

EXAMINING THE EFFECTS OF THE INTERNET OF THINGS (IOT) ON E-COMMERCE: ALIBABA CASE STUDY

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ABSTRACT

The Internet of Things (IoT) connects billions of things far beyond our imaginations. These internet-connected objects communicate with each other and share information, thereby nurturing business model innovation in various industries, notably including e-commerce. The IoT links objects that are offline in the current e-commerce business model, and generates an unprecedented amount of data on their status, product performance, and consumer behavior and preferences. Centralized IoT platforms hosted by e-commerce firms are continuously transforming this data into knowledge, generating a huge impact on e-commerce. In this paper, we review the conception of the IoT, the e-commerce road map, and the key elements of the e-commerce business model. We then study the case of Chinese e-commerce giant Alibaba's IoT initiatives, and finally discuss how the IoT will transform e-commerce. We conclude that the IoT will not only create new value and catalyze innovation, but also transform e-commerce firms into information-flow intermediaries and knowledge generators. We also conclude that the IoT ecosystem will achieve economies of scale in industries other than e-commerce, and that the IoT will create new cross-industry market opportunities and competitive advantage.

Keywords: Internet of Things (IoT), Internet of Everything, e-commerce, business model, innovation, smart device, information sharing, big data analytics, cloud computing, Alibaba

INTRODUCTION

The Internet of Things (IoT), also called the Internet of Everything, became popular in the 2010s and in recent years has attracted the attention of both scholars and business decision-makers. The IoT connects billions of objects, such as buildings, air conditioners, coffee machines, washers, cars, animals and even people. The IoT connects things and people on an unprecedented scale; Cisco predicts that, although so far in 2015 more than 99% of things in the physical world are not connected, by 2020 the number of internet-connected devices and objects will reach 50 billion [9]. These internet-connected things communicate with each other and share information, nurturing business model innovation in various industries. The e-commerce sector is certainly not excluded from the IoT boom. The IoT connects objects that are offline in the current e-commerce business model, and generates an unprecedented amount of data on their status, product performance and consumer behavior and preferences. Centralized IoT platforms hosted by e-commerce firms are continuously transforming this data into knowledge, generating a huge impact on e-commerce.

THE INTERNET OF THINGS

The arrival of the IoT in the mid-1990s was not the outcome of thorough, innovative research, but resulted from an innovative idea aimed at solving a practical business problem through the use of readily available technology. In the mid-1990s, Kevin Ashton, the father of the term "Internet of Things," was a brand manager at Procter & Gamble (P&G) London. When he visited P&G's cosmetic retail stores, he found that one type of lipstick always appeared to be out of stock. This was a paradox, because, although P&G's inventory system showed that a lot of the lipstick was in the retail stores' warehouses, no one could find it. About the same time, Ashton met a manufacturer of a tiny radio-featured chip, an early implementation of the radio frequency identification ("RFID") chip. Ashton had the idea of attaching the tiny chips to products, thereby allowing sales staff to identify both the presence and precise location of an item in inventory by using a wireless RFID reader. P&G sponsored Ashton in establishing a research center, the Auto-ID Center, to explore how the RFID technology might enhance inventory management. In one of his P&G presentations in 1999, Ashton coined the term "Internet of Things" [20].

The Global Standards Initiative on Internet of Things (IoT-GSI) defines the Internet of Things as a global information infrastructure for the information society, in which physical and virtual "things" are uniquely identified and connected to the internet [12]. There is no doubt that the wired or wireless internet is a key element in the IoT infrastructure. Other elements that uniquely identify an object and connect it to the internet are also necessary, elements including sensors, RFID tags and network

adaptors. Applications (software) controlling this physical hardware are also indispensable. Connected objects continuously generate great amounts of data, thus calling for technologies such as mass data storage, big data analytics and cloud computing to transform data into knowledge and create value for both businesses and customers.

