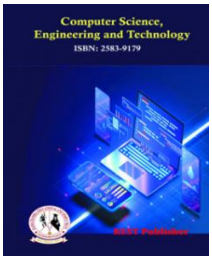
Computer Science, Engineering and Technology

Vol: 3(3), September 2025

REST Publisher; ISSN: 2583-9179

Website: https://restpublisher.com/journals/cset/

DOI: https://doi.org/10.46632/cset/3/3/14



Analysis of Communication Technologies by using TOPSIS Method

***Sathiyaraj Chinnasamy, Nathiya Murali, M. Ramachandran, Arunambigai Ramesh**

Rest Labs, Kaveripattinam, Krishnagiri, Tamilnadu, India.

*Corresponding Author Email: sathiyaraj@restlabs.in

Abstract: *Transportation-related information and communication technologies (ICTs). Under The three branches of collecting information and user guiding (for transportation system), operating and management of cargo infrastructure for transport, and leading and operation of systems (all types), a variety of applications are researched. A succinct and critical analysis of the uses of the several technologies that are currently in use in their last stages of exploration or commercial deployment is provided for any of those. The review covers the several subcategories of the top three. The essay goes on to look at potential futures with 2010 as the medium-term horizon. Information and communication technologies, or ICTs, are anticipated to be crucial to growth. Many believe that these technologies have the power to revolutionize unprofitable sectors, fix broken public institutions, and open up previously unheard-of possibilities for information-intensive social services like healthcare and education. However, it is well acknowledged that obtaining these growth benefits has proven challenging due to a multitude of intricate factors. Here, there are two connected issues. First of all, a lot of businesses struggle to create and maintain sophisticated technological projects for the extended durations usually needed. Secondly, the ICT-based solutions that are produced might not significantly reduce the institutional vulnerability that they are meant to address. There are several indications that in the future, the telephone will play a significant role in raising living standards and income levels on a large scale. The convergence of phone access across the nation is still a historical tendency (Grace et al., 2001). This is due, in part, to the fact that phones are becoming more and more affordable as technology advances. As we have shown, for the previous forty years, the average amount of work that can be done from home at a particular income level has increased, and new advancements are probably going to speed up this trend. For instance, where fixed-line provision is not feasible, the Grameenphone program previously mentioned depends on mobile telephony to give connectivity These prospects demonstrate how numerous applications have proven technologies and safeguard the sustainability of businesses. this decade's tendency Technologies for gathering and disseminating traffic data and related data are a few examples of these application areas. Shows the Ranking of Communication technologies. Bluetooth is got the first rank whereas is WiMAX is having the Lowest rank*

Keywords: *Bluetooth, Z-Wave, ZigBee, LoRaWAN, WiFi, WiMAX.*

1. INTRODUCTION

Research is being conducted to explore opportunities for the Information and communication technology or ICT, connection across sectors tourism sector. Various applications are being investigated under the following three main headings network functionality and performance (in all its forms), information and user guidance (of tourism systems), and the efficiency of operation and commercialization of tourism systems. Evaluation focuses on assessing the diverse applications of various technologies available today, in terms of their final development or commercialization prospects and their impact on the industry. The evaluation highlights the diverse support functions of the three main aspects. Research continues to investigate opportunities for the post-pandemic era,

Copyright@ REST Publisher

building on the advancements made during the last decade, and addressing potential avenues for further exploration. The opportunities presented demonstrate the utilization of innovations such as safeguarding commercial trustworthiness. This decade has witnessed a surge in applications that showcase segments of these opportunities. Key indicators of these applications include data collection and analysis systems for tourism [1]. In the present day structures the basis of data connection is based on the technology of communication and information, or ICT. Also in order to pinpoint existing and forthcoming disruptions in different organizational configurations, the structures and forms of information linkage have been examined. Experts continue to be evaluating how computers help individuals and businesses with their financial activities since the 1980s. Scholars have investigated the functions and effects of ICTs on the information connectivity and operations within businesses. The introduction of email and internet connection in the 1990s led to an exponential rise in connectivity. Industry has been the importance of organizations makes study of technology for communication and information (TIC) crucial. Recent developments include the widespread use of mobile devices, the rise of wearable and "smart" technologies, cloud computing, and social networking site [2]. ICT refers to communications and information technologies. ICTs have become a crucial part of the communication environment in contemporary companies, and research has demonstrated that they're having an assortment of expected and unexpected impacts on the types and designs that communication takes within these settings. Since the 1980s, analysts have examined the function and implications of ICTs for inter organizational interactions, highlighting the connection between humans, businesses, and computers. The study of ICTs got significance in the field of organizational communication throughout the 1990s due to the remarkable rise in the use of emails as well as internet communication. The value (and difficulty) of researching more recent innovations (such the widespread use of cell phones, the development of "smart" and connected devices, the rise of cloud computing, and social media) has only risen [3]. Techniques of communications and information (ICTs). My purpose is to describe analyze the proposed relationship(s) among these new ICTs (or "network") and proposed new work organization and structural paradigms (or "network" structures). To achieve this goal, an independent perspective on modern concepts needs to be provided through an examination of theory and empirical data. According to Rockmart (1998) and Falk & descants (1995, p. 339), communication technologies are viewed as "essential components" to these new methods of working as well as facilitator of this shift. In fact, certain scholars (such as Drunker, 1988; Hinds & Kessler, 1995) contend that novel technology must Organizations need to restructure and adopt cutting-edge operating strategies if they want to be successful in a marketplace that is becoming increasingly competitive. Technologies of knowledge and communication (ICTs). My intent is to clarifying pursuit of this objective, both empirical evidence and theory are reviewed, with the aim of providing a critical perspective on recent conceptualizations. Communication technologe are seen as enablers of this change, a 'significant part' of these novel methods in operation (Fulk & deSanctis, 1995, p. 339; Rockart, 1998). In fact, some analysts (such as Drucker, 1988; Hinds & Kiesler, 1995) contend that novel technologies must In order to thrive in a constantly vicious sales, businesses are forced to rearrange and adopt novel ways of operating [4]. implies of communication include banking via telephone, mail delivery, and online communication. These results agree with the growing popularity of current voter survey strategies, including focus discussions and survey methods. Moreover, there have been adjustments to how party operate in, with leader in addition to the media and PR consultants spotting power shifts both inward and outward (Meir et al., 1999). Probably foremost, political campaigning has generally adopted a more commercial approach (Gibson and Rommel, 2001). In this piece, I take an effort to contextualize the role of developing technologies for communication inside this extremely structured framework of party communications and provide some speculative hypotheses regarding possible uses of its newfound potential. My primary contention is that flexibility [5]. One of the most important chapters in the book is Information Technologies for Rural Development, written by Day and Greenwood, which tackles the particular circumstances that most impoverished individuals, particularly those dwelling in remote regions, find themselves in. This is of particular importance because those sectors are notoriously lacking in the complementing resource such as infrastructure, energy, and skilled labor—necessary for deploying multiple forms of technology. The main cause of the large number of unused or abandoned computers in nations that are developing, particularly in Africa, is a lack in these resources. The standard Western model of ownership by individuals is insufficient to meet the problem of introducing information technology to rural areas, regardless of the case of cell phones (particularly but not limited to Africa) [6]. Technology for connection here are suggestions made. For electrical grid applications, the PLC system is thought to be the most developed method of communication. The large amount of investigation done in this area and the reach of power line technology are two for the primary causes of this. Comparing to other possible and proposed options, building of Software Based PLC Modems substantially lowers the installation as well as the costs of the whole system [7]. Technologies to connect in a smart grid environment. It illustrates these technologies'

