



# Internet of Things-assisted E-marketing and distribution framework

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## Abstract

Internet of Things (IoT) provides major advantages as it allows for more creativity and competitiveness for E-marketing and distribution. The IoT technologies in digital marketing have virtually no detailed and interconnected view detecting the growth in E-marketing. Many marketing platforms have recognized the drawback to establishing distribution deals with marketing companies. Therefore in this paper, the Internet of things-assisted E-marketing and distribution framework (IoT-EDF) has been proposed to improve the marketing strategies in the different phases of the distribution, procurement, and promotion process E-marketing. IoT-EDF is implemented for customer retention actions and focuses on data that are the strongest sources of information. The IoT offers an unparalleled way to collect data via client support. EDF allows the acceptance of nonprofit e-marketing by nonprofits with soft computing and varies largely from the potential for the preparation of marketing distribution. Moreover, preparation affects the adoption of e-marketing greatly, and adopting capability plays a crucial role in effective acceptance. The results found that top management's concentration on e-marketing contributes to the acceptance of e-marketing. The Internet of things impacts related marketing fields, including goods, place, price, advertising, procedures, and the hard evidence, based upon the findings from the proposed IoT-EDF. The experimental result obtained achieves the highest efficiency rate of 98.56% and satisfaction rate of 97.9%.

**Keywords** Internet of things · E-marketing · Distribution · Soft computing

## 1 Introduction to E-marketing in IoT platform

In terms of economic development, e-marketing plays a very important role and is recognized as one of the key contributors to financial opportunities and job advancement (Hu et al. 2002). E-marketing is a marketing technique that uses the Internet to purchase and sell goods or services (Kadri et al. 2016). E-marketing covers not just online marketing; it handles all types of selling and buying of goods (Farivar et al. 2019). It employs a wide variety of innovations to bind companies to their clients. E-marketing is a mechanism for developing and implementing the delivery, advertising, and pricing of goods in an attempt to promote transactions and fulfill consumer requirements. E-marketing gives consumers more flexibility and

affordable pricing, helping companies to reduce operating costs (Elhoseny et al. 2018).

E-marketing is a method of researching, generating, and providing value digitally to fulfill the target customers' requirements and desires (Kumar et al. 2018). Conventional marketing has been affected by growing Internet usage by encouraging entrepreneurship among companies and changing existing advertising frameworks (Thota et al. 2018). In several sectors, the IoT is used to distribute computers and services that can store, record, or send data continuously (Anand et al. 2020). The questionnaire session circulated to marketing directors inside e-marketing and publicity companies (Bansal et al. 2019). In marketing, IoT has come up with various, new methods that all seek to improve consumer experience and lead them to embrace the product and have a good picture of the brand (Ahmad et al. 2019). In many ways, like IoT is an instance in the marketing sector, electronic equipment called (phones) are based upon notices, advertisements, or alerts to consumers on cell devices (Maram et al. 2019).

One of IoT applications in marketing is that when a user opens his/her location on a mobile phone, IoT sends data for the customer regarding the sale, deals, and discounts in

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the marketing (Hajli et al. 2020). When all the financial dealings concentrate on the efficacy of the marketing strategy in their function, certain components become the object of interest and concern of several big manufacturers pursuing innovation and gaining competitive advantages over their partners (Bohnsack et al. 2020).

Electronic market research is based on basic principles that underlie sales processing (Tolstoy et al. 2020). And various marketing techniques are used to reach optimum performance targets in the components of the electronic marketing strategy to achieve advertising effectiveness. Marketing is an important strategy for business success, the main source of profit-making, in a competitive and dynamic climate (Borchardt et al. 2020). If incorporated correctly, e-markets provide several benefits for both well-established and small companies. This study aims to examine the potential benefits of e-marketing in small businesses (Noorbehbahani et al. 2019). For example, since the advertisement is digital, there is a constant sale (Calvert et al. 2020). Besides, e-marketing audiences are increased because they are not confined to physical meetings with a prospective customer (Vapiwala 2020). Virtual reality (VR) benefit disabled persons in shopping or e-purchase. VR can fool the brain into reusing or rerouting around disused neural connections caused by sickness or damage. The brain can progressively process and fix the harm by mapping the virtual reality gear to represent a disused right hand operating in response to orders received. Wheelchair users may traverse a virtual world, such as a busy street or retail mall, using virtual reality devices.

Furthermore, e-marketing social networks offer good business comments and visibility, while poor comments allow the brand to be rectified (Singh et al. 2020). E-marketing eliminates direct construction expenses and thus is compensated for the cost of goods and services. Besides, e-marketing enables consumers to order their products and stop producing impulses (Çelik et al. 2019). The early adoption of e-commerce and information technology in their sector is due to large multinational institutions; their size often decreased their flexibility concerning evolving consumer trends. The empirical results suggest that a business needs to incorporate its existing mechanism into the economic value to change the e-market effectively.

E-marketing enables businesses to be better established in a larger culture to improve their lives. E-marketing is extremely relevant because it needs a great deal of comfort and data volume in technology. The main contribution of IoT-EDF is described as follows

- IoT-EDF has been proposed to improve the marketing strategies in the different phases of E-marketing's distribution, procurement, and promotion process.

- IoT-EDF is implemented for customer retention actions and focuses on data that are the strongest sources of information. The IoT offers an unparalleled way to collect data via client support.

The remaining article is organized as follows: Sect. 2 comprises various background studies on E-marketing. Section 3 elaborates the proposed IoT-EDF model for improving marketing strategies. Section 4 constitutes the results that validate the performance with its corresponding descriptions. Finally, the conclusion with future perspectives is discussed in Sect. 5.

## 2 Background study on E-marketing

This section discusses several works that various researchers have carried out; Dr. P. S. Aithal et al. (Aithal and Aithal 2019) developed digital service innovation (DSI). DSI is initially defined with different quality characteristics for digital services and several influential works for digital services innovation. The significance of digital technologies that emerged as twenty-first-century innovations, including artificial intelligence and automation, online marketing, and virtual and increased reality, is seen as a potential advancement. Digital technologies are identified, characterized by the technology used in several of the leading service industries.