The IoT will generate huge amounts of data from internet-connected devices. Seagate Technology predicts that, by 2025, the IoT will generate more than 20 trillion gigabytes of data [22]. So far, in 2015, the IoT has penetrated a variety of industries, such as retailing, manufacturing, healthcare, insurance, home appliances, heavy equipment, airlines and logistics [17]. Three categories of practical IoT enterprise applications enhance customer value: monitoring and control; big data and business analytics; and information sharing and collaboration [17]. McKinsey predicts that, by 2025, the IoT will have a huge potential economic impact and that its potential annual economic value will reach as high as US\$11.1 trillion [18].

THE E-COMMERCE ROAD MAP

Kenneth Laudon and Carol Traver in their latest book, *E-commerce 2015: business. technology. society.* define e-commerce as commercial transactions conducted over the internet, using websites and mobile applications to facilitate such transactions among manufacturers, merchants, retailers and customers [16]. E-commerce firms thereby provide customer value and generate revenue and profits. Laudon and Traver also summarize three e-commerce developmental phases in the past twenty years: the invention of retail e-commerce from 1995 to 2000; the retail and services e-commerce consolidation period from 2000 to 2007; and the reinvention of e-commerce for retail, services and content between 2007 and 2015 [16]. Currently, there are five different types of e-commerce: B2C e-commerce, B2B e-commerce, C2C e-commerce, mobile e-commerce and social e-commerce [16]. The major e-commerce trends in 2014 and in 2015 are mobile and social e-commerce; mobile e-commerce platforms and social networks that provide search, advertising and payment services will create another e-commerce revolution [16]. Acting as online marketplaces, e-commerce websites and mobile applications that facilitate online commercial transactions allow manufacturers, merchants, retailers and service and content providers to list their products, services or content online. By visiting e-commerce websites or using mobile applications, customers can choose these products, services and content, place orders, and make online payments. The products, services and content will then be delivered to customers through delivery services or electronically, thus ending a typical e-commerce process.

Although the IoT has been developing rapidly in recent years, particularly in 2014 and 2015, the impact of the IoT on e-commerce receives limited discussion in research. This paper aims to fill this research gap.

E-COMMERCE BUSINESS MODEL

A business model is a series of planned activities aimed to create profit for an organization in a marketplace. This being the case, an e-commerce business model is one that aims to use and leverage the unique characteristics of the internet and the World Wide Web [16]. A successful business model, in both e-commerce and other areas, must effectively address eight key elements: value proposition, revenue model, market opportunity, market strategy, competitive environment, competitive advantage, organizational development and management team [16].

Table 1. Key elements of an e-commerce business model

Element	Description
Value Proposition	How a company's products or services fulfill its customers' requirements [14].
Revenue Model	How a company generates revenue and creates profit.
Market Opportunity	The marketplace that a company intends to enter, as well as the company's potential financial opportunities in that marketplace. Many small market segments constitute a marketplace.
Market Strategy	How a company plans to enter a new marketplace and attract new customers.
Competitive Environment	Potential new entrants or other companies that offer similar products or services in the same marketplace.
Competitive Advantage	A company offers superior products or services at a lower price than its competitors do [23].
Organizational Development	How a company organizes its work in a targeted, goal-oriented manner.
Management Team	Leaders of a company's business unit, responsible for the business model.

Source: Adapted from Laudon, K.C. and Traver, C.G. *E-commerce 2015: business. technology. society.*, 11th edition, pp58-68, Pearson [16].

ALIBABA AND ITS CLOUD COMPUTING ARM

Believing the internet would enable small companies to compete more effectively in domestic and global marketplaces by leveraging innovation and technology, Jack Ma established the Alibaba Group in 1999, when e-commerce, in the form of online retail, was being invented in China [1]. Sixteen years later, Alibaba Group operates a variety of businesses, including online marketplaces, online marketing, cloud computing and big data analytics, financial services for small enterprises and consumers, and logistical information services [1].

Table 2. The Businesses of Alibaba Group

Business	Description
Taobao.com	The largest online shopping marketplace in China.
Tmall.com	The largest online shopping platform for brands and retailers in China.
Juhuasuan.com	A popular Chinese group-buying marketplace.
AliExpress	A global marketplace for international customers.
Alibaba.com	A leading online platform for global wholesale trade.
1688.com	A leading online platform for wholesale trade in China.
Alimama.com	A leading online marketing technology provider.
Aliyun.com (AliCloud)	A cloud computing and big data analytics provider.
Ant Financial	A provider of financial services for small enterprises and consumers.
Cainiao	A logistical information services provider.