Copyright@ REST Publisher

present status for various electrical grid uses. It also makes reference to recent studies in these areas along with accessible ways to communicate. Applications and cases from the four main electricity system/network components—power generation, power transmission, power distribution, and consumer were taken into consideration for evaluation. GSM/GRPS technologies are becoming progressively more prevalent in both traditional and unusual generations for clever connectivity. It has been hard for other forms of technology to enter this market. This is a result of how reliable the GSM/GPRS communication techniques are [8]. Technologies of Information and Communication (ICT). Numerous important topics are covered, such how ICT influences education, how instructors are evolving in educational environments, and what novel abilities they must have to use new technology. The piece makes the case that bringing ICT into education poses basic queries concerning the essence of education and instruction and could put the concept of "time and space" to the test. An assessment of ICT applications in US and UK primary schools is given in this article. The final part discusses upcoming technologies (along with relevant websites) to see how they may improve future "anytime, anywhere" learning possibilities [9]. One of the most significant challenges facing instructors worldwide is the use of technology for communication and information (ICT) in the classroom. On the other hand, society greatly impacts the creation, application, and governance of data, interactions, and education systems (Wild, 1999). Instructors in distinct instructive cultures in the United States and the East incorporate and use technological tools for a range of purposes. Even though cultural variances are usually slight, studying the differences will help to comprehend the contextual limitations and other options, and will help you build an innovative learning strategy that is culturally adapted. Using a lens of culture, this essay analyzes the rise of ICT in Chinese along with other Eastern cultures' classroom while bringing up important issues that need to be taken properly [10]. The Information and Communication Technology (ICT) industry is a powerful emblem of innovation and technical advancement in society at large. As a matter of fact, this industry's employment, work structure, and technology usage habits frequently precede those of other industries. The obvious explanation is that the industry produces the majority of the technologies that change lives and jobs throughout economies and civilizations. It bases its methods on using its own inventions for self-application. These technologies expanded to other areas and sectors of society at the same time, changing and adapting to their new surroundings [11]. Information and communication technologies, or ICTs, are anticipated to be crucial to growth. Many believe that these technologies have the power to revolutionize unprofitable sectors, fix broken public institutions, and open up previously unheard-of possibilities for information-intensive social services like healthcare and education. However, it is well acknowledged that obtaining these growth benefits has proven challenging due to a multitude of intricate factors. Here, there are two connected issues. First of all, a lot of businesses struggle to create and maintain sophisticated technological projects for the extended durations usually needed. Secondly, the ICT-based solutions that are produced might not significantly reduce the institutional vulnerability that they are meant to address [12]. There are several indications that in the future, the telephone will play a significant role in raising living standards and income levels on a large scale. The convergence of phone access across the nation is still a historical tendency (Grace et al., 2001). This is due, in part, to the fact that phones are becoming more and more affordable as technology advances. As we have shown, for the previous forty years, the average amount of work that can be done from home at a particular income level has increased, and new advancements are probably going to speed up this trend. For instance, where fixed-line provision is not feasible, the Grameenphone program previously mentioned depends on mobile telephony to give connectivity [13]. technologies for communication that are based on an analysis of the features of technology according to the type of job that employees do and how it is organized. According to our argument, communication technologies can be graded according to how well they facilitate collaboration, especially when it comes to the intensive information sharing needed for technology transfer and planning. Based on an examination of the features of voicemail, email, and telephones, we anticipated that using the phone and, moreover, email would be linked to technical staff communication and communication across organizational boundaries [14].

2. MATERIALS AND METHOD

Bluetooth: Gadgets can communicate with each other securely via Bluetooth technology. Anything that comes with Bluetooth connectivity may interact as long as it is inside the necessary distance. Bluetooth connectivity is based on short-range radio signals. A majority of business-related devices, such as pocket speakers, a pair of headphones, and smart phones, are defined as Class 2 and have a range of approximately 33 feet. Bluetooth 5.0.0 and later upgrades better efficiency and bandwidth. The technology behind Bluetooth is totally computerized and wireless. It is also

extremely inexpensive Excellent reliability, little interference, low power consumption, voice and information exchange, encrypted network.