Daiva Labanauskaite et al. (Labanauskaitė et al. 2020) introduced E-marketing tools as communication management (ECM). ECM seeks to recognize possible developments in tourism e-marketing, in which the value of tourism creativity can be defined. Consider from the point of view of Lithuanian tourism consumers the main e-marketing contact platform priorities. Overall, the study goal was reached with a poll of 384 visitors. E-marketing tools for Lithuanian tourism are successful, but strategies are not completely operational or not used.

bin Abdul Lasi and Salim discussed A Conceptual Framework (CF). CF examines whether e-marketing impacts integrated marketing communication. The researcher stressed and deliberated the requisite e-marketing formula of  $2P + 2C + 3S$  (personalization, privacy, customer service, community, site, security, and sales promotion). This role has revolutionized how the organization interacts with existing and prospective consumers, maximizes the investment return, and reduces the cost of reaching customers with an E-marketing approach.

Jamil et al. (2020) developed the impact of E-marketing on business performance (IE-BP). IE-BP explores the effect of e-marketing on Northern Malaysia's market efficiency. The study explores the effects of e-marketing on company results on e-marketing, perceived competitive

profit, consumer pressure, and competitive level. Small Medium Enterprises with businesses are the target respondents for IE-BP. In the experimental result, 30 sets of questionnaires were collected to see whether all the impact of e-marketing on business performance.

Al Adwan et al. (2019) introduced sale in local E-market (SLE). SLE aims to explore how Jordanian small businesses can raise their respective total sales using local e-market. Some of the conceptual framework components include after-sale services, e-marketing budget, online marketing tools, and e-promotions to improve marketing performance. In addition to marketing approaches, the study findings even have serious implications on digital marketing growth in smaller companies in Jordan.

Anser et al. (2020) proposed strategic business performance (SBP). SBP attempts, through its advice on how ICT and e-marketing achieve strategic success, to provide a strategic business performance (SBP) model for business companies working in the hospitality industry. SBP discusses the moderating role of preparation in the ICT/e-marketing partnership. The empirical findings have shown that using ICTs is the foundation for an effective e-marketing process that could allow resorts to achieve SBPs. Besides, ICTs impact marketing through organizational preparation is reinforced.

Based on the survey, in the various phases of distribution, acquisition, and promotion e-marketing, the IoT-EDF has been proposed to enhance marketing strategies. For consumer retention initiatives, IoT-EDF concentrates on the most relevant data sources.

### 3 Internet of things-assisted E-marketing and distribution framework (IoT-EDF)

The emergence of e-marketing caused many businesses to reinvent their existing channel systems through direct orders. The model conceptualizes the effect on supply chain design of direct sales for consumer adoption, the degree to which consumers consider a direct channel as a substitution for conventional shopping. Hence, this paper IoT-EDF has been proposed to improve the e-marketing sales increases. The individual producer can open the consumer approval of the canals to deal with its retailers. Direct marketing in these areas is used for strategic channel management purposes, even though it is effective. Interestingly, it may be of use to the producer even though direct sales arise. Direct marketing, which indirectly improves profits flow through the retail channel, allows producers to boost overall profitability by reducing double marginalization's inefficient price.

Figure 1 demonstrates E-marketing strategies. Segmentation is a partition into smaller segments of email



Fig. 1 E-marketing strategies

subscribers based on set parameters. Marketers are well aware that segmenting email marketing lists can help them increase open and clickthrough rates. Many marketers start with demographic data when segmenting their email marketing campaigns. Another simple method to improve targeting is to segment by prior purchases. Start sending email recommendations for comparable goods or accessories that might complement their past purchase. In general, segmentation is used as a customizing strategy to provide subscribers with more specific email marketing based on their location, preferences, acquisition history, etc. Marketing worth, often called customer-perspective value, is the contrast in assessing a potential customer's profit and expense about other items.

Marketers employ many criteria to build a target market for their product or service, and each market segment is distinct. After completely analyzing the target consumer's demands, lifestyles, demographics, and personalities, marketing experts uniquely tackle each group. Target markets through segmentation are proven to respond to marketing strategies, plans, and promotions in predictable ways. Marketing differentiation implies the production of specialized products which benefit from competitive advantages in a specific market segment. The differential parameters for marketing are product differentiation, service differentiation, distribution differentiation, relationship differentiation, image/reputation differentiation, and price differentiation. The difference makes a product or service more appealing to the target market by recognizing the target audience and communicate something unique and different from the competition.

The positioning of the commodity determines the location of the other goods and services available on the market and the customer's mind. A strong placement makes a product distinctive and makes it a distinct advantage for consumers. Internet marketing correspondence is the tool that online marketers utilize to reach customers to use their full marketing efforts in the advertisement, public relations, personal purchases, promotion of sales, Internet marketing, and direct marketing to affect the marketing significantly. CRM is a means of finding, attracting, and retaining clients as the biggest company. CRM allows enterprises to optimize each customer's benefit and enhance sales efficiency by providing the means of handling and organizing customer relations. Any mix of techniques, methodologies, tools, or online apps used by organizations using a sales channel to connect with their channel partners is PRM or Partner Relationship Management. One of the four marketing blend components is delivery. Distribution is a method in which the customer or the enterprise recipient wants a product or service. The manufacturer or service provider may do directly or through indirect networks with distributors or intermediaries, responsible for both business publicity campaigns and operations, monitors and provides input and reviews on major initiatives in the communications department. Makes crucial choices on the distribution, budgeting, branding, and sales of goods. Marketing is a technique that splits a broad market into smaller divisions to focus on consumers' particular community. Any brand uses focus ads to communicate with a single audience within the industry instead of penetrating a whole market.

Figure 2 illustrates the IoT-EDF. Intelligent machines can run without the fear of restricted bandwidth and power access, such as access devices or storage sources in wireless network environments, in specific, provide the user-driven service modeling method for an access service, a platform that incorporates IoT sensors, cloud computers, and applications in Fig. 2. The cloud-based service iAccess allows disabled customers to create a digital shopping list with voice recognition or text, scan the bar code or a mobile device with the RFID reader, and then forward it to the IoT cloud portal. The created item(s) lists are saved and recorded in an IoT cloud-based web-service repository. IoT's service summarizes the findings of the service modeling to the e-commerce site. The following are the four essential principles of e-commerce: (1) All business information (such as distribution tactics, brand images, and so on) directly impacts customers' motivations to buy and their decision-making. (2) The customer's established analysis and assessment of products or services and its own past purchasing experience dictates clearly (3) the consumer's concrete purchasing action during the purchasing process. (4) The external circumstance impacts the original symbolic purchasing purpose, either implicitly or explicitly, and the ultimate actual buy behavior. The web portal displays the user the correct thing.