Source: Adapted from "About Us", Alibaba Group [1]

Founded in 2009, AliCloud (Aliyun.com) provides highly scalable cloud computing and data management services. It runs the network that supports Alibaba Group's online and mobile e-commerce ecosystem, and helps third parties to participate in this ecosystem [1]. AliCloud also acts as the basic infrastructure for Alibaba's IoT initiatives. In July 2015, Alibaba invested US\$1 billion to improve its cloud computing services, aiming to compete with Amazon in e-commerce services [26]. In August 2015, Alibaba established its first international cloud computing headquarters in Singapore, expanding its cloud computing services from China to overseas [27].

ALIBABA'S IOT INITIATIVES

Alibaba started its IoT initiatives as early as 2014. It partnered both with appliance makers, such as Midea and Royal Philips, and with the automotive manufacturer SAIC Motor. It also launched open IoT platforms. In 2015, Alibaba established two business units to facilitate the adoption of the IoT in e-commerce, moving forward toward new business opportunities generated by the booming IoT development trend.

Building an Open IoT Platform in China with Midea

In March 2014, Alibaba signed a strategic cooperation agreement with Midea, a leading Chinese electrical appliance maker, initiating this Chinese e-commerce giant's IoT trials. Under this agreement, Alibaba and Midea would jointly build an open IoT platform in China, based on AliCloud [25]. This newly-established platform would enable electrical appliances to connect to the internet, route communications, and allow users to control the appliances remotely and receive operational reports through applications installed on their mobile devices. At the same time, Midea launched its first "smart" air conditioner, which embedded a network adaptor, making it an internet-connected smart device. Midea selected Tmall, Alibaba's B2C e-commerce platform, as the sole distributor of its smart air conditioner. In the launch ceremony, Midea announced that in the coming three years more than 50% of its air conditioners it made would be connected [25].

In practice, customers could send instructions to an air conditioner to start or shut down, or adjust temperature settings by using a Midea mobile application installed on their mobile phones. In the meantime, air conditioners could record operational data such as elapsed time, utility usage, fine particulate matter (PM2.5), temperature and humidity, and transmit this data to the open IoT platform hosted by AliCloud. Customers could then check operational reports through the Midea mobile application at any time.

Customers could also use Alibaba's mobile chat application Laiwang, which means "association with friends," which was launched in April 2014, to control the air conditioners. In the future, Laiwang would enable manufacturers to diagnose their products remotely and provide after-sales services. It would also allow customers to communicate in real time with customer service representatives, ask for technical support, make maintenance appointments and pay for services via Alipay, Alibaba's on-line payment platform [see Appendix 1 for the open IoT Platform jointly built by Alibaba and Midea].

Mr. Wenxin Wu, President of Household Air Conditioning at Midea, stated that this corporate strategy would be implemented in three phases: formulating a unified communications standard for IoT products and applications; achieving data-based operations allowing manufactures to conduct product enhancement and new product design by reviewing customer-behavior data and forming a complete industry supply chain for smart living by centralizing data, thus providing value-added services and changing the traditional home appliance industry's business model [24]. Mr. Jian Wang, CTO of Alibaba, said that strategic cooperation between Alibaba and Midea would accelerate the adoption of AliCloud computing services and of the IoT in electronic appliances. This would have a huge impact on the Chinese home appliance makers and even the entire Chinese manufacturing industries, transforming traditional home appliance manufactures into smart home appliance makers [21].

In the future, Alibaba and Midea would open their unified communications standard and provide an application programming interface (API) for third-party applications. This would create a huge, open IoT platform, connecting billions of devices and providing data storage and analytics services.

