

# The Role of the Internet of Things (IoT) in Business and Marketing Areas: A Systematic Literature Review Using the Bibliometric Analysis Approach

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## ABSTRACT

The Internet of Things (IoT) is now turning into a global infrastructure that enables sophisticated services by connecting various things (physical and virtual) based on information system technology. This research reveals the role of Internet of Things (IoT) technology in business and marketing. Specifically, this study also profoundly reveals IoT technology to understand various key elements, operational domains, and various cases of applying these technologies in the business and marketing areas. This attempt is to analyze scientific article data quantitatively by using a literature study approach and bibliometric analysis. Based on 1.309 scientific articles taken from the science direct database during the 2011-2020 publishing period, 52 articles have been selected which meet the required screening criteria. Various research questions are presented in this study related to the main entities that need to be investigated more profoundly and require managerial focus when IoT technology is adopted.

**Keywords:** *internet of things (iot), technology, bibliometric analysis, marketing, business.*

## 1. INTRODUCTION

In the last two decades, the Internet of Things (IoT) has become a hot topic of discussion in various fields of life [1], defining objects that can connect and transfer data through the Internet [2]. IoT is a new technology paradigm that aims to connect anything and anyone at anytime and anywhere, giving rise to new innovative applications and services [3]. This technology enables physical devices to connect and exchange data through the Internet by gathering strategic information, thus creating opportunities for companies to be more efficient and responsive to market changes [4,5]. Behind it all, the phrase Internet of Things (IoT) was introduced by Kevin Ashton in a presentation titled Procter & Gamble (P&G) in 1999 [6] to describe Radio Frequency Identification (RFID) technology and other sensors added to other objects. IoT is currently used for network entities connected through all forms of sensors that

allow it to be placed, identified, and operated without human intervention [7].

IoT technology allows everyone, processes, data, and various things to be put together to form a relevant network and have value to transform information into concrete actions that can create new experiences and opportunities for every business person [8]. These opportunities are unprecedented, with technology enabling interaction with 4.5 billion internet users today. These conditions provide a large playing field for businesses to develop new business models to gain wider market share [9].

Today, there are more devices connected to the Internet, sensors, and robots. Not only companies but also individuals get data from IoT devices [10]. The purpose of this study is to answer the following research questions:

RQ1: How is IoT's role in creating business and marketing that is more interactive and smart in interacting with customers?

RQ2: What topics are opportunities for future research based on the results of the bibliometric analysis?

Computer technology, together with network and telecommunications technology, has collaborated to form a more complex network platform connecting humans with humans, humans with machines, and machines to machines [11]. Integration of these technologies in contemporary marketing is critical [12]. This is based on the literature; IoT has significant potential where 51% of the world's top global marketers expect IoT to revolutionize the marketing landscape in 2020 [13]. This is also in line with what was delivered by the Telecommunications Union Institute (ITU) that IoT is a global infrastructure for an information society that can connect anything (physical and virtual) based on existing and developing information that can be operated by information and telecommunications technology [5].

Based on research [14], IoT will continue to develop into technology that is widely regarded as the way of the future and underlie other trends, such as how smart products that are connected will become more widespread [15], automation and connectivity of processes and devices, increasing datafication trends [16], and increasing investments. In the consumer domain, there are many examples of IoT devices that make consumers' lives much simpler and more efficient, for example, the halodoc.com application that can connect consumers with doctors, pharmacies, hospitals, and other health services or how EVO is serving consumers for fitness and health by connecting to consumers' smartphones and capturing data about consumer activities such as steps, exercise, sleep, and stress levels.