RFID may be used for online payment, such as the smart device-built RFID chips or the credit card of RFID. The most common categories of RFID tags are low-frequency (LF) RFID, high-frequency (HF) RFID, ultra-high-frequency (UHF) RFID, active RFID, passive RFID, battery-

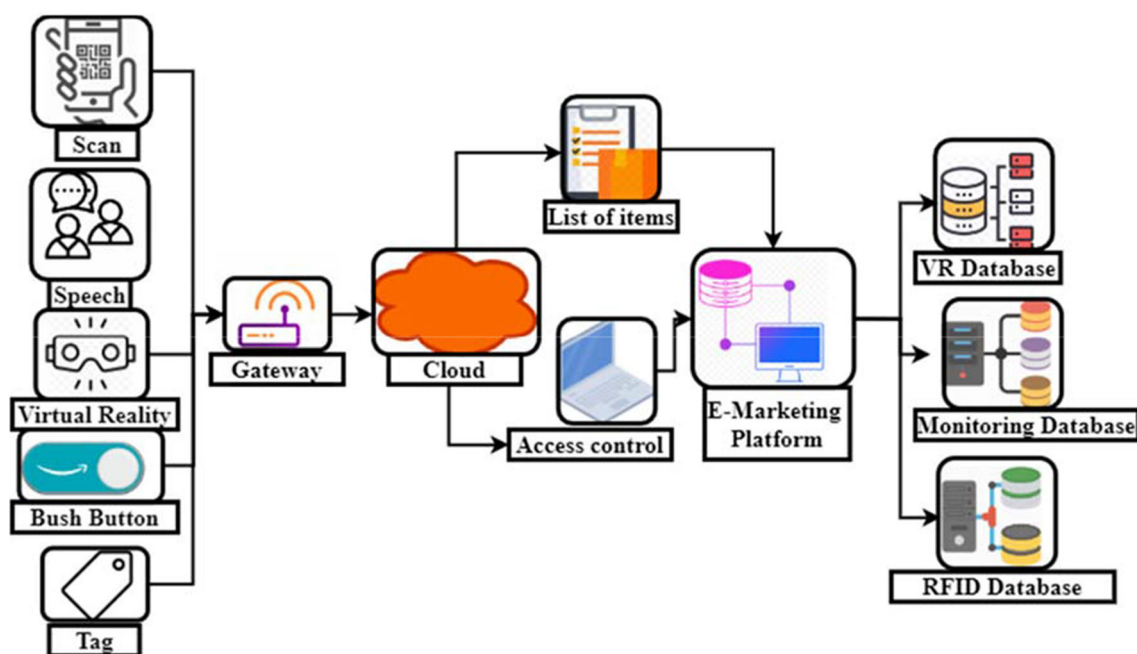


Fig. 2 Proposed IoT-EDF

assisted passive (BAP) RFID, etc. Dash button has since significantly improved the usability of household items such as washing powder, chocolate, tissues, and toothpaste. Suppose the button is pressed to send a message and submit the order confirmation to your mobile. In addition, virtual reality (VR) is characterized as interactive experiences that lead to users' behaviors, offering repeated contextual practice and feedback in line with the terms of a successful engine acquisition. Users can now get more interested in online shopping with the deployment of an interactive experience. The VR system usually leads to supporting disabled individuals, engaging consumers to be more involved, and providing businesses with far more chances to connect with their clients. Developers must know where to draw the line with virtual reality experiences and the possible negative implications of such ethically problematic content. Even low-stress VR scenarios can lead to hours of unpleasant rumination. Digital experience can generate an enticing experience. The immersive 3D environment of a product interface, in comparison with a graphical representation of the product, appears to facilitate the creation of more open and hidden brand actions. PrimeSense 3D Sensor technology, based on gesture recognition, facilitates natural contact between individuals and intelligent devices and their environment. PrimeSense technology provides an IoT-EDF for marketers to grasp exactly and in real-time what consumers are doing before a supermarket shelf.

Figure 3 shows the purchasing procedure for the e-marketing business. As mobile electronic devices were rapidly being developed and popularized, customers could finally make an appropriate purchasing decision as to price and quantity by receiving sufficient information at all times from digital websites and the internet. In a diverse e-marketing era, a rising number of businesses have backed and devoted themselves to evaluating the fundamental and possible elements that influence client decision-making to find the most profitable niches. The consumer decision measure indicates how consumers make purchasing decisions. The consequences of purchase decisions are influenced by various circumstances such as buying situations, marketing offers, perception, and beliefs. Such factors can influence such efficient decision-making frameworks in e-digital marketing. The IoT is further discussed to build the basic e-marketing mode in a deep understanding of the purchasing-decision process. There are numerous and intricate aspects that impact the customer problem-solving process. Marketers can draw more accurate inferences about customer behavior as they develop a deeper grasp of these driving elements. Situational, personal, psychological, and social elements have aided in a deep understanding of the purchase decision-making process. The decision-making process of e-marketing mode can then and eventually be explained as an approach toward IoT-EDF's use and actions.

In Fig. 3, the NI model's four distinct circumstances in succession in the three sessions (knowledge flow, search

