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.

In summary, we propose the following hypotheses:

H2. IoT capability is positively associated with marketing intelligence capability.

2.4 Marketing Intelligence and Business Strategy

Marketing intelligence is about staying ahead of the competition by gathering information which could be converted to actionable intelligence and which can then be applied to both short and long term strategic planning [48, 49]. Marketing intelligence is considered as a strategic resource that enables a firm to strengthen its opportunity recognition, threat identification and achieve a positional advantage over its competitors [1]. Hence it is related to the firm's business strategy formation.

Marketing intelligence capability enables a firm to acquire and analyze the cost structures and distinctive features of products and services of peers in the marketplace. It helps the firm to determine which market segments are suitable for cost leadership, and which market segments are feasible for differentiation. Marketing intelligence about cost analytics of all levels needs to be collected and accurately analyzed for a firm to maintain a viable leading cost status. Marketing intelligence about customer preferences and distinctive features are required for a firm to determine the need to differentiate its products against the need to keep its cost structure under control in order to offer a distinctive product at a competitive price [50, 51].

Therefore, the following two hypotheses are proposed:

H3a. Marketing intelligence capability is positively associated with cost leadership strategy formation.

H3b. Marketing intelligence capability is positively associated with differentiation strategy formation.

3. Method

3.1 Survey Instrument

The survey instrument was developed using questions derived from the literature on information technology capabilities, marketing capabilities, and Porter's typology of competitive strategies discussed previously. We operationalized the study variables by using multi-item reflective measures on a 7-point scale [52].

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 [45, 53]. 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 [53, 54]. This four-item scale was adapted from Vorhies, et al. [55] and Trainor, et al. [22].

The construct of cost leadership strategy formation was measured using four items that reflect the extent to which a firm forms a cost-oriented strategy. The formation of cost leadership strategy aims at achieving low manufacturing and distribution costs [38, 54, 56]. The third item was the economic scale. A firm can usually lower cost through economies of scale or superior manufacturing processes [11, 38]. Finally, formation of cost leadership is often reflected in lower price of products or services [56, 57].

The construct of differentiation strategy formation was measured using four items that reflect the extent to which a firm forms a differentiation strategy. Differentiation implies being unique or distinct from competitors by providing superior functionality or customized feature within products or services to customers [38, 58]. Extending Porter's business strategy framework, Miller [59] discriminated differentiation strategy based on innovation from that based on intensive marketing [59, 60]. This distinction forms two items included in the construct.

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, as these variables have been noted in several studies to affect deployment of information technologies [61, 62]. 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

CLS:	Cost leadership strategy formation
CLS1:	We provide low cost products or services based on manufacturing efficiency
CLS2:	Our products or services have lower distribution cost than our competitors
CLS3:	We develop and deliver products or services with economy of scale
CLS4:	Our products or services have lower prices than competitors in the market
DFS:	Differentiation strategy formation
DFS1:	We deliver products or services with superior functionality to our competitors
DFS2:	We provide products or services with customized feature to our customers
DFS3:	Our firm differentiates our products or services based on innovation
DFS4:	Our firm differentiates our products or services based on intensive marketing
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 [63]. 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

Our goal was to investigate the impact of a firm’s IoT capability on marketing intelligence capability and business strategy formation, and the possible mediation role of marketing intelligence capability. The empirical results were expected to demonstrate that a firm’s formation of business strategy, such as cost leadership strategy and differentiation strategy, is influenced by IoT capability and marketing intelligence capability. The results were also expected to verify the mediating role of marketing intelligence capability in the link between IoT capability and business strategy formation. Finally, the results were used to test the relationship between IoT capability and marketing intelligence capability.