Z-wave: Z-wave technology and Zig are requirements for communications that are wireless. Their function is to set up linkages amongst devices in an artificial home system. The starting point for each is the networking mesh concept, stating that data "hops" or travels from one gadget to another till it gets to where it was intended. Z-wave technology is a standard for communicating via wireless devices.

ZigBee: By transmitting information across a distributed system of intermediary equipment to reach farther-off devices, Zig sensors can carry data across enormous distances. Low bandwidth applications that demand long battery life and secure networking often use ZigBee. Several cable and phone companies use Zig in their telecommunications equipment, satellites transmitters, and home gateway in order to give clients with energy-efficiency and residence surveillance solutions. Distributors of interconnected illumination items for households as well as companies use

LoRaWAN: Long-distance communication connections is rendered possible via the LoRa practical layer, while LoRaWAN as describes the system's connection protocol and system framework. Likewise LoRaWAN networks is in the role of controlling all equipment' power, communication efficiency, and communication frequencies. LoRa radio modulation is the foundation for the low-power devices, wide-area wireless network known as LoRaWAN technology It controls communication between end-node devices and gateways to the network and wirelessly connected devices to the Internet. LoRa radio encoding is the basis for the low-power devices, wide-area networking technology known as LoRaWAN. It controls communication between end-node devices and gateway networks and establishes wireless links among devices and the web.

Wi-Fi: Using electromagnetic radiation, wireless internet is a type of wireless networking that provides mobile users with quick access to the Internet. Unbelievably, some people believe that having access to the Internet equates to "portable fidelity," even though IEEE 802.11x standards are the intellectual property of Cisco. Wi-Fi and other Computers, laptops, mobile devices, and many other products may be linked to the Web via Wireless devices. A wireless router transmits a radio signal to an adjacent device, which interprets it into observable and useable data. The outcome is referred to as Wi-Fi.

WiMAX: The International Infrastructure for Wimax Access, or WiMAX, aims to enable wireless information transmission over long distances through various methods, including point-to-point networks devoid of cellular access. As a means to offer an always-on connected internet option, WiMAX, which an IP-based internet connection technology, may be included in mobility and wireline connections, including wide-area third-generation (3G) wireless networks. Providing internet access offered by a service supplier is the intent of the college environment. With one WiMAX center station, an operator can reach a full institutional instead of requiring many bases for various other wireless technologies for example Wi-Fi..

Standard/ governing bodies: The organization's basic administrative body, the International Organization for Standardization (ISO) Committee, answers to its board of directors. A total of twenty organizations with members, ISO employees, and members of the CASCO, COPOLCO, and DEVCO Policy Development Boards make up the committee that meets twice a year.

Frequency: In science, speed is the amount of oscillations that travel to from one location to another in a unit time. It can additionally be defined as the number of rotational motions or oscillations that a body in continuous motion makes in a unit of time. Speed is defined as the quantity of phases or phases per second. The hertz (Hz) is the SI unit for frequency. A single revolution per second is comparable to one hertz.

Range: The difference between a set's greatest and lowest values. In mathematics, an interval, occasionally referred to as a range or a range, is the set of real numbers containing all values among both values in the set. The variation between the highest and lowest numbers in an equation for a specific set of data is called its range of values. As an example, the band of values will be $10 – 2 = 8$ if the information being provided set is {2,5,8,10,3}.

Data rates: bytes per second is a measure of measuring used to quantify the frequency at when information moves within the machine or across a peripheral gadget and a computer. Verify where it is, time, and exchange rate. (2) The bit-per-second rate at which both video and audio data is encrypted (compressed).

Method: For performance and quality measurements, The TOPSIS technique, which stands for Method for Preference for Order by Parallels to Ideal a solution, offers an open assessment involves combines qualitative as well as quantitative aspects. For the criteria with unclear values, the method first uses weight assignment by weighted averaging. The best and worst solutions are then identified based on the highest and lowest scores in the performance metric. Next, an intermediate The difference across each scheme Then the TOPSIS technique is applied to find the optimal and anti-ideal alternatives. The schemes' rankings are then established by calculating the

