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E-Customer Profiling Technology in Service Industry

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Abstract: ***Service companies are very customer oriented in serving the needs of the customer. Higher services require competitive advantage in companies, including customer identification or e-customer profiling. The aim of this qualitative research is to determine the trend of the technology used for e-customer profiling or customer identification, so that service companies obtain customer information deeper and more accurately with customer identification. The research question in this study is "what is the technology used for e-customer profiling in the service sector?". By using literature research, there are 39 technologies that support e-customer profiling in service companies. The most service companies in this study are banking and financial services, hospitality and other services. 11 technologies used include data mining, big data analysis, customer data platforms, data management, demographic data, digital identity, machine learning, biometric recognition, CRM, social network analysis and transaction data. Apart from the 11 technologies used, there are several other technologies that are currently starting to develop, such as blockchain technology, social CRM, semantic web, etc. Service companies may also consider using the latest technology according to the needs of service companies in e-customer profiling such as competitive advantage.***

Keywords: ***customer identification, e-customer profiling, services industry, technology used.***

I. INTRODUCTION

In the current era, customers need better service than service companies. This is because service companies are currently growing and developing more to meet customer needs. Customers have many choices when choosing a service company as part of customer service. With this condition, the company needs a competitive advantage in services, in particular to serve customers properly and according to customer needs [1].

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One way for service companies to increase their competitive advantage in knowing customer characteristics is by doing customer profiling. Customer profiling can be easily performed by the company if the company understands exactly the technology used to formulate customer profiling. With the development of the current digital age, customer profiling is not only in the form of a manual format, but with an electronic format that makes it easier for companies to find data and formulate customer data more clearly. Therefore, in the current electronic age, electronic customer profiling is called or abbreviated as E-customer profiling or also commonly referred to as customer identification [2].

Service companies have a very high customer-oriented service because the main purpose of a service company is to increase the value of the customer's life. Service companies must know the customer profile of potential customers and customers that the company already has. With the competitive advantage that the customer needs for the service company, it will offer positive value to both the customer and the company in building a good relationship, for example with a customer, it can increase loyalty to the service company and can even provide business services offering to others to use the company's services. recommended [3].

Customers can increase loyalty to the service company because one of them is that the customer feels surprised and proud of the company that understands the needs of the customer. Companies must pay attention and value the input of customers to improve service companies when serving customers. The need for media / technology that can support this, so that companies know the characteristics of customers more easily. Companies can discover the needs of customers with e-customer profiling, especially for those who are already customers or potential customers. Why do service companies have to profile customers? So that companies gain insights that can help to observe the character of customers, behavior and characteristics. So that it can understand the customer and the company will understand that communication with the customer will be more effective [4].

In this qualitative research, the approach to be taken in this study is to use a systematic literature review with a research question that reads: "What is the technology used for profiling e-customers in the service sector?" This study uses systematic literature reviews from different types of sources in previous studies that have focused on e-customer profiling or customer identification specifically in-service companies. It is therefore expected that this research will influence the description of the latest innovations in improving e-customer profiling or customer identification,

especially in-service companies to increase the competitive advantage in serving customers. This research answers the research question and receives an evaluation of the use of technology that has existed in the last 5 (five) years.

In this way researchers can provide information about the results of technology that is needed for service companies.

II. METHODOLOGY

The research method consists of 2 parts, namely the introduction phase and data extraction. The first part is the search for renowned international publications from every world famous publisher. The second part performs data extractions and analyzes research publications in order to answer the research questions in this research.

A. Introduction Stage

At this stage, the research begins with searching for publications that already have an international reputation, namely: 1) ACM Digital Library (dl.acm.org), 2. Emerald Insight (www.emeraldinsight.com), 3) IEEE Xplore Digital Library (ieeexplore.ieee.org), 4) Science Direct (www.sciencedirect.com), and 5) Springer Link (link.springer.com).