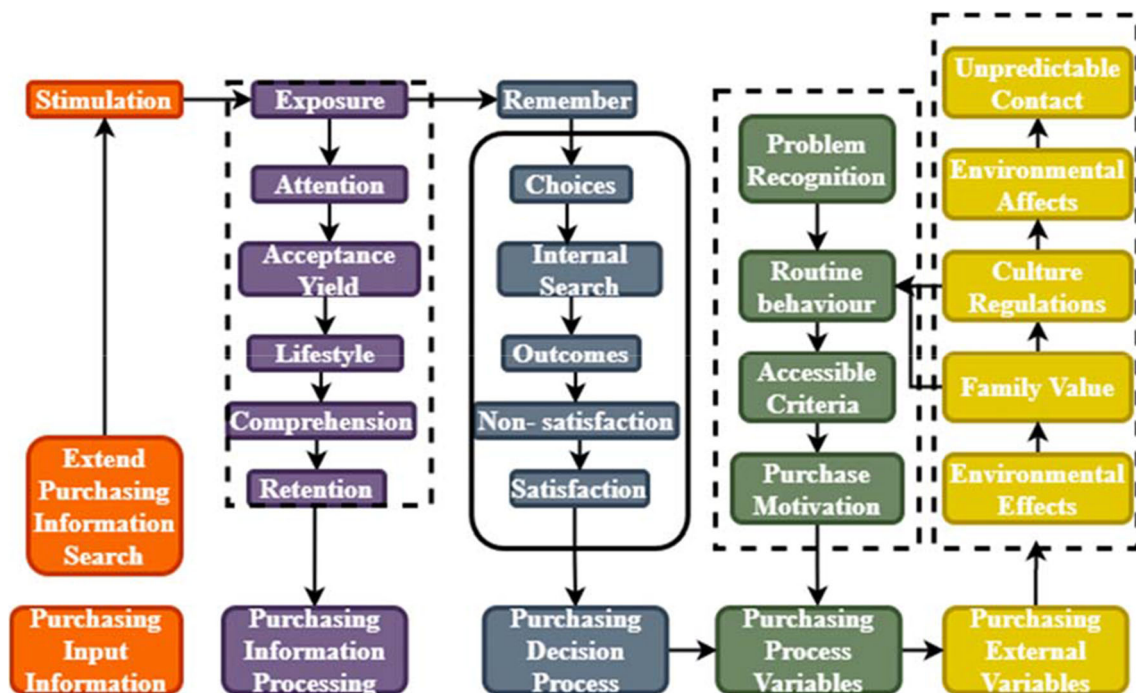


Fig. 3 Purchasing procedure for E-marketing business

and decision-making, and buying behavior), explaining the effects of the distinct circumstances on the flow of information in the buying. Objects and their relationships are the focus of the network interaction (NI) model. Individual objects' behavior and the aggregated impact of their interactions are learned by an object-centric model. The behavior of two or more interacting objects is learned using a relation-centric model.

This segment presents the listing, the basic buyer expectations, and the pricing preferences where a product is sold in a conventional department shop for brick and concrete. The manufacturer–dealer relationship is modeled with the well IoT-EDF. Assume that in product valuation, the customers are heterogeneous. For analytical convenience, indicate the value of consumption  $v$  and suppose it is evenly distributed among consumers from 0 to 1 and has a density of 1. The retailer purchases at rates  $Q_p$  that by purchasing a product, a customer at value  $\omega$  can derive a net surplus of  $\omega - Q_p$ . In this segment, proposed to presume that the commodity is not available anywhere for sale, all customers whose evaluations comply with  $\omega - Q_p$  to 0, can purchase. In particular, the customer whose value is equal to the vendor's price is oblivious to the purchase. All customers with interval valuations must buy the commodity. In short, demand from the customer for the commodity is  $[Q_p, 1]$  and from 0 to 1, respectively. In place of analytical convenience, presume that the retailers do not bear merchandising costs associated with the commodity. The seller produces the exclusive retailer at a selling price  $\omega$ , and costs per item,  $D_p$ , including processing and logistic costs. The independent channel calculates the earnings of the retailer, and the profits of the manufacturer are specified in Eq. (1):

$$\begin{aligned}\pi_p &= (Q_p - \omega)P_p = (Q_p - \omega)(1 - Q_p) \\ \pi_n &= (\omega - D_p)P_p = (\omega - D_p)(1 - Q_p) \\ \pi_{Uj} &= (Q_p - D_p)P_p = (Q_p - D_p)(1 - Q_p)\end{aligned}\quad (1)$$

Figure 4 shows the distribution-based consumer valuation, and Eq. (1) retailer profit and manufacture profit has been calculated. In Eq. (1),  $\pi_p$  computes the retailer profit,  $\pi_n$  computes the manufacturer profit, and  $\pi_{Uj}$  gives the consumer validation. If the manufacturer behaves individually as an e-marketing pricing pioneer, the manufacturer shall set the wholesale price before the retailer determines the retail price. Regarding the retail price, the merchant takes the wholesale price as predefined and maximizes retail benefit as set out in Eq. (1). The retailer anticipates this retail reaction, and the manufacturers' earnings in equal terms are maximized, subject to retail price decisions and reduced computational cost. Every business does its utmost to seek high-profit margins individually and, therefore, higher costs and lower revenue and revenues

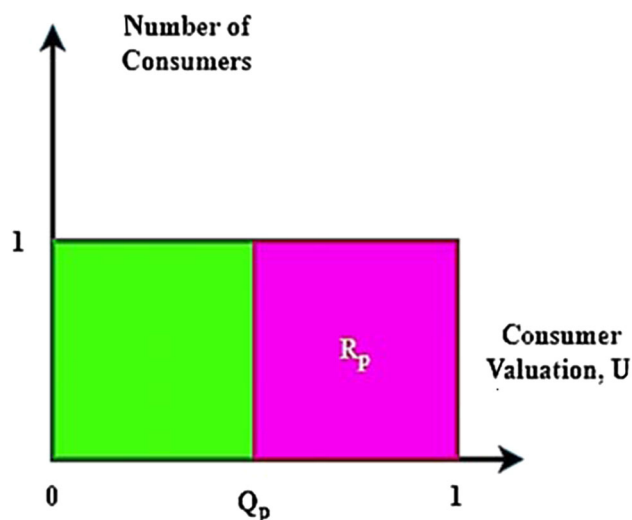


Fig. 4 Distribution-based consumer valuation

than a vertically integrated channel. It must include a paradigm of customers' preference when purchasing a product directly through a full study of this strategic usage for e-marketing. By immersive product introduction, a marketer directs the clients in a paper or website catalog using text, pictures, or icons. Therefore, the use of the senses used in pre-sale evaluations is excluded from the senses' adaptation. Shoppers can create errors in the assessment if the refund is usually just partial after a mispurchase, the goods can be recalled, which decreases customer expectations.

The marginal customer whose value  $u^c$  is equivalent to  $\frac{Q_c}{\theta}$  is unconcerned or not purchasing from the store. Equally, all customers who satisfy their valuations are entitled to purchase directly from the channel. The customer whose worth  $u - Q_p \geq \theta u - Q_c$  is oblivious to the two outlets, and the store is superior, the Product valuation delivery has been derived uniformly based on the retailer and channel request in correlation with linear demand function as shown in the Eq. (2):

$$\begin{aligned}R_p &= \begin{cases} 1 - \frac{Q_p - Q_c}{1 - \theta} & \text{if } \frac{Q_c}{\theta} \leq Q_p \\ 1 - Q_p & \text{otherwise} \end{cases} \\ R_c &= \begin{cases} \frac{\theta Q_p - Q_c}{\theta(1 - \theta)} & \text{if } \frac{Q_c}{\theta} \leq Q_p \\ 0 & \text{otherwise} \end{cases}\end{aligned}\quad (2)$$

As described in Eq. (2) demand function of the retailer and product valuation have been derived. The retailer will lose consumers to the direct channel, and demand becomes increasingly priced as the retail price approaches  $\frac{Q_c}{\theta}$  company. The value  $\frac{Q_c}{\theta}$  correlates in the direct channel to the "real" price, which corrects the commodity's decreased

benefit. Customers can see when the retail price is high that the direct channel is the right option, even though the value of the commodity  $(1 - \theta)u$  is renounced.