An IoT Platform for Start-Up Businesses

In June 2014, Alibaba launched its IoT platform for start-up businesses, a platform aimed at lowering the barriers for entrepreneurs wishing to start smart hardware businesses [2]. The newly established IoT platform would integrate Alibaba's marketing resources, cloud computing, big data analytics, information security solutions and other technologies to reduce smart-hardware manufacturing costs, accelerating IoT industry development. The IoT Platform for Start-Up Businesses included five elements: the Taoxiang sharing and marketing platform, a cloud computing platform, a developer platform, a data platform and an interconnection platform [3]. By providing this basic IoT infrastructure, Alibaba permitted its business partners to concentrate on business innovation, and allowed these innovations to reach targeted customers more quickly [3].

The Taoxiang platform provided business partners with marketing and promotion channels on Alibaba's e-commerce platforms, such as Taobao and Tmall. This created a community allowing customers to communicate with manufacturers, understand smart products, and become involved in product design. The cloud computing platform, with its powerful computing capabilities, provided a cloud server, a server load-balancing service and an open data-processing service. The developer platform offered a variety of smart application solutions aimed at reducing software development costs and transforming ideas into products more efficiently and effectively. The data platform provided a centralized user login service through Taobao accounts, as well as big data analytics support. The interconnection platform connected supply chains, developers, manufacturers, merchants and customers [3].

Developing Internet-Connected Cars with SAIC

In July 2014, Alibaba reached an agreement with the Shanghai Automotive Industry Corporation (SAIC), a Fortune Global 100 company and Chinese state-owned automotive manufacturer, to develop internet-connected cars [5]. The new cars would include such elements as the Aliyun (AliCloud) operating system, Alibaba's online music service platform (Xiami), an automatic navigation system and AliCloud computing services. The preliminary idea was to connect cars to the internet, allowing drivers and passengers to use Alibaba's online services, such as online digital entertainment, maps and navigation, news and financial information. The project's long-term goal was to construct a network linking tens of thousands cars to an integrated system that enabled information-sharing among cars, drivers and other users of the road, enhancing traffic management and even achieving auto-pilot driving [see Appendix 2 for the integrated IoT platform for cars] [6]. SAIC envisioned that this project was cross-industry integration in the era of the internet economy. These internet-connected cars were expected to be introduced into the market in August 2016.

Hosting Philips' IoT Platform in China

In October 2014, Royal Philips, the Dutch electronics manufacturer, announced that it made an agreement with Alibaba to use AliCloud to host its IoT platform in China for healthcare and "smart" products [7]. AliCloud would provide data communications, data storage, data security, and big data analytics services for Philips' new IoT devices by providing a wireless communication infrastructure. In the same month, Philips introduced its first HealthSuite device into China. The device, called the Philips Smart Air Purifier, and its mobile application were connected to AliCloud. The smart air purifier could monitor indoor air quality with an internal sensor. When the sensor found that air quality had reached unhealthy levels, it would send an instant message to AliCloud. AliCloud would then send a real-time alert message to the customer's mobile devices [see Appendix 3 for Philips' IoT platform in China].

As was the case with Amazon's Dash Replenishment Service, which could automatically make online refill orders for laundry detergent, coffee and ink cartridges, the Philips air purifier would know when a filter would fail and send "right-time" replacement requests to its customers. On the other hand, Philips could acquire operational data on its products, automatically gathered by the air purifiers and sent to AliCloud. AliCloud could help Philips transform this data into knowledge to be used for product improvements and energy efficiency enhancement.

Another product that Philips would like to introduce to the Chinese market in the future is internet-connected LED lighting [8]. Global urbanization has accelerated the demand for more lighting and therefore energy, pushing the requirements for energy-efficient lighting solutions [8]. Comprised of IoT components such as a wireless-network adaptor, sensor and controller, a connected light could automatically manage its energy efficiency or be controlled remotely by an application or in a control center. In fact, Philips had already introduced intelligent street lighting solutions in Europe and the US.

Mr. Patrick Kung, CEO of Philips's Greater China Operations, said that China was the company's second-largest market, and that the strategy that connected Philips' smart products with the AliCloud ecosystem would create major innovations in mobile connectivity, cloud computing, and big data analytics [7]. Mr. Jian Wang, Alibaba CTO, commented that new technologies would make Philips's internet-connected devices smart, enabling users to enjoy a more convenient and smarter life [8].