To focus on searching for e-customer profiling or customer identification in service companies, you need keywords that match the web publisher on the 5 (five) websites above. Keyword uses Boolean operators to find a database of every research that is already in the publisher. What is meant by Boolean operators are such as OR, AND. The keywords when searching for the five web publishers are ("customer profiling" OR "profiling of customers) AND ("know your customer" OR "KYC"). With this keyword search, the researchers filter every publication found using this keyword so that the filtering process that researchers do starts from the found study, the phase of found study is a research that originates from a title that is in accordance with the key words expected from the researchers selected as a candidate criteria will be the summary after reading and Chapter 1 according to the researcher's keywords The researcher re-selects the filter from existing candidates to arrive at selected studies, what is meant by selected studies is that all content in each article corresponds to research questions expected by researchers in this study, with d Thus the researcher takes over the selected studies.

This research also has exclusion criteria, so that this research can focus more on the research questions to be answered. Exclusion criteria are:

- The year of publication of the study is before 2015.
- Other problems with customer identification or customer profiling.

B. Data Extraction

By using keywords that were done on all the reputable websites of journal publishers in the world, 326 research reports were found in the study found. Of the 326 research paper studies found, the researchers then looked deeper than the summary, title and chapter 1, so that 61 research papers were obtained as candidate studies. The researcher reads the entire paper of 61 research reports, so there are 31 research reports that are selected studies. 31 this study will be the study literature in finding answers to the research questions in this study. For more information in Table I, a summary of studies has been found, candidate studies to selected studies.

Table- I: Paper from Studies Found until Selected Studies

Source	Found	Candidate	Selected
Science Direct	126	22	7
IEEEXplore Digital Library	33	16	11
Emerald	36	2	2
ACM Digital Library	87	12	5
Springer	44	9	6
TOTAL	326	61	**31**

III. RESULTS AND DISCUSSION

From the results of selected studies, there are a total of 31 research reports that will be discussed in this study. 31 these research documents have a technology element that can be used for e-customer profiling or customer identification at service companies to increase the competitive advantage in accordance with the research question in this study. Table II shows a total of 31 research reports selected in this study. These 31 research reports are a total of 5 (five) publishers with different types of articles, namely journal, conferences (proceedings), book chapters and chapters.

Table- II: List of Paper Publication

Publisher	Type Paper	Year	Title
ScienceDirect	Chapter	2017	Selfie banking: is … [5]
ScienceDirect	Chapter	2019	Can Selfies Spark … [6]
ScienceDirect	Journal	2015	Achieving Tourist Loyalty … [7]
ScienceDirect	Journal	2016	Reputation and Intentions … [8]
ScienceDirect	Conference	2019	Analysis of the Geospatial … [9]
ScienceDirect	Journal	2016	Using Data Mining … [10]
ScienceDirect	Journal	2018	Using Big Data … [11]
IEEE	Conference	2019	Hotel Recommendation System … [12]
IEEE	Conference	2018	Profiling Driver Behavior … [13]
IEEE	Conference	2015	Managing Software Engineering … [14]
IEEE	Conference	2016	Digital Identity Based … [15]
IEEE	Conference	2016	Know Your Customer (KYC) … [16]
IEEE	Conference	2015	Social CRM using … [17]
IEEE	Conference	2018	Customer Segmentation in … [18]
IEEE	Conference	2016	Latticing and Device-Histories … [19]
IEEE	Conference	2016	Data Mining Technique … [20]
IEEE	Journal	2019	Improve Profiling Bank … [21]
IEEE	Conference	2017	Research on Methods … [22]
ACM	Conference	2015	Data Profiling with … [23]

Publisher	Type Paper	Year	Title
ACM	Conference	2016	Behavior Profiling for … [24]
ACM	Journal	2018	Fintech: AI Powers … [25]
ACM	Conference	2017	Data Profiling … [26]
ACM	Conference	2019	Zero Coding UMAP … [27]
Springer	Journal	2019	The Identity Challenge … [28]
Springer	Journal	2019	Reconciling contradictory Forces … [29]
Springer	Book Chapter	2015	Know Your Customer … [30]
Springer	Journal	2018	Profiling Web Users … [31]
Springer	Journal	2019	Cognitive Computing for … [32]
Springer	Journal	2016	A Study on the … [33]
Emerald Insight	Journal	2015	The FATF's Customer … [34]
Emerald Insight	Journal	2018	Systematic Review of … [35]

Table II above shows that there are 4 types of paper, of which 31 research papers are 13 journal-type research publications, 15 conference / congress-type research publications, 2 research-type chapter publications and 1 research-book-type chapter publication.

Table III below shows that the research publications were taken from 2015 to 2019.