All three options are monitored by a vertically organized company: production, conventional retail, and direct marketing. Since demand is practical in Eq. (3), if the consolidated vertically fixed business sets  $Q_p$  market price  $Q_C$  assume that it is equal in Eq. (3):

$$\pi_{Uj} = (Q_p - D_p)R_p + (Q_C - D_p)Q_C \tag{3}$$

As found in Eq. (3), vertically integration has been obtained. where  $D_p$  and  $D_c$  are the manufacturer’s marginal costs for the commodity offered by the supplier and channel direct, because customers pay for shipping and handling on a standard direct market, usually  $D_p < D_c$  is predicted, in relation with the findings of partially linear structure of the request curves as shown in the Fig. 5.

Start with the assumption of  $\frac{Q_c}{\theta} \leq Q_p$  function, to focus on the top demand lines Eqs. (4) and (5)

$$\begin{aligned} \pi_{Uj} &= (Q_p - D_p)R_p + (Q_C - D_p)Q_C \\ &= (Q_p - D_p) \left( 1 - \frac{Q_p - Q_C}{1 - \theta} \right) \\ &\quad + (Q_p - D_p) \frac{\theta Q_p - Q_C}{\theta(1 - \theta)} \end{aligned} \tag{4}$$

The  $Q_p = (1 + D_p)$  and  $Q_C = \frac{\theta + D_p}{2}$  can be maximized with  $Q_p$  and  $Q_C$ . This approach fulfills  $Q_C/\theta \leq Q_p$  when  $\theta \geq D_p/D_c$ . If  $\theta$  is lower than  $D_p/D_c$ , need to have zero direct consumer demand. If  $\theta$  one is too high, the retailer’s demand will collapse to null.

Figure 6 depicts the direct marketing. Now imagine the producer plans to open a direct market outlet. In comparison with a vertically integrate business, the manufactured company and the manufacturer are separate decision-

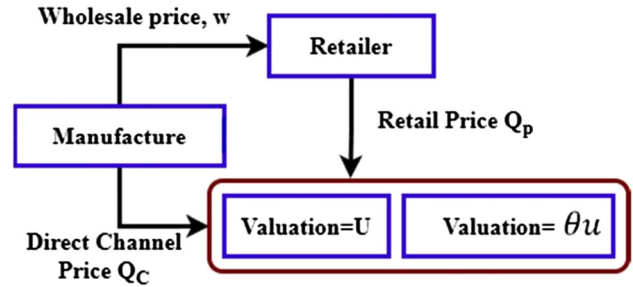


Fig. 6 Direct marketing

makers here. When deciding rates, everyone sees their benefit and lacks the overall effect of prices on the whole channel. Recall that customers’ direct recognition of an incorporated vertically integrated business may be restricted. Direct sales do not wish that economists were categorized as inefficient if the direct market is used or not, can be preferred by the individual producer regardless of its quality. It will show that a direct market can be used for costly competitive reasons, even if expensive. In this segment,  $\theta$  the role of the direct channel is introduced into the IoT-EDF design to explore the ties between producers and retailers. The next series of movements is in the game. In the first point, the producer determined whether to directly market and be the pioneer in Stackelberg’s wholesale price  $\omega$  and price  $Q_C$  for the direct channel. The wholesale price should not be higher than the direct channel price  $Q_C$ , to discourage the retailer from purchasing from the direct channel or other arbiters with cheaper costs.

To increase its benefit, the retail price pro is regulated by a variable. The merchant must consider the  $Q_p$  part-way linear demand in Eq. (4) and Fig. 6 to render an optimum retail price  $Q_p^*$ . In this field, the direct costs are poor that

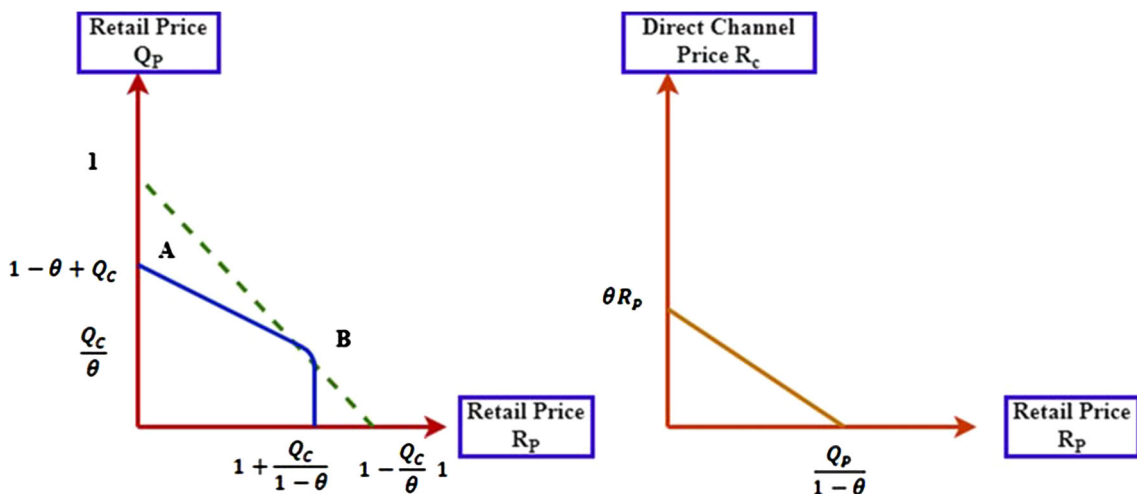


Fig. 5 Demands of retail price and direct channel price

the distributor lacks a few buyers in the direct market, firstly consider the excellent prices for the AB high line segment Fig. 6; this is followed by working  $Q_p^* = \frac{1-\theta+Q_C+\omega}{2}$ , if this price at kink point B approaches or matches the price,  $\frac{Q_C}{\theta}$ .