A 2015 IoT Milestone

In April 2015, Alibaba announced that it had established two new business divisions, the automotive business unit and the "smart living" business unit, representing a milestone for Alibaba's IoT initiatives [10]. AliCloud will power these new business divisions and their IoT initiatives.

The automotive business unit will take the advantage of Alibaba's big data on customers, including online purchasing history and product preferences. Alibaba would conduct big data analysis and provide financing services and marketing support to car manufacturers and dealers. Alibaba will allow car manufacturers and dealers to upload their catalogues to its e-commerce platform, Tmall, and offer financing deals to potential customers, creating an innovative model for generating revenue. By April 2015, Alibaba had partnered with around 50 car manufactures, including BMW, Toyota and Volkswagen, and with more than 10,000 car dealers and 20,000 car service providers in China [11]. SAIC said it would invest US\$161 million to jointly develop internet-connected cars with Alibaba [10]. At the same time, Alibaba's Tmall would use knowledge gleaned from big data analytics and cloud computing to match buyers and dealers, recommend the right cars to the right buyers and provide loans to people purchasing cars.

The "smart living" business unit will integrate Taobao's and Tmall's electronic appliance sections to create a new smart home-appliance category. The new e-commerce platform will allow small businesses to raise capital online. It will also allow manufacturers and merchants to promote and sell products with built-in internet components. In addition, Alibaba will continue to provide cloud computing and data analytics services to customers, merchants and manufacturers after the completion of online purchases, expanding its business scope beyond that of current e-commerce firms.

DISCUSSION

Retailers will still sell, but as web-connected products generate a wealth of information about consumers, online merchants will want to rethink their role beyond the transaction. This is not e-commerce in the way a lot of people think about it now.... This is about building a very intelligent relationship with consumers [19].

- James McQuivey, Vice President, Forrester Research

We apply the key elements of the e-commerce business model [16] to discuss how the IoT will transform current e-commerce, utilizing the case study of Alibaba's IoT initiatives.

Value Proposition

In the current e-commerce business model, e-commerce firms fulfill customer requirements by providing personalized recommendations and customizations based on online purchasing history and preferences, reducing search and price discovery costs, and facilitating online transactions [4, 13]. For example, Amazon's online shopping platform, which functions as an online marketplace, and Kindle, which delivers e-books instantly, allow customers to choose products and services online conveniently, any time and any place, as long as their computers, mobile phones or tablets are connected to the internet, thereby providing unparalleled selection and convenience [16].

By linking things that are offline in the current e-commerce business model, such as manufacturers, customers, and products and services, the IoT will extend e-commerce far beyond the current online shopping-platform concept, and will create new customer

value, such as more convenient and smarter living and highly personalized products and services. The IoT will also make sophisticated information-sharing among manufacturers, e-commerce firms, customers, and products and services possible. Unlike current e-commerce business transactions, which end when products or services are delivered to customers, IoT e-commerce enables Alibaba to continue to provide information sharing, cloud computing and knowledge transformation services after completion of an online purchase, thus creating value for both end users and manufacturers.

The innovative Midea smart air conditioner and Royal Philips smart air purifier, both connected to the internet and AliCloud platform, allow customers to control the devices remotely and receive real-time alerts and operational reports. These smart devices also allow manufacturers to conduct remote product diagnoses and provide after-sales services. Thus, home appliance manufacturers create customer value for end users around convenience, safety, and smarter living, while Alibaba creates customer value for manufacturers around efficiency and effectiveness of after-sales service and product improvement. Similarly, internet-connected cars create customer value by allowing drivers and passengers to enjoy Alibaba's online digital entertainment, navigation, news and information services. At the same time, manufacturers can design and make highly personalized products for customers based on product operational data, as well as data on customer preferences and behavior. Manufacturers can even invite customers to join the product design process.

Alibaba's services, which match buyers and merchants and provide financing services and manufacturer marketing support, coupled with its open IoT platforms, allow existing manufacturers and start-ups to innovate and exploit IoT's prospective business opportunities. Thus, the economies of scale of IoT e-commerce are huge and not limited to the e-commerce sector alone. As Alibaba's CTO said, adoption of IoT in electronic appliances will affect the home appliance makers and even the entire Chinese manufacturing industry, transforming manufacturers' current business models. The software industry, which designs operating systems and applications, will definitely benefit as well.