Table- III: Numbers of Publications Year

Year	Quantity (#)	Percent (%)
2015	6	19%
2016	8	26%
2017	3	10%
2018	6	19%
2019	8	26%
TOTAL	31	100%

Table III above shows that since the last 5 years from 2015 to 2019, service companies that use technology for e-customer profiling or customer identification recorded in research papers have been on average between 6-8 research papers annually. Only in 2017 did researchers find only 3 research reports. This shows that service providers have paid sufficient attention to increasing the competitive advantage in knowing the needs of customers, in particular how customers can be identified or customers can be profiled.

Table IV below shows the details of each research paper, in particular the name of the journal that researchers have obtained as many as 31 research papers.

Table- IV: Number of each Journal Name from Selected Studies

Journal Name	Quantity (#)	Percent (%)
19th International Conference on Computer and Information Technology	1	3%
2015 International Conference on Information Technology Systems and Innovation (ICITSI)	1	3%
2015 PICMET: Management of the Technology Age	1	3%
2016 49th Hawaii International Conference on System Sciences	1	3%
2016 International Conference on Information and Communication Technology (ICICTM)	1	3%
2017 13th International Conference on Natural Computation, Fuzzy Systems and Knowledge Discovery	1	3%
2018 IEEE International Conference on Big Data	1	3%
2018 International Conference on Information Management and Technology (ICIMTech)	1	3%
2019 4th International Conference on Computer Science and Engineering (UBMK)	1	3%
2nd International Conference on Applied and Theoretical Computing and Communication Technology (ICATCCT)	1	3%
8th International Young Scientist Conference on Computational Science	1	3%
Anti-Money Laundering in a Nutshell	1	3%
Biometric Technology Today	2	6%
Communications of the ACM	1	3%
Electronic Markets	1	3%
European Business Organization Law Review	1	3%
IEEE Access	1	3%
International Journal of Contemporary Hospitality Management	1	3%
Journal of Banking Regulation	1	3%
Journal of Business Research	2	6%
Journal of Medical Systems	1	3%
Journal of Money Laundering Control	1	3%
Proceedings of the 2017 ACM International Conference on Management of Data	1	3%
Proceedings of the 3rd ACM International Conference on Big Data Computing, Applications and Technology	1	3%
Proceedings of the VLDB Endowment	1	3%
Proceedings of UMAP 2019	1	3%
Social Network Analysis and Mining	1	3%
Tourism Management	1	3%
Tourism Management Perspectives	1	3%
TOTAL	31	100%

Table IV above shows that there is a journal name with 2 research articles in this study, namely "Biometric technology today" and "Journal of Business Research". Both journals indeed discuss more how they can physically identify themselves when identifying customers and how the application of customer identification technology that can be used in business. In addition to the two journals, each journal name has 1 paper in the journal. However, it has different technological variations that are included in each of the articles that will be discussed below.

Every research paper will certainly have a country of every author. Country data can be used as a perspective that the author of a country is interested in the research conducted. Table V below shows a list of the countries of the authors conducting research with the keyword 'e-customer profiling' or customer identification.

Table- V: Number of Authors based on Country from Selected Studies

Country	Quantity (#)	Percent (%)
Australia	3	3%
Bangladesh	2	2%
Belgium	2	2%
Canada	1	1%
China	25	24%
Egypt	3	3%
Estonia	3	3%
Finland	1	1%
Germany	10	10%
Greece	1	1%
Hong Kong	2	2%
Hungary	1	1%
India	3	3%
Indonesia	6	6%
Japan	1	1%
Luxembourg	5	5%
Macau	4	4%
Malaysia	3	3%
Portugal	1	1%
Russia	3	3%
South Korea	1	1%
Spain	5	5%
Sweden	1	1%
Turkey	6	6%
United Kingdom	2	2%
USA	10	10%
TOTAL	105	100%

Table V above shows that 105 researchers from 26 countries are participating in the selected studies in this study. The data in Table V shows that the first number of people conducting research into customer identification or customer profiling is 25 Chinese researchers. The second largest were from the USA and Germany, each with 10 researchers. The third highest comes from Indonesia and Turkey, each with 6 researchers. The fourth rank comes from Luxembourg and Spain with 5 researchers each and the fifth rank comes from Macau with 4 researchers. It can be seen that the care for customer profiling or customer identification comes from China, the USA and Germany.