Copyright@ REST Publisher

alternatives' proximity to the ideal solution set. Ultimately, a process is implemented to showcase the earlier method's operating process and its suitability [15]. Clear assessments of both quantitative and qualitative factors in performance and quality measures are offered by the TOPSIS technique. First, the method's basis involves evaluating criteria with unclear values using weighting and weighted average. It also identifies the best and worst solutions based on the performance metric's highest and lowest scores. Moreover, the performance score throughout the method's implementation is used to compare better and worse alternatives. Next, an intermediate distance is determined by calculating the separations of Each choice from the optimal course to follow and beyond the ideal and anti-ideal solutions. The TOPSIS approach with exact and unambiguous interim values helps resolve conflicts between assessments. Personalized preference orders are possible, though, if there are more than five modifications. [16]. The modified TOPSIS approach evaluates both the quantity and quality of data using sharp and fuzzy assessment criteria. The TOPSIS method has been incorporated by scholars like Sen and others into software review and operational management, demonstrating its clear methodology. Language-specific words are used to assess elements and weights, which are then converted into clear or hazy numerical values. For the purpose of evaluating robots in industrial settings, Rao and Padmanabhan have developed a system based on the TOPSIS and matrix approaches. Furthermore, they have approved the outcomes of the MCDM approach (TOPSIS) and chosen a robot for industrial use [17]. 36 options should measure the shortest distance and 37 the ideal distance among the positive values used by the TOPSIS approach. The theory and applications of TOPSIS are extensively documented in literature" Rank reversal is one of the issues that TOPSIS causes." The order of the alternatives in this software is affected by the Adding or removing something from the process of choosing This is sometimes referred to as total rank. Inversion: When the order is entirely reversed, the best option is regarded as the one that adds to or corrects the worst alternative during the process. Such a phenomenon may not be acceptable in many situations. According to Vaung et al. and Luvo (2009), rank inversion is limited to the TOPSIS approach [18]. The TOPSIS approach has a few shortcomings. One significant disadvantage is that it causes phenomena known as rank reversal. This indicates that adding or removing an option from the choice problem modifies the preference order of the remaining alternatives. This is sometimes referred to as "total rank inversion," when the preferences are arranged in reverse order, with one option being deemed superior, followed by worse, and then adding or eliminating the alternative from consideration. Such a scenario frequently may [19]. For evaluation, the TOPSIS approach using forward/forward technology materials has been applied. Thus, it enables the evaluation of various fuel cells, such as gas gasoline engine, hydrogen fuel solid-state oxide fuel cell, hydro fuel phosphorus fuel cell, and propane fuel cell. The aforementioned category of operating units includes the gases-fueled solid-oxygen fuel cell, which includes the gases-fueled engine, gas turbine, and natural gas-fueled mixed cycle. Other analyzing variables are carbon dioxide (CO2), NOX emissions, productivity, initial cost, costs of operation and upkeep, service life, and the value for the energy provided. [20]. There are still some shortcomings with the TOPSIS technique. We attempt to broaden the area of the suggested solutions' applicability; however the articles in our study are restricted to analyzing instances of ranking changes through the addition or deletion of alternatives. In other words, we started by doing an analysis to find important rank inversion examples that have been published in the literature and to pinpoint important topsis method gaps. Next, we establish a framework for assessing the suggested model as well as the TOPSIS approach [21]. The corresponding weights for every standard and the assessments of the alternatives in the TOPSIS technique are based on actual values. Numerous fields have seen the successful application of the traditional TOPSIS technique. The literature contains a thorough analysis of TOPSIS technique applications. These estimates are given as fuzzy values because, depending on local conditions, it might occasionally be challenging to ascertain the true values of the assessment of alternatives. A few scholarly articles focus on fuzzy extensions of the TOPSIS technique; however, these extensions are not all-inclusive and may result in ambiguous values that cannot be achieved in the result matrix [9]. The Hsu and Chen method is applied in the TOPSIS method to change the objective criteria. This guarantees consistency between the language assessments of the subjective criteria and the objective criteria's values. The member function of each weighted estimate for every option and condition is computed using gap arithmetic of numbers that are uncertain. The weighted projections are decomposed into smoothed values employing the ranking technique of calculating the mean of cuts, which avoids the arduous aggregate of arbitrary numbers that are uncertain [22]. After calculating the distances between all possibilities and the very best and negative-best answers, the closeness ratio is used to decide which choices are ranked most. Finally, another numerical instance illustrates the mathematical calculations of the suggested procedure [10] the TOPSIS approach method. The ordering of steps drawn from "classical" and "new" technique is not always the same, as Garca-Cascales and Lamata (2012) noted. This revisiting of the operations of the measurement mechanism. The estimations and weights of 70 criteria are known with precision for the 69 classical MCDM approaches. These

Copyright@ REST Publisher

techniques are reviewed in Hwang and Yoon (1981), p. 71. The real 73 numbers determine the assessment of the choices and the weights assigned to the standards 72 in the traditional TOPSIS technique. Multi-criteria decision-making problems are not immediately addressed by the TOPSIS approach put forth by [23]. First, interval fuzzy attribute values are subjected to weighted computations depending on the interval value's operational criteria. It uses a score function to determine which solutions are the best and worse. It then determines the interval fuzzy value's distance and the distance between each project's best and worst options. The TOPSIS method's guiding principles are applied in this procedure [12]. The TOPSIS approach described in works quite well for quickly determining the best option. By combining entropy weighting with the TOPSIS method for information system selection, this study presents a revolutionary method. The intended weights of each of the parameters in this case are calculated via a revised entropy of information technique [13].

3. RESULTS AND DICUSSION

TABLE 1. Communication technologies

Communication technologies	Standard/ governing bodies	Frequency	Range (approximately)	Data rates
Bluetooth	42.02	145.52	30.54	22.05
Z-Wave	25.63	164.58	31.56	28.26
ZigBee	24.08	132.22	29.18	23.10
LoRaWAN	25.37	172.09	24.60	25.74
WiFi	45.36	176.24	72.65	19.25
WiMAX	**15**	**32**	**25**	**10**

Table 1shows the Communication technologies by using TOPSIS METHOD in alternative value in Bluetooth, Z-Wave, ZigBee, LoRaWAN, WiFi, WiMAX and Evaluation value Transaction Throughput (Standard/, Frequency, Range, Data rates it is also data set value.

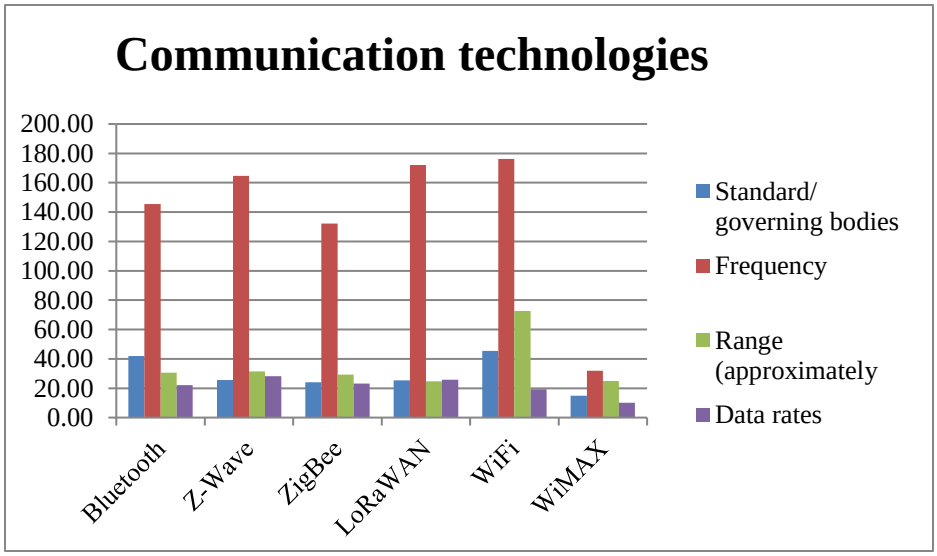


FIGURE 1. Communication technologies

Figure 1shows the Communication technologies by using TOPSIS METHOD in alternative value in Bluetooth, Z-Wave, ZigBee, LoRaWAN, WiFi,WiMAX and Evaluation value Transaction Throughput (Standard/, Frequency, Range, Data rates