Revenue Model

In the current e-commerce model, revenues are generally generated from advertising (e.g., Yahoo and Google), content subscriptions (e.g., *Wall Street Journal* and *Financial Times*), transaction services (e.g., eBay), sales (e.g., Amazon and Best Buy) and referral services (e.g., MyPoints and MoneyBack) [16].

To capitalize on IoT business opportunities, e-commerce firms will transform themselves from commodity-flow intermediaries to information-flow intermediaries. Their businesses will expand from facilitating online transactions to transforming shared information into knowledge with practical applications.

Alibaba's AliCloud hosts IoT platforms for manufacturers such as Midea, Philips and other firms, facilitates the connection of things and information sharing, conducts big data analytics and cloud computing, and converts data into knowledge. All these new service offerings create additional revenue streams for Alibaba that did not exist in the current e-commerce business model. In addition, Alibaba's two newly established business units, automotive and "smart living," provide financing deals to car manufacturers and consumers, and allow small businesses to raise capital online. Alibaba will receive revenue from such innovative services that could not have been imagined within the current e-commerce scenario.

Market Opportunity and Market Strategy

In the current e-commerce business model, companies promote their products and services through online advertising and cross-selling. Companies also invite current or potential customers to share information about existing products and services and about customer experiences. For example, Twitter and YouTube encourage users to post content and share information on the websites for free, and these users thereby conduct social network marketing for Twitter and YouTube [16].

Alibaba allows its business partners, such as manufacturers, information and communications technology (ICT) companies, and small businesses with limited IoT capability, to jointly build and utilize its open IoT platforms, which constitute an integrated IoT ecosystem. Alibaba, through its IoT ecosystem, gathers and stores big data on customer preferences and behavior, and encourages customers to join product design and marketing processes. Thus, the aims of marketing are not only to promote existing products and services, but also to invite customers to improve, as well as jointly create, innovative and more highly personalized products and services. Customers will enjoy the products and services they jointly design more, thereby enhancing marketing effectiveness.

Competitive Environment and Competitive Advantage

In the current e-commerce business model, e-commerce companies can leverage their existing experiences to create new competitive advantage. For example, Amazon established its online grocery business by leveraging its huge customer database and years of experience in e-commerce [16]. Customers can choose products and services from a certain e-commerce website or other websites that provide similar or identical products and services. In this scenario, superior products and services and lower prices make for competitive advantage [23].

As is the case with Amazon, Alibaba could, when moving into the IoT market, leverage its enormous customer database, including credit data and customer preferences and browsing behavior, its AliCloud capability, its huge merchant networks and multiple e-commerce marketplaces, and its sixteen years of e-commerce operational experience. Alibaba could generate competitive advantages by using its integrated IoT ecosystem, thus establishing standards and creating valuable knowledge. On the other hand, smart devices could notify end users to reorder complementary items at the right time, before existing items run out, or automatically make orders online, thus reducing fierce manufacturer competition for repeat buying.

Organizational Development and Management Team

Organizational development and management team are as important as the other elements in evaluating a business model) [15, 16]. The two newly established Alibaba business units, automotive and “smart living,” integrate resources, accelerate Alibaba’s IoT adoption and create a milestone for the Chinese e-commerce giant’s IoT initiatives. An examination of how Alibaba manipulates these two elements when designing and implementing IoT initiatives requires further information from company interviews.

We summarize Alibaba’s case in table 3. In this table, we examine Alibaba’s innovative IoT practices and applications in 2014 and 2015 and their impact. These innovative IoT practices and applications include Alibaba and Midea’s open IoT platform for home appliances, Alibaba’s open IoT platforms for start-up businesses, Alibaba and SAIC’s internet-connected car planning, Philips’s AliCloud-hosted IoT platform in China, and Alibaba’s 2015 IoT milestone. We divide Alibaba’s innovative IoT practices and applications and their impact into five groups, based on the e-commerce business model [16], to address how Alibaba’s IoT initiatives create value, generate revenue, create market opportunities, achieve competitive advantage, and boost organizational development.