4.1 Reliability and Validity

The reliability of the survey instrument was tested by using Cronbach's alpha [64] 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 [65] recommended a threshold alpha value of .7. Cicchetti, et al. [66] 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 [67] 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 [65, 66]. 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

CLS	CLS1	4.329	.910	0.951	0.933	0.931
	CLS2	4.375	.863		0.937	0.941
	CLS3	3.988	.729		0.943	0.937
	CLS4	4.724	.990		0.930	0.946
DFS	DFS1	4.675	.962	0.891	0.837	0.911
	DFS2	4.616	1.106		0.859	0.872
	DFS3	4.616	1.039		0.870	0.848
	DFS4	4.787	.959		0.873	0.848

Table 4 presents the results of a factor analysis. A four-factor structure emerged with all predefined indicators loading on to their respective constructs, which thereby affirmed convergent validity and unidimensionality of the constructs. The model explained 80.665% of the variance.

Table 4 Factor analysis

Construct	Item	Factor1	Factor2	Factor3	Factor4
IoT	IoT1	**.842**	.112	.133	.047
	IoT2	**.817**	.086	.130	.246
	IoT3	**.838**	.042	.084	.106
MIC	MIC1	.121	**.781**	.225	.231
	MIC2	.053	**.902**	.157	.180
	MIC3	.051	**.812**	.250	.245
	MIC4	.122	**.853**	.239	.294
CLS	CLS1	.099	.166	**.908**	.189
	CLS2	.168	.306	**.820**	.281
	CLS3	.184	.293	**.819**	.268
	CLS4	.092	.186	**.911**	.214
DFS	DFS1	.139	.252	.257	**.819**
	DFS2	.163	.228	.153	**.831**
	DFS3	.169	.249	.196	**.775**
	DFS4	.064	.249	.386	**.711**

Table 5 summarizes the correlations among different factors. We also assessed discriminant validity on the basis of the construct correlation that Campbell and Fiske [68] proposed. The tests indicated acceptable results with respect to discriminant validity.

Table 5 Construct correlation

Construct	1	2	3	4	5	6	7
1. IoT	1						
2. MIC	0.254**	1					
3. CLS	0.322**	0.532**	1				
4. DFS	0.355**	0.580**	0.576**	1			
5. Industry	0.131	-0.062	0.080	0.046	1		
6. Firm Size	0.150	0.006	0.099	0.055	-0.100	1	
7. IT Size	0.148	0.068	0.148	0.138	-2.790**	0.402**	1

*p < 0.05, **p < 0.01

4.2 Tests of Hypotheses

To test our hypotheses, 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 6 summarizes the test results regarding the parameter estimates and p-values of the hypotheses.

Table 6 Tests results of the hypothesized model

Dependent variable	Explanatory variable				Control variable						
	IoT		MIC		Industry		Firm Size		IT Size		
	Estimate	P-value	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
CLS	0.291	0.000***			0.077	0.278	0.014	0.847	0.120	0.118	0.119
DFS	0.340	0.000***			0.028	0.687	-0.038	0.600	0.111	0.146	0.135
CLS			0.533	0.000***	0.156	0.012	0.058	0.365	0.131	0.050	0.321
DFS			0.579	0.000***	0.119	0.051	0.012	0.845	0.127	0.052	0.360
CLS	0.158	0.012*	0.492	0.000***	0.125	0.052	0.041	0.524	0.109	0.102	0.343
DFS	0.197	0.001**	0.529	0.000***	0.080	0.181	-0.010	0.873	0.099	0.122	0.393