**2. METHODS**

This study uses the Systematic Literature Review (SLR) methodology with the stages of using the Prisma framework, namely identification, screening, eligibility, included [17]. To help see the topic that is developing has been widely researched, and topics that receive less attention from other researchers, this study conducted a bibliometric analysis using VosViewer software [18]

**2.1. Identification**

The literature used as a unit of analysis is a scientific article. A search was carried out during May 2020, focusing on the ScienceDirect database plus other searches using the 'literature search' facility in the Mendeley application. The keywords used are IoT AND

“Business OR Marketing”, IoT in “Business OR Marketing”, “IoT” OR “Internet of Things” in “Business OR Marketing”, “IoT” OR “Internet of Things” AND “Business OR Marketing”. With the 2010-2020 publishing year span, the search resulted in 1,166 articles in the ScienceDirect database and 143 articles obtained from the search process through Mendeley, bringing the total to 1,309 articles.

**Table 1.** Distribution of Journal Publication of Scientific Articles

No	Jurnal Publications	SJR	Q category
1	Journal of Neuroscience	3.7	Q1 in neuroscience
2	International Journal of Information Management	2.88	Q1 in artificial Intelligence
3	Industrial Marketing Management	2.08	Q1 in marketing
4	Journal of Cleaner Production	1.89	Q1 in environmental science
5	Journal of Business Research	1.87	Q1 in marketing
6	Technological Forecasting and Social Change	1.82	Q1 in applied psychology
7	Journal of Network and Computer Applications	1.39	Q1 in computer network & communication
8	Future Generation Computer Systems	1.22	Q1 in computer network & communication
9	Journal of Marketing Management	1.16	Q1 in marketing
10	Journal of Business & Industrial Marketing	0.69	Q1 in business & international management
11	Procedia Manufacturing Symmetry	0.52	Q2 in artificial intelligence
12	IFAC – PapersOnline	0.37	Q2 in chemistry
13	International Journal of Distributed Sensor	0.33	Q2 in control & systems engineering
14	Networks Journal of Physics Conference Series	0.32	Q2 in engineering
15	Indian Journal of Marketing	0.23	Q3 in physics and astronomy
16	Material Science Forum	0.21	Q3 in marketing
17	Advances in Intelligent	0.18	Q3 in material science
18	System and Computing	0.18	Q3 in computer science

**2.2. Eligibility**

After checking the abstract carefully, 278 articles were released due to lack of relevance to the theme being studied, bringing the total number of articles considered eligible to be 116 articles

**2.3. Include**

The final step is to read through the entire text of the article. Fifty-two articles are obtained that fit the

research needs. The distribution of these articles based on the year of publication can be seen from Fig. 1

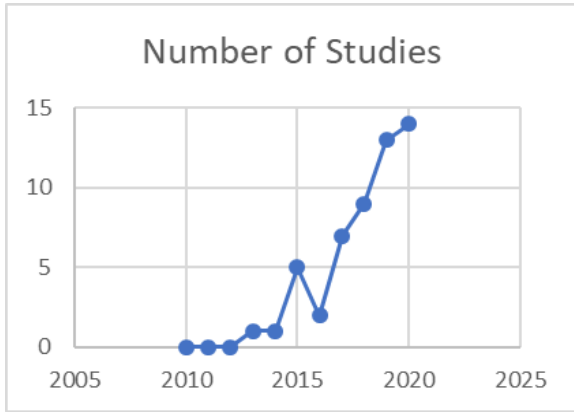


Figure 1. Distribution of articles by year of publication

Overall stages of the PRISMA framework can be seen from Fig. 2 below:

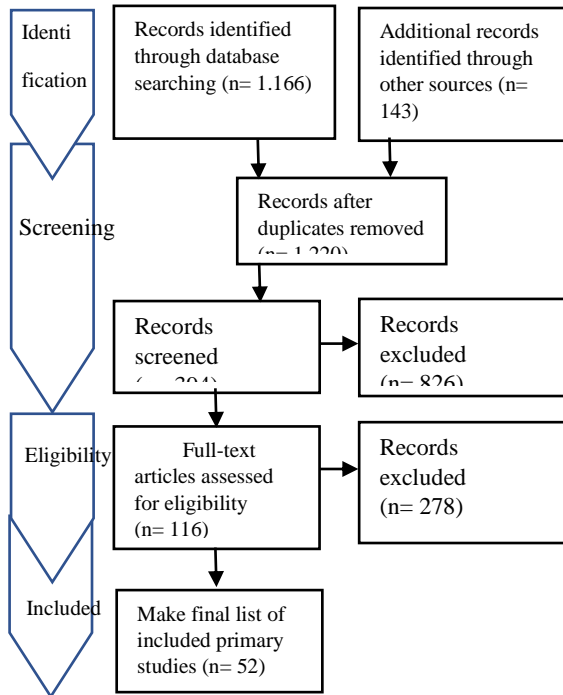


Figure 2. Flow chart of scientific articles

### 3. RESULTS AND DISCUSSION

Broadly the role of IoT in business and marketing with various objectives shows a holistic view of the company to see the reality of business competition that is happening now [10]. Companies compete in utilizing IoT to support business and marketing activities, including customer relationship management (CRM), business intelligence, and product design [19]. Reference [20], to achieve its objectives, at least five IoT technologies are widely used to disseminate

products and services, including 1). Radio Frequency Identification (RFID), 2). Wireless Sensor Network (WSN), 3). Middleware, 4). Cloud Computing, 5). IoT Application Software.

The device mentioned above enables new services for consumers, such as the function of giving a warning or notification of product changes [21], for example how middleware with sensors installed in the washing machine can provide washing regulatory information through the customer's smartphone about how to use the washing machine optimally and saving energy, as well as IoT application software that is embedded in the machine can notify consumers via a smartphone if certain parts require service or replacement [19]. The example shows that smart product connectivity enables companies to form closer relationships with customers and create more interactive business and marketing patterns [22].

Now businesses must be able to read marketing trends that are more focused on social media, where Internet and social networking capabilities are exploited for marketing purposes that are far more interactive [23] and make customers' lives more comfortable [14]. In the long-term perspective, IoT technology can provide different solutions in integrating back end and front end [24]. This trend must be identified as part of a potential corporate marketing strategy in the social media era, where [10] states there are at least six business trends that can be identified: personalization, interaction, integration, analytics, monitoring, and protection.

#### 3.1. The Role of IoT In Business and Marketing

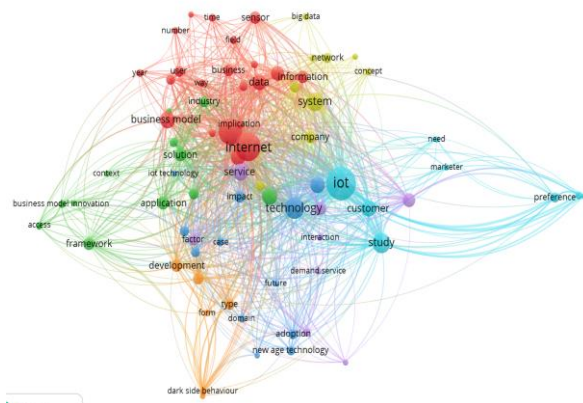
In business and marketing, the potential use to confirm marketing decisions and carry out product campaigns is one of IoT's roles that cannot be ruled out [25]. Participatory marketing through IoT presents evolution through interaction offered to solve business problems [23]. However, it must also be remembered that there is an increasingly greater need for rules that comply with technical measures to ensure that customer rights are protected when they might not realize their potential privacy [26]. Various IoT devices can provide a tremendous amount of data such as location, user movement, health conditions, purchasing preferences, and person's activities which all have a significant impact on privacy issues [20]. On the other hand, IoT technology produces smarter and connected products so that the communication style will be more attentive during the interaction [21]. This impacts the strengthening of the brands of the produced products [27].