Table 3. The Case of Alibaba

Element	The Case of Alibaba
Value Proposition	<ul style="list-style-type: none"> • Create customer value for end users around convenience, safety and smarter living. • Create customer value for manufacturers around efficiency and effectiveness of after-sales service and product improvement. • Facilitate information sharing and create knowledge. • Create business opportunities for start-up IoT businesses. • Generate economies of scale for other industries, such as the manufacturing and software industries.
Revenue Model	<ul style="list-style-type: none"> • Alibaba receives revenue from IoT platform hosting, big data analytics, cloud computing, knowledge transformation and online capital-raising services. • Manufacturers and small businesses receive revenue by raising capital online.
Market Opportunity Market Strategy	<ul style="list-style-type: none"> • Jointly build open IoT platforms with manufacturers (IoT ecosystem). • Connect customers and manufacturers, and push customer participation in product design and marketing, enhancing marketing effectiveness.
Competitive Environment Competitive Advantage	<ul style="list-style-type: none"> • Establish standards and provide valuable knowledge generated by its integrated IoT ecosystem. • Reduce fierce competition among manufacturers in the marketplace through automatic repeat buying.
Organizational Development Management Team	<ul style="list-style-type: none"> • In April 2015, Alibaba established two new business units, automotive and “smart living.”

We summarize how the IoT will transform current e-commerce business in table 4. In this table, we apply the key elements of the e-commerce business model [16] to IoT e-commerce practices and applications. We highlight the effects of the IoT on e-commerce with respect to value proposition, revenue models, marketing, and competitive advantage. We also highlight the differences between current and IoT e-commerce business models to address how the IoT creates value for end users, manufacturers and small businesses, produces new revenue absent from the current e-commerce scenario, gives rise to market opportunities, enhances marketing effectiveness, and generates new competitive advantage.

Table 4. The summary of how the IoT will transform current e-commerce

Element	Current E-commerce Business Model	IoT E-commerce Business Model
Value Proposition	<p><u>Highlight:</u> The IoT creates new customer value, advances information sharing, and catalyzes innovation.</p> <ul style="list-style-type: none"> Personalized recommendations; reduction of search costs and prices; facilitation of online transactions [4, 13]. Unparalleled selection and convenience [16]. 	<ul style="list-style-type: none"> New customer value, such as more convenient and smarter living, and highly personalized products and services. Sophisticated information-sharing among manufacturers, e-commerce firms, customers, and products and services. Business opportunities for manufacturers and small businesses to innovate and transform their business models. IoT economies of scale in industries other than e-commerce.
Revenue Model	<p><u>Highlight:</u> E-commerce firms will transform themselves into information-flow intermediaries, and their businesses will expand to knowledge generation.</p> <ul style="list-style-type: none"> Advertising, content subscriptions, transaction services, sales, and referral services [16]. 	<ul style="list-style-type: none"> Revenue from facilitation of information flow. Revenue from the generation of knowledge from big data analytics and cloud computing. Revenue from online capital-raising services.
Market Opportunity	<p><u>Highlight:</u> Cross-industry parties jointly build an integrated IoT ecosystem; the IoT will facilitate higher degrees of customer participation.</p>	
Market Strategy	<ul style="list-style-type: none"> Online promotion of and information-sharing on products and services developed by manufacturers. 	<ul style="list-style-type: none"> Construction of integrated IoT ecosystem. Consumers' active involvement in product design and marketing activities.
Competitive Environment	<p><u>Highlight:</u> The IoT will create competitive advantages other than lower prices.</p>	
Competitive Advantage	<ul style="list-style-type: none"> Superior products and services and lower prices [23]. 	<ul style="list-style-type: none"> Competitive advantage generated from integrated IoT ecosystem, standards and valuable knowledge. Reduction of competition through automatic repeat buying.
Organizational Development	Further information is needed to answer the question of whether e-commerce firms, when designing and implementing IoT initiatives, will manipulate these two elements differently than they do in their current e-commerce operations.	
Management Team		

CONCLUSION

The Chinese e-commerce giant Alibaba, as well as Amazon and other e-commerce firms worldwide, made great efforts to exploit potential IoT business opportunities in 2014 and 2015. This trend will continue in the coming years. By linking things that are offline in the current e-commerce business model, the IoT will disrupt the current perception that e-commerce is merely an online shopping platform. The IoT generates an unprecedented amount of data. E-commerce firms jointly build IoT ecosystems with partners in various industries, and are continuously transforming data into valuable knowledge, causing IoT's economies of scale to expand beyond the e-commerce sector.