Subsequently, researchers in Table VI below want to delve deeper into the 105 researchers in the studies found in this study from institutions around the world. Researchers broadly divided the two broad categories, namely business and educational institutions.

Table- VI: Number of Institution' paper and based on Category of Institution

Country	Institution	Qty (#)	Category
Australia	KPMG Law King and Wood Mallesons, UNSW Sydney	1	Corporate
Belgium	Bank of Portugal	1	Corporate
Belgium	United Nations Development Programme	1	Corporate
China	Ant Financial	1	Corporate
China	Baidu Research	1	Corporate
China	China Pacific Insurance Company	1	Corporate
China	Huawei Technologies Co. Ltd	1	Corporate
China	Ping An Technology (ShenZhen) Co., Ltd	1	Corporate
China	State Grid Information and Telecommunication Group Co., Ltd	9	Corporate
Germany	TU Berlin	1	Corporate
Japan	Arm Treasure Data	1	Corporate
Luxembourg	OLAMobile	2	Corporate
Malaysia	Media Prima Berhard	1	Corporate
Portugal	GECAD	1	Corporate
South Korea	Samsung Electronics	1	Corporate
Turkey	Etstur Company	1	Corporate
Turkey	Papillon Hotels Resort & SPA, Antalya	1	Corporate
USA	AML Consulting Manhattan	1	Corporate
USA	Daon Company	1	Corporate
USA	Mitek Company	1	Corporate
Australia	Deakin University	1	Education
Australia	Griffith University	1	Education
Bangladesh	United International University	2	Education
Canada	University of Waterloo	1	Education
China	Business School Central South University	2	Education
China	Renmin University	1	Education
China	Shenzhen University	1	Education
China	Tsinghua University	5	Education
Egypt	Arab Academy for Science, Technology and Maritime Transport	3	Education
Estonia	Tallinn University of Technology	3	Education
Finland	Tampere University of Technology	1	Education
Germany	Hasso Plattner Institute	6	Education
Germany	Karlsruhe Institute of Technology	3	Education
Greece	Athens University of Economics and Business	1	Education
Hong Kong	The Hong Kong Polytechnic University	2	Education
Hong Kong	University of Hong Kong	2	Education
Hungary	Corvinus University of Budapest	1	Education

India	Maharashtra Institute of Technology	3	Education
Indonesia	Bina Nusantara University	3	Education
Indonesia	Institut Teknologi Bandung	3	Education
Luxembourg	University of Luxembourg	3	Education
Macau	University of Macau	4	Education
Malaysia	UITM	1	Education
Malaysia	UniKL MIIT	1	Education
Russia	ITMO University	3	Education
Spain	Rey Juan Carlos University	3	Education
Spain	Universidad Politecnica de Madrid	2	Education
Sweden	Linnaeus University	1	Education
Turkey	Akdeniz University	1	Education
Turkey	Istanbul Technical University	2	Education
Turkey	Koc University	1	Education
United Kingdom	University of Leeds	1	Education
United Kingdom	University of Southampton	1	Education
USA	Pennsylvania State University	1	Education
USA	Radford University	1	Education
USA	University of St. Louis	2	Education
USA	University of Wisconsin	3	Education
	TOTAL	105	

The 105 researchers listed in Table VI above show that there are 29 authors from 11 countries for the Corporate category. Most authors in the Company category come from 14 authors from China. The companies that gave the most author to the study came from China, namely the State Grid Information and Telecommunication Group Co., Ltd, with 9 authors.

In the Education category there are 76 authors from 22 countries. Most authors in category education come from China and Germany with 9 authors each. Following the US, no fewer than 7 authors and Indonesia no less than 6 authors. The most educational institutions that provided authors in this study came from Germany, namely the Hasso Plattner Institute with 6 authors and China, Tsinghua University with 5 authors.

The following in Table VII is from the perspective of the industry involved in 31 research reports. This must be known to see the technology used for customer profiling or industry identification, performed by 105 authors of selected studies in this study.