This retail price is optimum when the retailer sets the price paid for the direct channel  $Q_C$  and the wholesale price  $\omega$  in the price area  $P_1$ , in Eq. (4):

$$P_1 = \left\{ \left( (Q_C, \omega) \left| \frac{1-\theta+Q_C+\omega}{2} \geq \frac{Q_C}{\theta}, \omega \leq Q_C \right. \right) \right\} \quad (5)$$

As deliberated in Eq. (5), the whole price region has been estimated. Then take into account the optimal price for the  $\overline{BC}$  section. This will be  $Q_p^* = \frac{(1+\omega)}{2}$  if the price is less than or equal to  $\frac{Q_C}{\theta}$ , this optimum retail price reacts to the prices in  $P_3$  in Eq. (6):

$$P_3 = \left\{ \left( (Q_C, \omega) \left| \frac{1+\omega}{2} \leq \frac{Q_C}{\theta}, \omega \leq Q_C \right. \right) \right\} \quad (6)$$

As explored in Eq. (6), the optimum retail price has been computed. Finally, if the manufacturer does not indicate  $(Q_C, \omega)$  in either region  $P_1$  or region  $P_3$  And the optimum retail price is placed at the kink B point in the demand, where  $Q_p^* = \frac{Q_C}{\theta}$  in Eq. (7):

$$P_2 = \left\{ \left( (Q_C, \omega) \left| \frac{1-\theta+Q_C+\omega}{2} \leq \frac{1+\omega}{2} \geq \frac{Q_C}{\theta}, \omega \leq Q_C \right. \right) \right\} \quad (7)$$

As expressed in Eq. (7), retail price region demand has been determined. The price regions  $P_1, P_2$ , and  $P_3$  And officially claim the best pricing technique for retailers in the following theorem. Provided the wholesale price  $\omega$  and the direct market price  $Q_C$  determined by the seller, the retailer's optimum price in Eq. (8):

$$Q_p^* = \begin{cases} \frac{1-\theta+Q_C+\omega}{2} & \text{if } (Q_C, \omega) \in P_1 \\ \frac{Q_C}{\theta} & \text{if } (Q_C, \omega) \in P_2 \\ \frac{1+\omega}{2} & \text{if } (Q_C, \omega) \in P_3 \end{cases} \quad (8)$$

As initialized in Eq. (8), direct market pricing has been calculated. The challenge is optimizing overall income with the option between wholesale price  $w$  and direct market pricing  $\omega \leq Q_p$  The vendor can vary in prices by offering a higher wholesale price than a direct product. Without offering a higher wholesale price, the producer could not afford to transfer orders directly to the channel. At the heart of the consumer's dilemma is that by setting high market rates, the manufacturer seizes profit margins. This 'double marginalization' promises to be delivered at a

low, similar cost the supplier will want to limit. The direct channel already has a positive amount of revenue in the area  $P_1$ . However, as the proposed method have seen, in either region  $P_2$  or region  $P_3$ , a strategic producer can fix rates such that all buyers choose to buy from a retailer. Rates in the area  $P_2$  or  $P_3$  should be ideal depends on whether customers approve the direct channel. Notice that when optimal prices in the area  $P_3$  penetrate, the optimal retail price will collapse on the demanding branch. Its subsequent actions would be in line with the problem of double marginalization.

Direct channel approval of the consumer,  $\hat{\theta}$  as defined as the cannibalistic threshold in Eq. (9):

$$\hat{\theta} = \frac{(1+D_p)^2 + (1+D_p)\sqrt{1+6D_p+D_p^2}}{4} \quad (9)$$

As obtained in Eq. (9) cannibalistic threshold has been formulated. The best prices for the producer are if the sum crosses  $\theta$  the threshold in Eq. (10)

$$Q_c^* = \omega^* = \frac{\theta+D_p}{2} \quad (10)$$

As determined in Eq. (10), the best price for the procedure has been calculated. The selling price is corresponding  $Q_p^* = \frac{\theta+D_p}{2\theta}$  the corresponding retail price. If the price is below the cap, optimal prices represent the issue of 'double marginalization'. The proposed IoT-EDF achieves a high-efficiency rate, improved productivity rate, enhanced distribution rate, increased satisfaction rate, adaptability rate, reduced computational cost, and performance metrics.

## 4 Results and discussion

The proposed IoT-EDF has been validated based on efficiency and the productivity rate. The EDF is developed by analyzing the customer purchase predictions and the revenue benefit it can provide. IoT-EDF shows the highest revenue generation system with fewer errors indicative of a consumer's purchases with a similar product developed at a set price to that group of customers. As time progresses and more data is gathered by devices that provide more reliable results and determine the productivity rate. The experimental results have been performed based on the performance metrics such as buying, efficiency ratio, productivity rate, customer satisfaction ratio, adaptability rate, and product distribution rate.

EDF can support the companies and customers in marketing to more efficiently evaluate and meet consumer satisfaction. EDF can provide more accuracy in digital marketing. IoT-EDF offers valuable customer information



to marketing companies to evaluate their relationship with customers. It allows customers to anticipate and respond rapidly to commodity demand in digital marketing. IoT-EDF provides companies with knowledgeable and practical differences in numerous implementations that positively influence the digital market through intelligent decision-making. To evaluate consumer buying decision-making procedures, the EDF model triggered the customer's purchase operations to the network interactive (NI) model. In many stages of the selling, purchasing, and marketing process, IoT can affect decision-making style. The IoT-EDF rather defines how and why it should be implemented to propose a smart system based on IoT to assist businesses and marketers in developing effective marketing strategies by leveraging data gathered from IoT devices. The efficiency rate is shown in Fig. 7

Productivity rate defines different output efficiency steps. Sometimes, the proportion of the cumulative output to the single device or the total information used in the manufacturing process is the efficiency indicator for a certain amount of time. Productivity in digital marketing is a key factor in companies and nations' output efficiency. Increased national productivity would then increase the standard of living by rising marketing trends to enhance people's capacity to buy goods and services, enjoy leisure, boost housing and education, etc. The productivity rate of IoT-EDF is shown in Fig. 8.