Copyright@ REST Publisher

TABLE 2. Normalized Data

Communication technologies	Standard/ governing bodies	Frequency	Range (approximately	Data rates
Bluetooth	0.5457		0.3169	0.4059
Z-Wave	0.3329	0.4610	0.3275	0.5202
ZigBee	0.3127	0.3704	0.3028	0.4252
LoRaWAN	0.3295	0.4821	0.2552	0.4738
WiFi	0.5891	0.4937	0.7538	0.3543
WiMAX	0.1948	0.0896	0.2594	0.1841

Table 2 shows the Normalized data Communication technologies. Computational time, Simplicity, Mathematical calculations involved, Bluetooth, Z-Wave, ZigBee, LoRaWAN, WiFi,WiMAX it is also the Maximum in Normalized value.

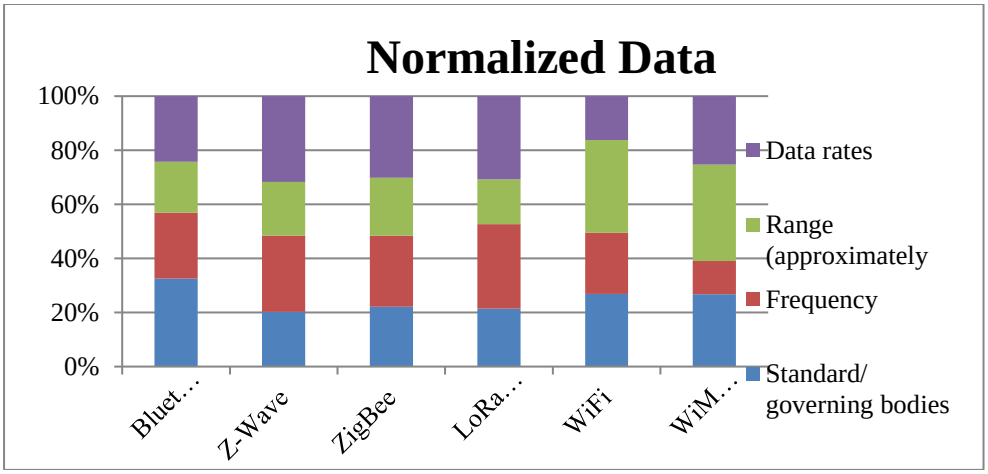


FIGURE 2. Normalized Data

Figure 2**s**hows the various Normalized Data for Communication technologies for Analysis using the TOPSIS Method. Computational time, Simplicity, Mathematical calculations involved, Bluetooth, Z-Wave, ZigBee, LoRaWAN, WiFi,WiMAX it is also the Maximum in Normalized value. it is also data set value.

TABLE 3. Weightages

0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25

Table 3 shows Weightages used for the analysis. We taken same weights for all the parameters for the analysis.

Copyright@ REST Publisher

TABLE 4. Weighted normalized decision matrix

	Weighted normalized decision matrix			
Bluetooth	0.1019	0.1019	0.0792	0.1015
Z-Wave	0.0832	0.1153	0.0819	0.1300
ZigBee	0.0782	0.0926	0.0757	0.1063
LoRaWAN	0.0824	0.1205	0.0638	0.1184
WiFi	0.1473	0.1234	0.1885	0.0886
WiMAX	0.0487	0.0224	0.0649	0.0460

Table 4 shows the Weighted normalized decision matrix for Social Communication technologies for Analysis using the TOPSIS Method. Computational time, Simplicity, Mathematical calculations involved, Bluetooth, Z-Wave, ZigBee, LoRaWAN, WiFi, WiMAX it is also data set value.

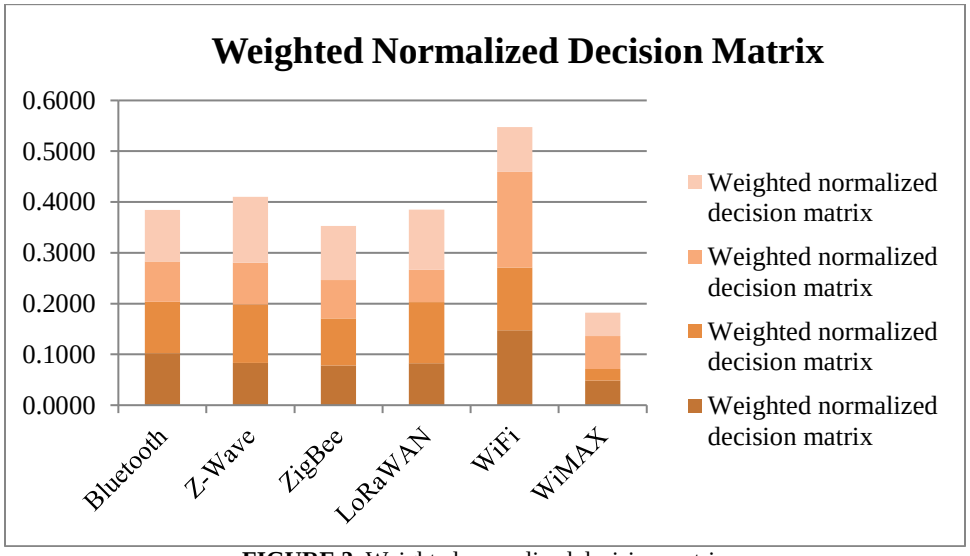


FIGURE 3. Weighted normalized decision matrix

Figure 3 the Weighted normalized decision matrix for Communication technologies for Analysis using the TOPSIS Method. Computational time, Simplicity, Mathematical calculations involved, Bluetooth, Z-Wave, ZigBee, LoRaWAN, WiFi, WiMAX it is also data set value.