To better understand how IoT has a business role, it can also be seen from two perspectives: users' and companies' perspectives [3]. IoT support can create

value, strategy, innovation, design, and security from a company perspective. On the other hand, from the user's perspective, the influence of IoT on products has a significant impact on consumer purchase intentions determined by six characteristics and mediated by customer experience [28], namely: 1). IoT connectivity, the extent to which things are connected, 2). IoT interactivity, related to customer feelings when two-way communication occurs and timely response, 3). IoT Telepresence, customer subjectivity about the extent to which the media represent the physical and social environment, 4). IoT intelligence, thinking ability, accurate recognition function, and correct judgment, 5). IoT convenience, related to the extent to which consumers can save time during planning, purchasing, and using a product, 6). IoT security, the extent to which vulnerable and valuable assets can be protected.

**3.2. Bibliometric Analysis**

After going through the screening process with established requirements, to see what research topics are most likely to go forward, 52 articles will then be analyzed using bibliometric VosViewer software version 1.6.15, released on April 1, 2020. Nees Jan van Eck and Ludo Waltman developed this software at the Leiden University Center for Science and Technology Studies (CWTS) in 2010. Mapping is based on keywords that often appear both found in the article title and abstraction. Visually this mapping is described in the form of network visualization and density visualization. Network visualization mapping can be show fig. 3.

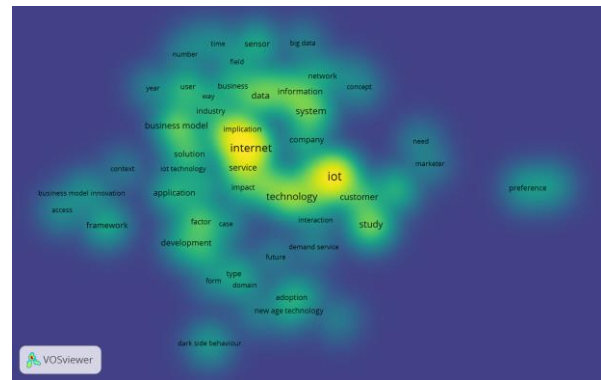


**Figure 3.** Network visualization mapping

In this mapping, the minimum requirements for the appearance of keywords in the article (title and abstract) as many as five times, then obtained 1473 items with 77 items meeting the specified threshold. Figure 3 above shows the mapping is divided into 7 clusters, namely: 1) first cluster :business; business model; data; device; everything; field; implication; information; internet; literature; number; opportunity; organization; person; sensor; things; time; user; year, 2) second cluster : access; addition; analysis; application; business model

innovate; case study; context; framework; frontier market; industry; research; solution; value, 3) third cluster : adoption; case; challenge; domain; firm; future; impact; influence; iot technology; marketing; new age technology; technology, 4) fourth cluster : big data; company; concept; interest; iot device; network; process; product; system, 5) fifth cluster : consumer; demand service; factor; interaction; model; risk; service; smart customer experience, 6) sixth cluster : customer; Indian context; iot; marketer; need; preference; restaurant; study, 7) seventh cluster : approach; dark side; dark side behavior; development; form; type.

Meanwhile, the color difference fig. 4 provides a visual affirmation, where the yellow color indicates the keyword is widely researched and is a topic used as a tendency in research. In contrast, the green color indicates keywords that still rarely appear in research, so it has the opportunity to be research material in the future.



**Figure 4.** Density visualization mapping

From the 7 clusters above, it can be seen the potential of future research based on the connectedness of keywords both in the title and abstract, such as how the connection between IoT technology and business model innovation; framework; development, dark side behavior; demand service; customer preference, marketer; new-age technology adoption; concept; network; big data; and information system.

**4. CONCLUSION**

IoT in business and marketing is essential from the back end to the front end, creating smart products and campaigning for customers. IoT support can create value, strategy, innovation, design, and customer service security from the company side. Meanwhile, from the customer side, IoT is very influential on product purchase intentions.

The still limited research related to the role of IoT in business and marketing provides excellent opportunities for subsequent research, especially exploring the connection of IoT with business model innovation; framework; development, dark side behavior; demand

service; customer preference, marketer; new-age technology adoption; concept; network; big data.