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

The results in Table 6 supported our hypotheses. The direct effects of IoT on CLS and DFS, IoT on MIC, and MIC on CLS and DFS are tested significant. In the links of IoT on CLS of hypothesis H1a and IoT on DFS of hypothesis H1b, in addition to the found direct effects, partial mediation effects of MIC in the links were also found. This indicates that IoT capability influences business strategy formation with a direct effect and through a mediation effect. The test procedure concerning mediation follows the suggestion of Baron and Kenny [69]. We compared the proposed mediation model with an alternative direct effect model without MIC variable. The mediation model explains more variance on CLS ($R^2 = 0.343$) and DFS ($R^2 = 0.393$) than the direct effect model ($R^2 = 0.119$ and $R^2 = 0.135$). The test results show that positive relationships exist between IoT and MIC ($\beta = 0.271$, $p < 0.001$), between MIC and CLS ($\beta = 0.533$, $p < 0.001$), and between MIC and DFS ($\beta = 0.579$, $p < 0.001$). Furthermore, the significant relationships between IoT and CLS ($\beta = 0.291$, $p < 0.001$) and between IoT and DFS ($\beta = 0.340$, $p < 0.001$) in the direct effect model is greater than those in the mediation model ($\beta = 0.158$, $p < 0.05$ and $\beta = 0.197$, $p < 0.01$). Taking into account these results as a whole, we thus conclude that the effect of IoT capability on business strategy formation is partially mediated by marketing intelligence capability [69]. The effects of paths are summarized in Table 7.

Table 7 Effects of paths in the hypothesized model

Hypothesis	path	Effect from test results
H1a	IoT → CLS	Direct effect supported Partial mediation of MIC supported
H1b	IoT → DFS	Direct effect supported Partial mediation of MIC supported
H2	IoT → MIC	Direct effect supported
H3a	MIC → CLS	Direct effect supported
H3b	MIC → DFS	Direct effect supported

5. Discussion

This study investigated the impact of a firm's IoT capability on business strategy formation, and tested the possible mediating role of marketing intelligence capability. By supporting the research hypotheses, this study could be directed toward helping managers and practitioners realize the links between organizational capabilities and business strategy formation.

First, the cultivation of organizational capabilities, in general, is expected to enhance an organization's business strategies and further elevate its competitive advantage [1, 3, 70]. This study substantiates the positive correlation between a firm's organizational capabilities and business strategy formation. In particular, our results support the positive correlations between two different organizational capabilities and the formation of two types of business strategies. The findings demonstrate that both IoT capability and marketing intelligence capability have positive effects on the formation of both cost leadership strategy and differentiation strategy, which could further lead to competitive advantage [11, 38]. Therefore, the study serves to inform business managers that firms should do more than just invest in innovative technologies or marketing operations. They need to identify and build distinctive capabilities and put them in productive use. This study suggests that both IoT capability and marketing intelligence capability are worthy of attention in this regards. The findings that these capabilities may impact business strategy formation indicate that their influence on a firm are cross-functional and may transcend managerial hierarchy.

Second, this study identifies a mediator in the association between IoT and business strategy. While IoT capability is shown to positively influence business strategy formation, our findings also point out that the link between IoT capability and business strategy formation is partially mediated by marketing intelligence capability. Our study is unique that it explores the link between IoT capability and marketing intelligence capability, and reveals the mediating role of marketing intelligence capability on the relationship between IoT capability and business strategy formation. For the partial mediation to be established, both of the links between IoT capability and marketing intelligence capability and between marketing intelligence capability and business strategy formation need to be significant, and the influence of IoT capability on business strategy formation is alleviated with the presence of marketing intelligence capability [69]. That is, in addition to the direct effect of IoT capability on business strategy formation, there is also an indirect effect through marketing intelligence capability. These two effects contribute to the total effect of IoT capability on business strategy formation. From the literature contribution perspective, few of the extant literature refer to what happens to the inside of a firm when IoT is introduced. Furthermore, 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 and marketing function together on business strategy through the mediating role of marketing intelligence. Our findings support not only the marketing orientation concept of Jaworski and Kohli [46], 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.

Finally, our findings indicate the similar effects of organizational capabilities on the two types of business strategies. Both cost leadership strategy formation and differentiation strategy formation are positively influenced by IoT capability and marketing intelligence capability. This demonstrates that IoT capability and marketing intelligence capability are both enabling capabilities for business strategy formation, regardless of the strategy typology. 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. Furthermore, IoT capability and marketing intelligence capability may facilitate firms to identify opportunities for improvement and novel solutions. One of the opportunities is to explore the feasibility of mass customization, which may achieve cost leadership and differentiation simultaneously [71, 72].

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