TABLE 5. Positive and Negative Matrix

	Positive Matrix				Negetive matrix			
Bluetooth	0.1473	0.1234	0.0638	0.0460	0.0487	0.0224	0.1885	0.1300
Z-Wave	0.1473	0.1234	0.0638	0.0460	0.0487	0.0224	0.1885	0.1300
ZigBee	0.1473	0.1234	0.0638	0.0460	0.0487	0.0224	0.1885	0.1300
LoRaWAN	0.1473	0.1234	0.0638	0.0460	0.0487	0.0224	0.1885	0.1300
WiFi	0.1473	0.1234	0.0638	0.0460	0.0487	0.0224	0.1885	0.1300
WiMAX	0.1473	0.1234	0.0638	0.0460	0.0487	0.0224	0.1885	0.1300

Table 5 shows the Positive and Negative Matrix for Communication technologies for Analysis using the TOPSIS Method. Computational time, Simplicity, Mathematical calculations involved, Bluetooth, Z-Wave, ZigBee,

Copyright@ REST Publisher

LoRaWAN, WiFi, WiMAX Matrix in Maximum value0.1473,0.1234, Minimum value0.1234,0.0638is taken and for Negative matrix the Minimum value0.0487,0.0224and Maximum value0.1885,0.1300 is taken

TABLE 6. Final Result of Communication technologies

	SI Plus	Si Negative	Ci	Rank
Bluetooth	0.0764	0.1480	0.6596	**1**
Z-Wave	0.1075	0.1455	0.5751	**4**
ZigBee	0.0975	0.1381	0.5863	**3**
LoRaWAN	0.0973	0.1626	0.6256	**2**
WiFi	0.1317	0.1471	0.5276	**5**
WiMAX	0.1411	0.1495	0.5143	**6**

Table 6 shows the final result of TOPSIS for Communication technologies. In Table 6, Si positive is calculated using the formula (3). From figure 3, In Si positive, Bluetooth is having is Higher Value and WiMAX is having Lower value. Si Negative is calculated using the formula (4). In Si Negative WiMAX is having is Higher Value Alternative WiFi is having Lower value. Ciis calculated using the formula (5). In Ci, Bluetooth is having is Higher Value and Alternative WiMAX is having Lower value.

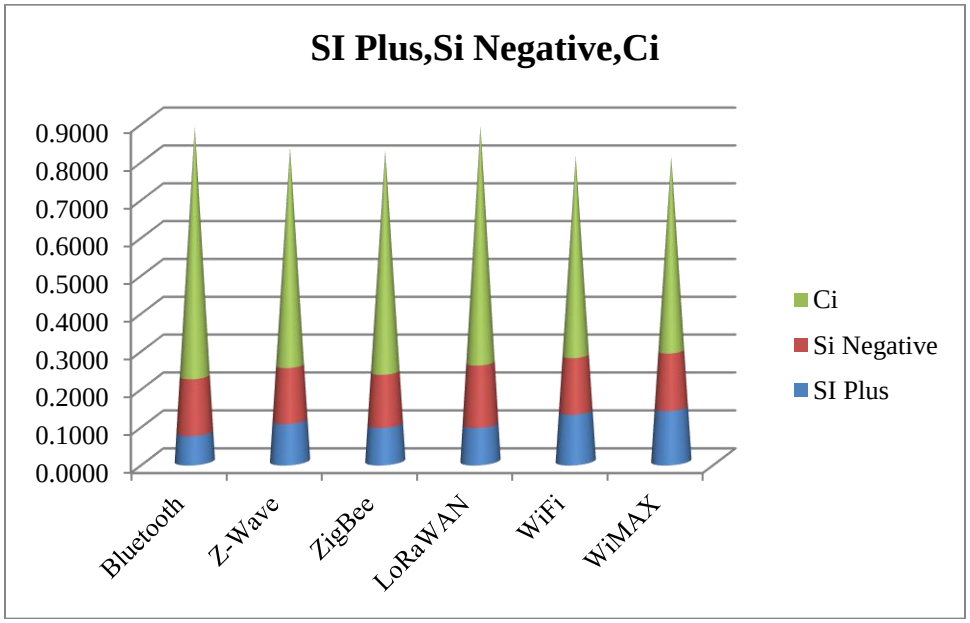


FIGURE 4. Result of Communication technologies

shows the final result of TOPSIS for Communication technologies. In Table 6, Si positive is calculated using the formula (3). From figure 3, In Si positive, Bluetooth is having is Higher Value and WiMAX is having Lower value. Si Negative is calculated using the formula (4). In Si Negative WiMAX is having is Higher Value Alternative WiFi is having Lower value. Ciis calculated using the formula (5). In Ci, Bluetooth is having is Higher Value and Alternative WiMAX is having Lower value.