## REFERENCES

- [1] E. Martínez-Caro, J. G. Cegarra-Navarro, A. García-Pérez, and M. Fait, "Healthcare service evolution towards the Internet of Things: An end-user perspective," *Technol. Forecast. Soc. Change*, vol. 136, pp. 268–276, 2018.
- [2] P. T. M. Ly, W.-H. Lai, C.-W. Hsu, and F.-Y. Shih, "Fuzzy AHP analysis of Internet of Things (IoT) in enterprises," *Technol. Forecast. Soc. Change*, vol. 136, pp. 1–13, 2018.
- [3] Y. Lu, S. Papagiannidis, and E. Alamanos, "Internet of Things: A systematic review of the business literature from the user and organisational perspectives," *Technol. Forecast. Soc. Change*, vol. 136, pp. 285–297, 2018.
- [4] F.-Y. Lo and N. Campos, "Blending Internet-of-Things (IoT) solutions into relationship marketing strategies," *Technol. Forecast. Soc. Change*, vol. 137, pp. 10–18, Dec. 2018.
- [5] ITU Corporation, "Internet of Things Global Standards Initiative," *Internet Things Glob. Stand. Initiati.*, vol. 2060, no. July 2015, p. 1, 2015.
- [6] [6] K. Aston, "That 'Internet of Things' Thing," *RFID J.*, pp. 1–20, 2009.
- [7] C. Falkenreck and R. Wagner, "The Internet of Things – Chance and challenge in industrial business relationships," *Ind. Mark. Manag.*, vol. 66, pp. 181–195, 2017.
- [8] B. Abazi, "An approach to the impact of transformation from the traditional use of ICT to the Internet of Things: How smart solutions can transform SMEs," *IFAC-PapersOnLine*, vol. 49, no. 29, pp. 148–151, 2016.
- [9] D. Narasimha Murthy and B. Vijaya Kumar, "Internet of Things (IoT): is IoT a disruptive technology or a disruptive business model?," *Indian J. Mark.*, vol. 45, no. 8, p. 18, Aug. 2015.
- [10] J. Remondes and C. Afonso, "An overview of main IoT trends applied to business and marketing," 2019, pp. 245–264.
- [11] Z. L. Peng and Y. L. Huang, "Research on E-commerce intelligence based on iot and big data," *Appl. Mech. Mater.*, vol. 496–500, pp. 1889–1894, Jan. 2014.
- [12] M. Brady, M. Saren, and N. Tzokas, "Integrating information technology into marketing practice – the IT reality of contemporary marketing practice," *J. Mark. Manag.*, vol. 18, no. 5–6, pp. 555–577, Jun. 2002.
- [13] M. F. S. Rushworth, "Attentional selection and action selection in the ventral and orbital prefrontal cortex," *J. Neurosci.*, vol. 25, no. 50, pp. 11628–11636, Dec. 2005.
- [14] V. Kumar, D. Ramachandran, and B. Kumar, "Influence of new-age technologies on marketing: A research agenda," *J. Bus. Res.*, no. January, Jan. 2020.
- [15] Z. Nicole Mndebele and M. Ramachandran, "IoT based proximity marketing," in *Proceedings of the 2nd International Conference on Internet of Things, Big Data and Security, 2017*, pp. 325–330.
- [16] B. Marr, "Technology Mega Trends That Will Change the World In 2018. Forbes," *Forbes.com*, 2017.
- [17] A. D. Moher D, Liberati A, Tetziaff J, "PRISMA 2009 Checklist PRISMA 2009 Checklist," *PLoS Med.*, vol. 6, pp. 1–2, 2009.
- [18] R. Heersmink, J. van den Hoven, N. J. van Eck, and J. den van Berg, "Bibliometric mapping of computer and information ethics," *Ethics Inf. Technol.*, vol. 13, no. 3, pp. 241–249, 2011.