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Health Management Information Systems

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Abstract: *Health management information systems (HMIS) have been developed to provide comprehensive and integrated solutions for managing and evaluating health-related data within healthcare organizations. These systems are designed to support various objectives, including patient care, administrative decision making, policy development, and research activities. They encompass a wide range of features, such as data collection, storage, retrieval, and sharing. HMIS plays a critical role in enhancing operational efficiency, effectiveness, and overall quality of healthcare delivery. As a result, it is a vital resource for policymakers, administrators, and healthcare professionals, serving as a valuable tool to support their responsibilities and improve healthcare outcomes. Research on health management information systems (HMIS) is crucial as it significantly influences healthcare delivery, decision-making processes, and ultimately, patient outcomes. Recognizing the importance of HMIS research is essential in identifying the necessity for investigating and enhancing these systems. The primary objectives of HMIS research include revolutionizing healthcare provision, providing valuable insights for policy-making, enhancing patient outcomes, and advancing healthcare research and development. By focusing on these goals, HMIS research aims to drive improvements in the healthcare sector and contribute to the overall advancement of healthcare practices. The DEMATEL method is a reliable approach for evaluating the complex interdependencies and interactions among components in decision-making scenarios. It offers a well-structured framework for understanding how various components in a choice problem interact with one another. Originally developed by Taiwanese researcher Dr. Hsi-Mei Hsu in the early 1970s, this method serves as a valuable tool for examining and comprehending the intricate dynamics involved in decision-making processes. By applying the DEMATEL method, decision-makers can gain deeper insights into the relationships between different factors and make more informed choices. Through the rank table, we can get the rank of alternative parameters. Whereas C1 is in 1st position and C4 is in 6th position. first ranking C1 is obtained with the lowest quality of C4.*

Keywords: *Health Management Information, DEMATEL, MCDM.*

1. INTRODUCTION

As information systems play a crucial role in determining and enhancing the quality and accessibility of healthcare services, their importance in the field of medicine continues to grow. The transition from palliative care to preventive care, from hospital-centered models to public health and community-cantered approaches, and from centralized to decentralized healthcare systems has created a need to consolidate dispersed health information systems into a single, comprehensive entity known as Healthcare and Management Information Systems (HMIS). Rebuilding health information systems in underdeveloped nations is of utmost importance, considering that primary healthcare has been globally recognized as a strategy for achieving universal health goals (Campbell, 1997). However, finding a uniform solution that works in all situations remains a challenge, and the process of reorganizing and improving these systems continues to be a learning experience [1]. For deploying reporting applications and uploading data to the DHIS2 database, basic feature phones were adequate. They lacked the tools for visualising and analysing data, therefore they were unable to monitor and use C-DHIS2 data at several levels, including health centres, districts, and central administration. Individuals, in particular Community Health Workers (CHWs), need cell phones, laptops, or personal computers to conduct data analysis. Our research shows that CHWs need continuing technical support to handle software (app) and hardware (phones and SIM cards) problems they run into while utilising mobile phone applications on a daily basis. It should be mentioned that in some areas of the district, inadequate cell network coverage made the usage of software difficult [2]. An efficient and standardized health reporting framework is essential for improving the entire health system as it provides timely data for organizing, tracking, and assessing service delivery across all levels. However, the widespread use of paper-based data collecting and storage systems leads to incomplete and erroneous reports, particularly in developing nations, especially in sub-Saharan Africa.