The distribution rate is a central strategic approach to digital marketing and the business, contributing to customer retention actions that focus on the data. The definition of distribution rate is similar to the preparation of marketing distribution. The proposed IoT-EDF is based on the distribution rate that affects digital marketing used to make decisions at a particular time. EDF ultimately influences creativity in E-marketing. The distribution of

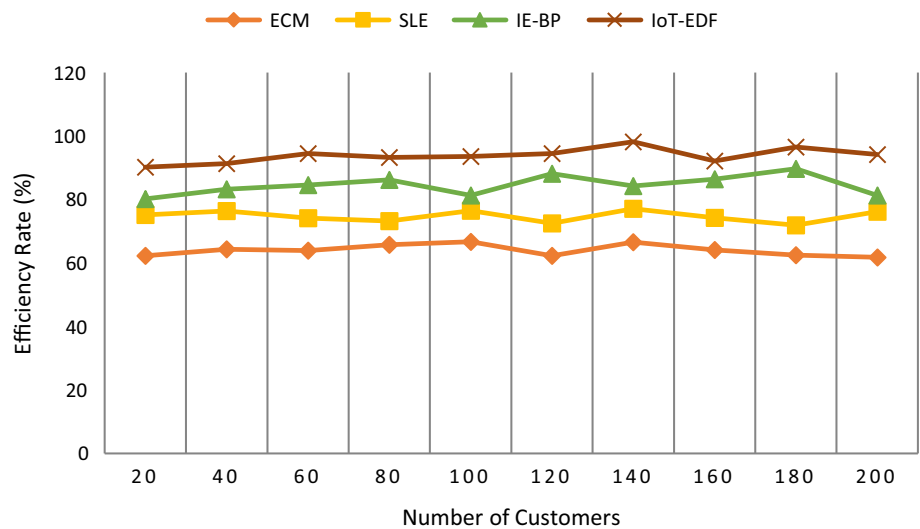
products varies spontaneously among all customers used to evaluate the performance. The distribution rate of IoT-EDF is shown in Fig. 9.

Customers acceptance aspects are to identify the types of products used for selling and buying. IoT-EDF provides certain procedures, strategies in E-marketing that helps to improve consumer adoption using product-service systems. EDF provides the acceptance of nonprofit e-marketing by soft computing and varies largely from the potential for the preparation of marketing distribution. IoT-EDF has shown insights into the validity of digital and the advantages of using customer service aspects to assess E-marketing customer-related aspects. The customer satisfaction rate is shown in Fig. 10.

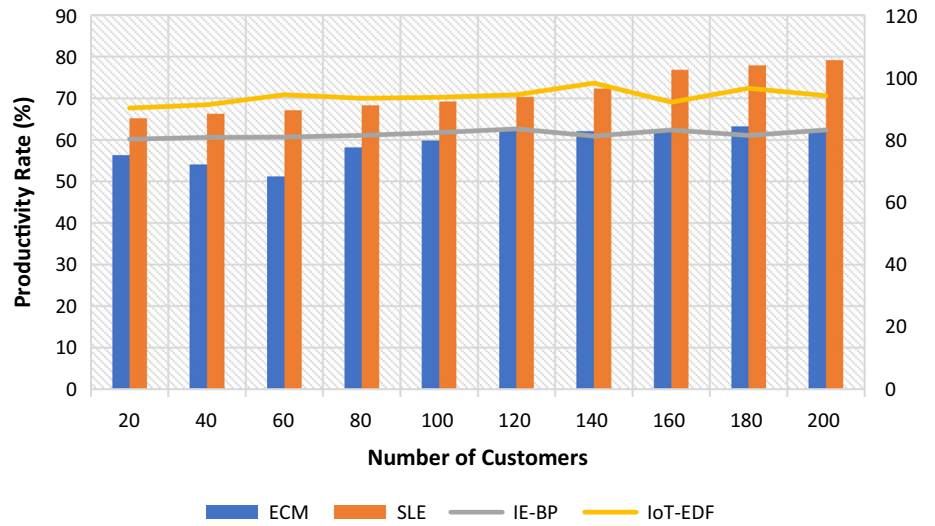
E-marketing must be interoperative to enhance competitiveness in this inclusive environment rapidly and rapidly share information at the marketing and business levels through companies flexible to network device conditions throughout all life cycle stages. Because of various complex structures and information systems, businesses face difficulties in sharing useful information, even when operating in business development contexts. In the end, market conditions result in the adaptability rate to harmonize the company's integrated marketing, resulting in a loss of equilibrium. The adaptability rate of IoT-EDF is shown in Fig. 11.

E-marketing allows the latest company innovation that supports and meets customers' diverse requirements worldwide to prepare market distributions. In an E-marketing platform for customer reaction action, IoT-EDF is made free to transfer digital data, communications and electronic funds. E-marketing provides the following services: nonprofit, credit cards, debit cards, knowledge cards, bank transfers, and other payment and software digital forms. The computational cost of IoT-EDF is shown in Fig. 12.

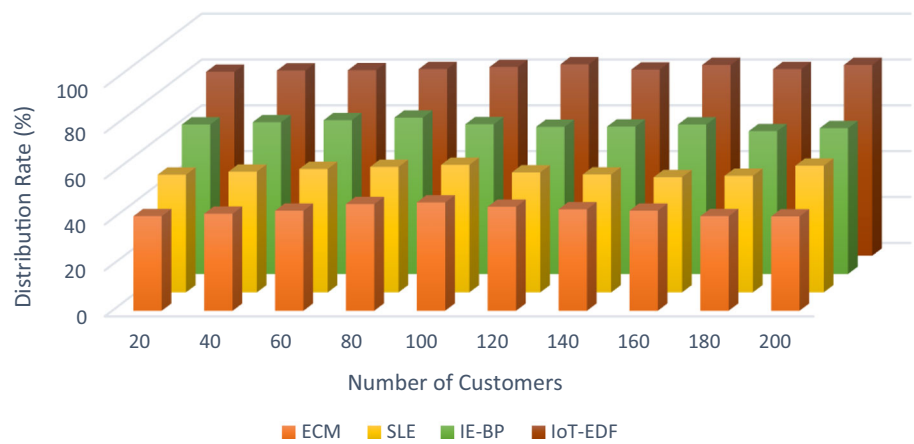
Fig. 7 The efficiency rate of IoT-EDF



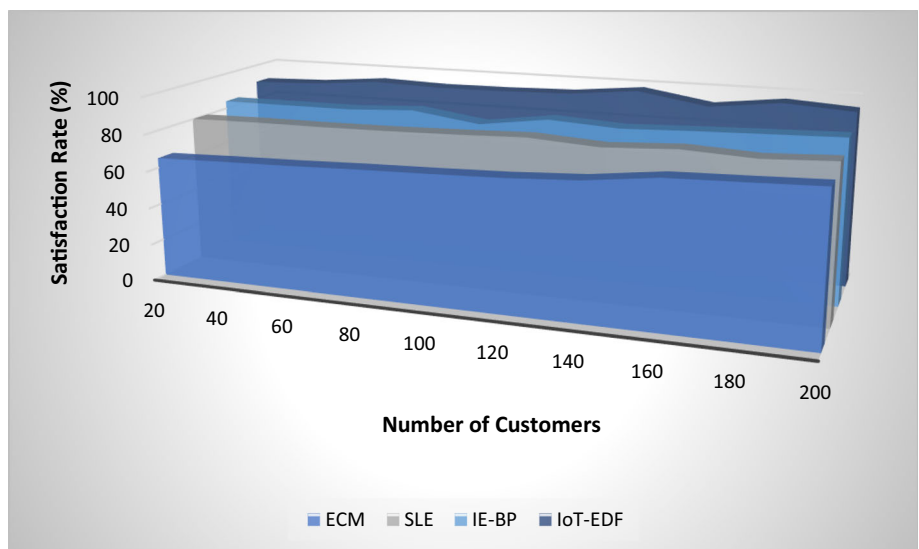
**Fig. 8** The productivity rate of IoT-EDF