Table- VII: Stream of services industry based on this research

Industry Research	Quantity (#)	Percent (%)
Advertising	2	6%
Banking & Financial Services	13	42%
Consultant	3	10%
Electricity / Utility	1	3%
Healtcare Services	1	3%
Higher Education	1	3%
Hospitality	5	16%
Insurance	1	3%
Software Developer Company	1	3%
Tourism	1	3%
Web Services	2	6%
TOTAL	31	100%

Table VII above shows that 31 selected studies have a large number of studies into the use of customer identification or customer profiling technology in banking and financial services. A total of 13 (42%) research documents discussed the banking and financial services. As we know, banking and financial services do indeed have many customers in the main activity financial and transaction activities. Of course the bank / financial services want to find out more and identify customers who are already in possession and who will become customers. In addition to banking and financial services, hospitality is in second place with 5 (16%) research reports. It can be seen that, according to the function of hospitality, of course to serve customers in the context of customer comfort in one place. Companies must therefore know and identify the customers they have and potential customers.

The focus of this research is to find out which technology is used for the industries in Table VII, so that companies can learn from existing technologies to always develop competitive advantages in industrial strategies to answer the research question "what is the technology used for e - customer profiling in the service industry? " To answer this research question, the researchers studied more in 31 research reports and found 39 technology in this country that is used in industry in 26 countries. The total use of technology from 39 types of technology, a total of 78 used items. This way we can see which technology is most used by the industry when it comes to seeing customer identification or e-customer profiling. Table VIII below is based on the order of most items used in the study note.

Table- VIII: The Technology Used of Services Industry

No.	Technology Used	Qty (#)	Reference
1	Data Mining	8	[11][17][18][20][21][24][31][34]
2	Big Data Analysis	5	[11][22][25][26][31]
3	Customer Data Platform	4	[13][21][27][33]
4	Data Management	4	[7][19][28][30]
5	Demographic Data	4	[13][21][31][32]
6	Digital Identity	4	[15][16][30][34]
7	Machine Learning	4	[11][14][21][32]
8	Biometric Recognition	3	[5][6][29]
9	CRM	3	[10][11][35]
10	Social Network Analysis	3	[15][17][31]
11	Transactional Data	3	[11][16][21]
12	Customer Profile Management	2	[22][29]
13	Customer Reservation Systems	2	[7][8]
14	Geospatial Location Profiles	2	[9][22]

No.	Technology Used	Qty (#)	Reference
15	Recency, Frequency, Monetary (RFM) Analysis	2	[10][18]
16	Recommendation System	2	[12][15]
17	Artificial Intelligence	1	[25]
18	Artificial Neural Networks	1	[21]
19	Authentication of Customer	1	[16]
20	Behavioral Risk Prediction	1	[16]
21	Blockchain	1	[25]
22	Customer Scoring and Recommendation	1	[19]
23	Dataset Analysis	1	[9]
24	Deep Learning and Natural Language Processing	1	[25]
25	Demand Side Platform	1	[24]
26	Documentation Management	1	[29]
27	Healthcare System	1	[33]
28	Insurance Claim System	1	[13]
29	Internet of Things (IoT)	1	[33]
30	Medical Records Data	1	[33]
31	Metadata	1	[23]
32	Metanome	1	[23]
33	Online Reservation Systems	1	[12]
34	Property Management Systems	1	[11]
35	Reputation Management	1	[8]
36	Semantic Web	1	[31]
37	Social CRM	1	[17]
38	UMAP: Uniform Manifold Approximation and Projection	1	[27]
39	Versatile tool for predictive analytics	1	[27]
	TOTAL	78	

Table VIII above shows that the 11 largest applications of e-customer profiling or customer identification technology are data mining, big data analysis, customer data platforms, data management, demographic data, digital identity, machine learning, biometric recognition, CRM, social network analysis and transaction data. These 11 technologies from 2015 to 2019 have become a technology trend in the search for customer identification and customer profiling. Before 2015, there were indeed many CRMs that became the mainstay of the most important technology in e-customer profiling. However, more and more unstructured data is circulating from social media and other data, so companies need higher technology, coupled with current data processing that is growing very fast worldwide. Data mining thus becomes one of the technologies that can increase the competitive advantage in the strategies of service companies to identify customers and perform customer profiling.