In this paper, we have applied the key elements of the e-commerce business model to discuss how the IoT will transform current e-commerce by utilizing the case study of Alibaba's IoT initiatives. We conclude that the IoT will not only create new value and catalyze innovation, but also transform e-commerce firms into information-flow intermediaries and knowledge generators. We also conclude that the IoT ecosystem will achieve economies of scale in industries other than e-commerce, and that the IoT will create new cross-industry market opportunities and competitive advantage.

Our paper is one of the first studies on the innovative IoT practices and applications that Alibaba, the largest e-commerce company in the world, implemented in 2014 and 2015. The study compares the current e-commerce business model with the IoT e-commerce business model, systematically addresses the effects of the IoT on e-commerce, and expands the application of the

theoretical e-commerce business model into IoT e-commerce. The study also permits e-commerce firms, manufacturers, small businesses, and start-ups that would like to take part in the IoT boom to refer to Alibaba's IoT initiatives in designing their own IoT strategies and implementation plans, and thereby makes significant contributions to IoT practices.

IoT e-commerce applications are in an initial stage in 2015. Widespread IoT adoption in e-commerce depends on many factors, such as stable ICT infrastructure, data security, customer privacy and trust regarding information sharing. The IoT initiatives of e-commerce firms or manufacturers could be further evaluated by using information system success models. Moreover, e-commerce firms' and consumers' information-security awareness, and consumers' willingness to accept such IoT offers as smart home appliances, smart cars, and other smart living products, are essential to the successful implementation of these IoT initiatives. Future research on these issues is therefore necessary.

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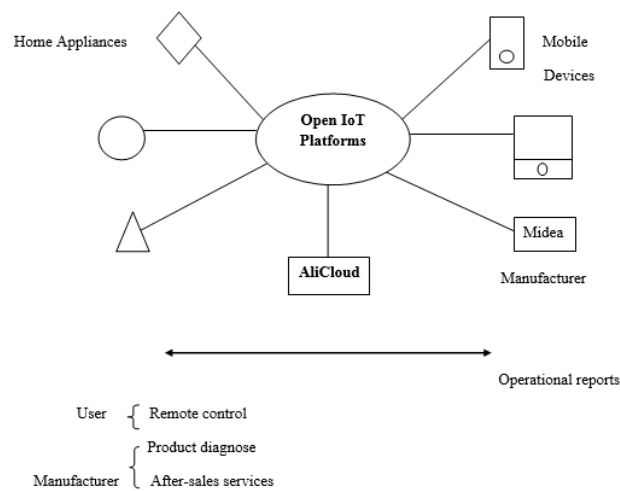
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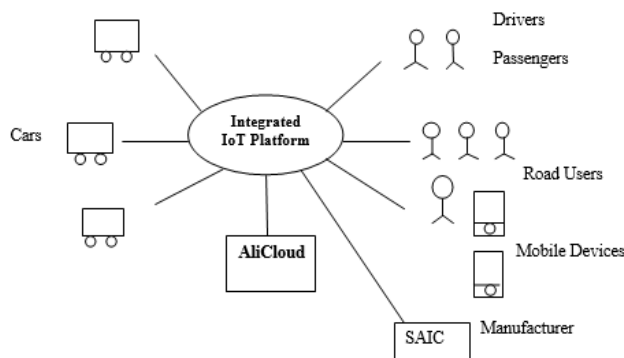
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APPENDIX 1: THE OPEN IOT PLATFORM JOINTLY BUILT BY ALIBABA AND MIDEA



APPENDIX 2: THE INTEGRATED IOT PLATFORM FOR CARS



APPENDIX 3: PHILIPS' IOT PLATFORM IN CHINA