Copyright@ REST Publisher

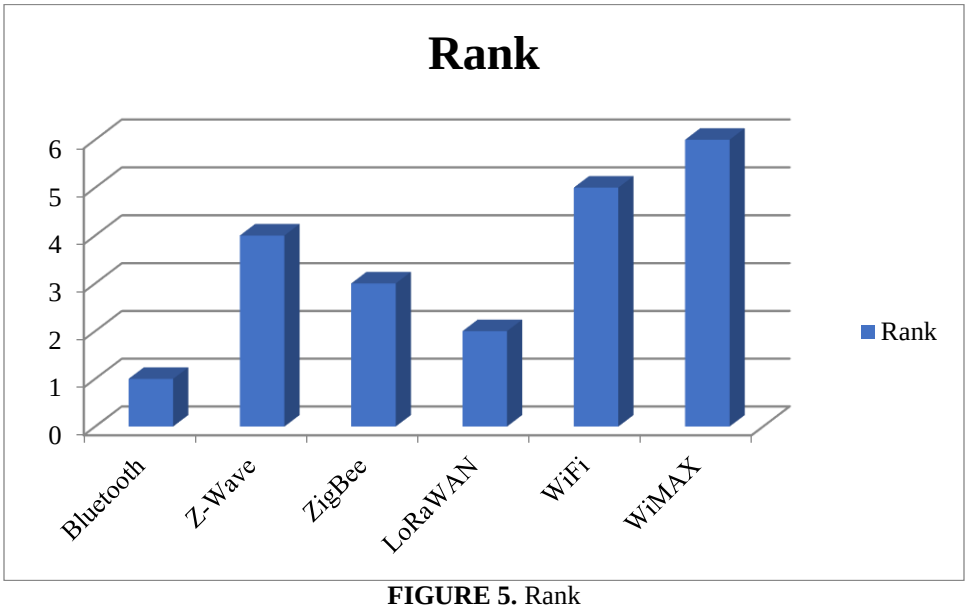


FIGURE 5. Rank

Figure 4 Shows the Ranking of Communication technologies. Bluetooth is got the first rank whereas is WiMAX is having the Lowest rank.

4. CONCLUSION

Transportation-related information and communication technologies (ICTs). Under The three branches of collecting information and user guiding (for transportation system), operating and management of cargo infrastructure for transport, and leading and operation of systems (all types), a variety of applications are researched. A succinct and critical analysis of the uses of the several technologies that are currently in use in their last stages of exploration or commercial deployment is provided for any of those. The review covers the several subcategories of the top three. The essay goes on to look at potential futures with 2010 as the medium-term horizon. Information and communication technologies, or ICTs, are anticipated to be crucial to growth. Many believe that these technologies have the power to revolutionize unprofitable sectors, fix broken public institutions, and open up previously unheard-of possibilities for information-intensive social services like healthcare and education. However, it is well acknowledged that obtaining these growth benefits has proven challenging due to a multitude of intricate factors. Here, there are two connected issues. First of all, a lot of businesses struggle to create and maintain sophisticated technological projects for the extended durations usually needed. Secondly, the ICT-based solutions that are produced might not significantly reduce the institutional vulnerability that they are meant to address. There are several indications that in the future, the telephone will play a significant role in raising living standards and income levels on a large scale. Research is being conducted to explore opportunities for the Information and communication technology or ICT, connection across sectors tourism sector. Various applications are being investigated under the following three main headings network functionality and performance (in all its forms), information and user guidance (of tourism systems), and the efficiency of operation and commercialization of tourism systems. Evaluation focuses on assessing the diverse applications of various technologies available today, in terms of their final development or commercialization prospects and their impact on the industry. These prospects demonstrate how numerous applications have proven technologies and safeguard the sustainability of businesses. this decade's tendency Technologies for gathering and disseminating traffic data and related data are a few examples of these application areas. Shows the Ranking of Communication technologies. Bluetooth is got the first rank whereas is WiMAX is having the Lowest rank.

Copyright@ REST Publisher

REFERENCES

[1]. Yzer, M. C., & Southwell, B. G. (2008). New communication technologies, old questions. American Behavioral Scientist, 52(1), 8-20.

[2]. Hayes, N., 1998. Communication Technologies. Organization, 5(4), pp.630-633.

[3]. Rogers, E.M., 1986. Communication technology. Simon and Schuster.

[4]. Ramprasath, Muthukrishnan, and Shanmugasundaram Hariharan. "A survey on question answering system." *International Journal of Research and Reviews in Information Sciences* 2, no. 1 (2012).

[5]. Bhuyan, Hemanta Kumar, and Narendra Kumar Kamila. "Privacy preserving sub-feature selection in distributed data mining." *Applied soft computing* 36 (2015): 552-569.

[6]. Gungor, V.C., Sahin, D., Kocak, T., Ergut, S., Buccella, C., Cecati, C. and Hancke, G.P., 2011. Smart grid technologies: Communication technologies and standards. IEEE transactions on Industrial informatics, 7(4), pp.529-539.

[7]. Gungor, Vehbi C., Dilan Sahin, Taskin Kocak, Salih Ergut, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke. "Smart grid technologies: Communication technologies and standards." IEEE transactions on Industrial informatics 7, no. 4 (2011): 529-539.

[8]. Heeks, R., 1999. Information and communication technologies, poverty and development. Development informatics working paper, (5).

[9]. Bhuyan, Hemanta Kumar, and Vinayakumar Ravi. "An integrated framework with deep learning for segmentation and classification of cancer disease." *International Journal on Artificial Intelligence Tools* 32, no. 02 (2023): 2340002.

[10]. Banerjee, Deepak, Vinay Kukreja, Shanmugasundaram Hariharan, Vishal Jain, and Soumi Dutta. "An intelligent framework for grassy shoot disease severity detection and classification in sugarcane crop." In *2023 2nd international conference on applied artificial intelligence and computing (ICAAIC)*, pp. 849-854. IEEE, 2023.

[11]. Giannopoulos, G.A., 2004. The application of information and communication technologies in transport. European journal of operational research, 152(2), pp.302-320.

[12]. Hamel, Jean-Yves. "Information and communication technologies and migration." (2009).

[13]. Qiang, C.Z.W., Pitt, A. and Ayers, S., 2004. Contribution of information and communication technologies to growth (Vol. 41181, No. 4). World Bank Publications.

[14]. Morley, D. and Silverstone, R., 1990. Domestic communication—technologies and meanings. Media, culture & society, 12(1), pp.31-55.

[15]. Unwin, P. Tim H., and Tim Unwin. Reclaiming information and communication technologies for development. Oxford University Press, 2017.