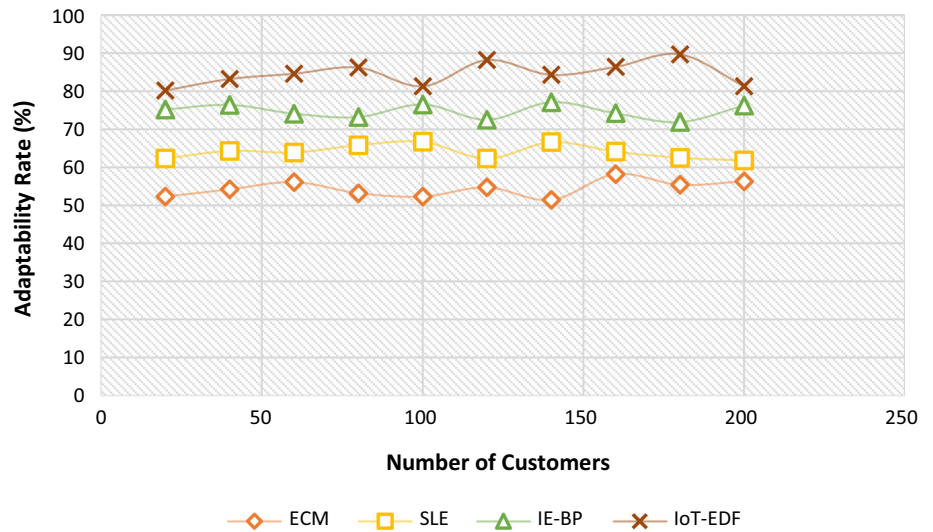
**Fig. 9** The distribution rate of IoT-EDF



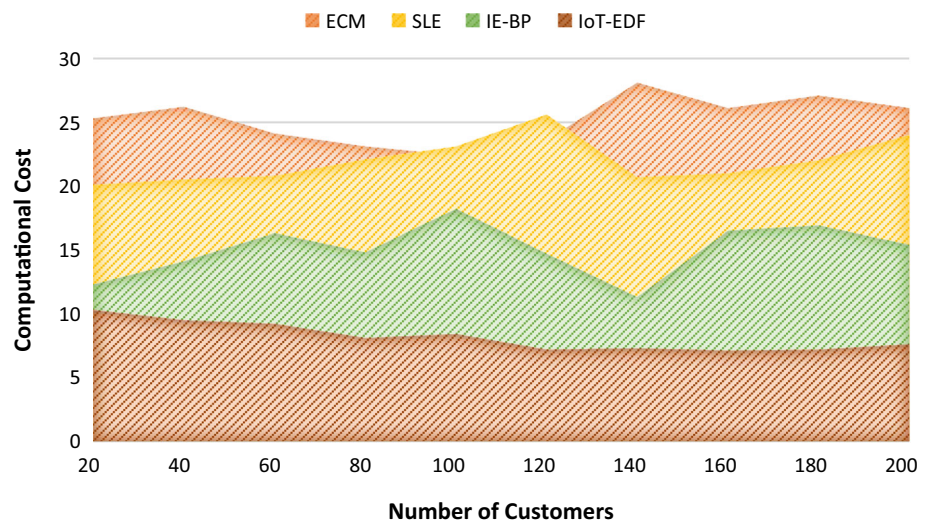
**Fig. 10** The customer satisfaction rate of IoT-EDF



**Fig. 11** The adaptability rate of IoT-EDF



**Fig. 12** The computational cost of IoT-EDF



Performance assessment is the mechanism by which data about individual performances, groups, institutions, structures, or constituents are collected, analyzed, and recorded. Performance assessments are being used to assess a company’s actions, operations, and efficiency. The distribution framework must be in the form of information,

enabling data to be shaped in a scope that could help achieve general marketing objectives. The performance metrics are shown in Table 1.

The proposed method achieves the highest efficiency and the highest satisfaction rate when compared to other existing E-marketing tools as communication management

**Table 1** The performance metrics of IoT-EDF

Number of customers	Efficiency (%)	Productivity (%)	Satisfaction (%)	Adaptability (%)
40	98.56	97.90	97.1	91.3
80	97.32	96.45	95.6	94.7
120	96	98.11	97.2	95.7
160	95	97.22	97.9	98.1
200	97	96.22	95.4	96.2

(ECM), sale in local E-market (SLE), the impact of E-marketing on business performance (IE-BP).

## 5 Conclusion

This paper presents IoT-EDF to improve the marketing strategies in the different phases of the distribution, procurement and promotion process in E-marketing. IoT-EDF is implemented for customer retention actions and focuses on data that are the strongest sources of information. The IoT offers an unparalleled way to collect data via clients support. EDF allows the acceptance of nonprofit e-marketing by nonprofits with soft computing and varies largely from the potential for the preparation of marketing distribution. Moreover, preparation affects adoption of e-marketing greatly and adopting capability plays a crucial role in effective acceptance. The results found that top management's concentration on digital marketing contributes to the acceptance of e-marketing. Besides, e-marketing is dramatically influenced by the planning and capacity adoption and top management on e-marketing. Interconnected marketing includes locations, prices, publicity, processes, and hard evidence, are impacted by the basis of the results of the proposed IoT-EDF. The experimental results obtained by IoT-EDF achieves the maximum efficiency levels of 98.56% and 97.9%. Improved productivity rate (86.13%), enhance distribution rate (82.43%), increase satisfaction rate (92.11%), adaptability rate (91.18%), reduced computational cost (23.67%), and performance metrics (96.2) when compared to other methods.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** This article does not contain any studies with human participants or animals performed by any of the authors.

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