In addition to data mining, the technological trend that is currently emerging is the existence of big data analysis as a technology that can offer companies solutions to increase their competitive advantage in e-customer profiling. This can be done because of data that does not come from customer data, but data environment around the customer, such as data from social media leading to the customer, or data about an area where the customer is located. This can be an analysis of big data to obtain customer identification at service companies.

Customer data platform and data management as sequence numbers 3 and 4 in Table VIII have a meaning that is not too different, but researchers separate because this depends on the case in the relevant research note. The customer data platform indicates that the company must have a platform that specifically knows customer data (such as CRM), but the name may not be CRM. With a customer data platform at this service company, companies can quickly find and identify customers for service companies. Although the data management in the related research paper is not only customer data, it can also contain transaction data made by the customer and all data relating to the relationship with the customer. With data management, data processing is not focused on customer data, but includes the factors that follow customer behavior or customer patterns in service companies.

One of the most important data for supporting e-customer profiling technology is demographic data. Demographic data is data used by service companies to view the environment of customers. With the company can see this data, the company can be helped in decision making. Because the company clearly knows the needs in every demography in accordance with the relationship with the customer. In this way, the service company can determine precisely a suitable promotion or event based on demographic data.

Digital identity is one of the keys with which companies can identify customers. Digitally executed identity data makes it easier for service companies to be identified. Because the data is not analogue or manual. As an example of a passport, the passport has now been made digital to facilitate travelers traveling abroad. Service companies therefore get their identity faster without having to search for data manually. In addition, data can be integrated, digitally and ontime connected to other systems.

Machine learning is also a technology that can help service providers increase their competitive advantage, especially when identifying customers. This is because machine learning patterns of customer behavior can immediately learn after purchasing a service. So after collecting different examples in machine learning, the company will understand the patterns that exist with existing customers and new customers. Machine learning becomes very useful when making a decision, because machine learning learns the results of the customer and then simulates them to see customer patterns. Of course, not only customer data such as transactions, but also data related to the customer.

Biometric recognition as part of customer data because it is physically closely related to the customer. For security reasons, biometric recognition can use fingerprint technology or retinal recognition to identify exactly who the customer is executing a transaction. Biometrics recognition is a solution to log in quickly. With the existence of biometric recognition, customer experience becomes more interactive. You do not need to use text but can be directly replaced by physical elements by the customer.

Customer Relationship Management (CRM) is a management application that started in 1990 until now. This CRM is built is aimed at establishing good relationships between customers and companies. In the beginning, the customer follows the company's loyalty program to collect points designed by the company. In this way the company can trace the transactions of customers and customer identity.

Social network analysis is a technology that aims to analyze customers, especially when using social media that have been made public.

By seeing customer responses via social media, service companies get information about customer feelings that occur when customers use a service offered by a service company. Service companies therefore receive information to improve services that have been delivered to customers.

The above statement is the top 11 of these research results with regard to supporting technology for e-customer profiling or customer identification in the competitive advantage of service companies. In addition to these 11 technological issues, other technologies used in selected studies in this study may be a good reference for companies to develop business strategies. Call it Blockchain, is a new technology that can provide data security because the data on the blockchain is unchangeable and cannot be replaced. With the blockchain, customer confidence in service companies in serving customers can certainly increase. In addition to the blockchain, there is also Social CRM, which can be a solution for increasing the competitive advantage in service companies. When this research was conducted, from selected studies, social CRM and blockchain were only discussed by 1 research paper. However, in recent times, social CRM has become a trend used by companies and is becoming a consideration for future use, especially in-service companies around the world in increasing the competitive advantage.

IV. CONCLUSION

With solutions and assistance in serving customers as a competitive advantage that currently exists in the world. From this research, the research question is "what is the technology used for e-customer profiling in the service industry?". The answer to this research question can be found in Table VIII. That so far 39 technologies have been used in service companies. The service companies that use this technology the most are banking and financial services, hospitality and various other service companies.

11 (eleven) list of technologies currently most used for e-customer profiling to increase the competitive advantage of service companies are data mining, big data analysis, customer data platforms, data management, demographic data, digital identity, machine learning, biometric recognition, CRM, social network analysis and transactional data. It is undeniable that in addition to these 11 technology lists, a number of technologies will begin to develop in the current era, such as blockchain technology, social CRM, semantic web, etc. Then the company could also consider using the technology in Table VIII. according to the needs of the service company in terms of e-customer profiling.

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