[16]. Banerjee, Deepak, Vinay Kukreja, Shanmugasundaram Hariharan, Vishal Jain, and Varun Jindal. "Hybrid CNN & Random Forest Approach for Accurate Identification of Tomato Plant Diseases." In *2023 World Conference on Communication & Computing (WCONF)*, pp. 1-6. IEEE, 2023.

[17]. Bhuyan, Hemanta Kumar, and Vinayakumar Ravi. "Analysis of subfeature for classification in data mining." *IEEE Transactions on Engineering Management* 70, no. 8 (2021): 2732-2746.

[18]. Fuchs, Christian. "The implications of new information and communication technologies for sustainability." Environment, Development and Sustainability 10 (2008): 291-309.

[19]. Eggleston, Karen, Robert Jensen, and Richard Zeckhauser. "Information and communication technologies, markets, and economic development." The Global Information Technology Report 2001-2002: Readiness for the Networked World (2002).

[20]. Eggleston, Karen, Robert Jensen, and Richard Zeckhauser. "Information and communication technologies, markets, and economic development." The Global Information Technology Report 2001-2002: Readiness for the Networked World (2002).

[21]. Hamelink, Cees J., and Cees J. Hamelink. New information and communication technologies, social development and cultural change. Vol. 86. Geneva: United Nations Research Institute for Social Development, 1997.

[22]. Çelikbilek Y, Tüysüz F. An in-depth review of theory of the TOPSIS method: An experimental analysis. Journal of Management Analytics. 2020 Apr 2;7(2):281-300.

[23]. Banerjee, Deepak, Vinay Kukreja, Shanmugasundaram Hariharan, Vishal Jain, and Soumi Dutta. "Hybrid CNN-SVM approach with regularization for accurate classification of images: a case study on Rudraksha Beads." In *2023 International Conference on Disruptive Technologies (ICDT)*, pp. 676-680. IEEE, 2023.

[24]. Kamila, Narendra Kumar, Lambodar Jena, and Hemanta Kumar Bhuyan. "Pareto-based multi-objective optimization for classification in data mining." *Cluster computing* 19, no. 4 (2016): 1723-1745.

[25]. Kakulavaram, Sridhar. "Artificial Intelligence-Driven Frameworks for Enhanced Risk Management in Life Insurance." *Journal of Computational Analysis and Applications* 33, no. 8 (2024).

[26]. Kanumarlapudi, P. K. "Improving Data Market Implementation Using Gray Relational Analysis in Decentralized Environments." *Journal of Artificial intelligence and Machine Learning* 2, no. 1 (2024): 1-7.

Copyright@ REST Publisher

[27]. Peram, S. R. "Advanced Network Traffic Visualization and Anomaly Detection Using PCA-MDS Integration and Histogram Gradient Boosting Regression." *Journal of Artificial Intelligence and Machine Learning* 1, no. 3 (2023): 281.
[28]. Chandrasekar Raja, Ramya Sharma, Nathiya Murali, Ramchandran Manickam, "Evaluating Key Factors in Autonomous Maintenance Using Grey Relational Analysis: A Focus on Weight and Data Analysis", Aeronautical and Aerospace Engineering, 3(1), March 2025, 1-11
[29]. Ren, Lifeng, Yanqiong Zhang, Yiren Wang, and Zhenqiu Sun. "Comparative analysis of a novel M-TOPSIS method and TOPSIS." Applied Mathematics Research eXpress 2007 (2007): abm005.
[30]. Pavić, Z. and Novoselac, V., 2013. Notes on TOPSIS method. International Journal of Research in Engineering and Science, 1(2), pp.5-12.
[31]. Zavadskas, Edmundas Kazimieras, Abbas Mardani, Zenonas Turskis, Ahmad Jusoh, and Khalil MD Nor. "Development of TOPSIS method to solve complicated decision-making problems—An overview on developments from 2000 to 2015." International Journal of Information Technology & Decision Making 15, no. 03 (2016): 645-682.
[32]. García-Cascales, M.S. and Lamata, M.T., 2012. On rank reversal and TOPSIS method. Mathematical and computer modelling, 56(5-6), pp.123-132.
[33]. Banerjee, Deepak, Vinay Kukreja, Dibyahash Bordoloi, and Kireet Joshi. "Hybrid CNN & random forest model for effective turmeric leaf disease diagnosis." In *2023 3rd International Conference on Smart Generation Computing, Communication and Networking (SMART GENCON)*, pp. 1-6. IEEE, 2023.
[34]. Dymova, L., Sevastjanov, P. and Tikhonenko, A., 2013. A direct interval extension of TOPSIS method. Expert Systems with Applications, 40(12), pp.4841-4847.
[35]. Liu, Peide. "Multi-attribute decision-making method research based on interval vague set and TOPSIS method." Technological and economic development of economy 15, no. 3 (2009): 453-463.ssss
[36]. Bhuyan, Hemanta Kumar, Narendra Kumar Kamila, and Subhendu Kumar Pani. "Individual privacy in data mining using fuzzy optimization." *Engineering Optimization* 54, no. 8 (2022): 1305-1323.
[37]. Kakulavaram, Sridhar. "Life Insurance Customer Prediction and Sustainbility Analysis Using Machine Learning Techniques." *International Journal of Intelligent Systems and Applications in Engineering* 10 (2022).
[38]. Praveen Kumar Kanumarlapudi, "Enhancing Generative AI Shopping Assistants through Advanced Multi-Attribute Decision Making Technique." Journal of Artificial Intelligence and Machine Learning, 3(2), (2025): 1-7. DOI: 10.55124/jaim.v3i2.267.
[39]. Peram, S. R. "Automated Label Detection and Recommendation System Using Deep Convolution Neural Networks and SPSS-Based Evaluation." *International Journal of Computer Science and Data Engineering* 1, no. 2 (2024): 258.

Copyright@ REST Publisher