Research indicates that the continued reliance on paper-based systems results in poor data quality, including issues with availability, timeliness, dependability, and completeness of reports, which ultimately hampers the provision of health services. The introduction of web-based health information systems offers an opportunity to enhance health reporting. While these systems are predominantly used in affluent countries, they are increasingly gaining popularity in underdeveloped nations as well. A study conducted in the United States evaluated the impact of an internet-based reporting system on gathering data regarding medication errors, demonstrating its potential to improve the collection of precise and effective data, thereby enhancing the process of planning and decision-making [3]. Due to the uneven funding of health programs, especially those aimed at addressing the HIV/AIDS epidemic, developing nations face a persistent challenge in establishing efficient and adaptable health information systems. Within a nation's healthcare system, there are various institutions, ranging from large, technologically sophisticated hospitals to small, basic healthcare centers. These organizations are governed by multiple, mutually exclusive organizational structures, which are further divided into districts, provinces, and nations. Additionally, there are vertical programs that focus on specific fields such as HIV/AIDS, maternity health, and immunization services [4]. Healthcare systems across the United States are rapidly adopting electronic health records (EHRs) along with healthcare information exchanges (HIEs). These systems provide a vast amount of information that can be utilized to enhance healthcare quality, delivery, and service provision. However, due to their substantial size and complexity, analyzing and effectively utilizing such data poses challenges. The emergence of big data technology holds tremendous potential in healthcare as it enables the processing of diverse data types quickly and on a massive scale. By improving outcomes and reducing costs in healthcare settings, this capability has the capacity to generate significant value (Rosky et al., 2014). Big data analytics have demonstrated their ability to elevate the standard of treatment, optimize healthcare spending across all levels, predict and prepare for disease outbreaks, and streamline administrative procedures [5]. A complete health data system that may be used in community, institutional, & hospital-based settings is becoming more and more in demand. For people with similar healthcare needs, this system should be able to accommodate modifications to the service delivery structure, procedure, and locations. To promote smooth treatment transitions and lessen the burden of evaluation when patients move between multiple healthcare sectors, it is essential to establish a system that retains similar information across diverse healthcare settings. The RAI/MDS family of assessment instruments provides unified information about health system with standard language, core items, and a uniform conceptual framework that follows a clinical method that emphasises the diagnosis of functional impairments [6]. There are many difficulties in providing and maintaining healthcare in underprivileged populations and areas of developing nations. Examples include India, which has a vast population and few primary healthcare facilities, Mozambique, which has high rates of maternal mortality, and South Africa, which is battling the HIV/AIDS epidemic. Meeting the healthcare demands of their populations presents significant challenges for these nations. The issues with providing medical services in these environments are being acknowledged by international organisations like the World Health Organisation (WHO), elected officials, information technology experts, growth theorists, and academics from a variety of fields, including public health [7]. Environmental Management Information Systems (EMIS) and Environmental Management Systems (EMS) have grown in popularity over the past 10 years, but the information systems (IS) community has paid them little attention. The multidisciplinary nature in the environmental administration area and the relatively recent growth of the sector can be blamed for this lack of interest. Environmental concerns have, however, been more generally accepted by other business disciplines, including management, operations research, or operations management. This also takes into account the viewpoints of administrative and industrial engineers. By developing and carrying out large-scale systems that aid in strategic decision-making and make it easier to integrate information management strategies, the IS community has the ability to dramatically advance environmental information systems [8]. An enabling discipline of methods and technologies called prognostics plus systems health management (PHM) has the potential to address dependability issues that have arisen as a result of complexity in design, manufacture, environmental and operational usage conditions, and maintenance. Over the past ten years, research in PHM of information- and electronics-rich systems has been carried out in an effort to diagnose intermittent failures that can result in field collapse returns exhibiting no-fault-found symptoms, enable forecasted servicing, improve system qualification, expand system life, and provide early warnings of failure. Model-based or data-driven implementation strategies have historically been used for PHM. The physical procedures and relationships between system components are taken into consideration by model-based techniques. The data-driven methodologies identify changes in parameter data using statistical pattern recognition & machine learning, allowing for the calculation of diagnostic and prognostic metrics. The PHM state of practise for each technique for information- and electronics-rich systems is provided in this section [9]. The process of identifying and avoiding system breakdowns while estimating the dependability & remaining useful life (RUL) for its components is referred to as health management. System management of health research has exploded over the past few years in order to deal with a variety of failures that can happen at the component level all the way up to the system level, according to Lee et al. Although these ideas have been researched in depth, the majority of approaches frequently call for triggering techniques that are capable of gathering sufficient information about the malfunctioning component, the type of fault, and the impact of that fault's severity on the performance of the entire system. The integration of anomalous, diagnostic, & prognostic technology across systems as well as associated platforms is hence the focus of current work [10]. There is currently a growing trend in the aquaculture industry towards production intensification and commercialisation. Similarly to other agricultural sectors, the likelihood of facing serious disease issues rises when aquaculture operations are extended and increased. As a result, the aquaculture business must deal with a number of illnesses and difficulties brought on by viruses, bacteria, fungus, parasites, and other newly discovered and unexplained pathogens. Disease outbreaks are now a significant barrier to the productive cultivation of many aquatic species, restraining economic and social advancement in many nations. A number of interrelated reasons, including the increased globalisation of aquatic live creatures and the products they are associated with, can be blamed for this scenario [11]. Both academic scholars and business professionals are very interested in using information systems technology (IST) to obtain a competitive advantage. However, little study has been done to pinpoint the precise elements that businesses must take into account in order to use IST to gain a competitive edge. Businesses these days are paying more attention to the possible advantages that could come from adopting information technology to acquire a competitive edge. This new trend can be attributed to a number of things, including changes in economic conditions like protracted periods of high inflation, elevated interest rates, and a lack of real growth; structural shifts in the economy brought on by international competition; and improvements in technological economics like cost savings in telecommunications, circuitry, as well as mass storage [12]. Traditional conceptions of power presuppose that power is a static power applied to people in a predetermined way. Power is frequently seen as a tool for coercion, suppression, or control. According to this viewpoint, adjustments in the allocation of resources, like information, which give power to those who have them, are the only factors that influence changes in power inside organisations? Early studies of systems of information in organisational contexts can be linked to this idea of power. This approach's weakness is that it does not recognise power as a relationship term. In a nutshell, power exists inside social interactions as a propensity to act rather than existing in people. Only specific interactions and contexts cause it to activate. This relational perspective on power is advanced by the ideas of Foucault [13]. Exploratory research has several goals, including discovery, explanation, and exploration. However, using survey research to accomplish these goals is different from using case studies or experiments. Exploratory research seeks to learn more about a subject and produce early insights. Surveys are used in this situation to narrow the scope of possible responses within a certain demographic and improve the measuring of perceptions. The study of surveys focuses on selecting the ideas to measure and figuring out the best way to measure them. An exploratory survey's goal is to find new possibilities & dimensions within the target audience, which will encourage the study of fresh concepts and viewpoints [14]. The focus of effective data management in the medical field is on the comprehensive handling of information inside a hospital. It is perfectly in line with the hospital's company plan and strategic goals, which must be efficiently transformed into a suitable information strategy. Strategic information management planning exercises result in the creation of a particular strategic information handling plan. This plan includes the goals and tactics for managing information and specifies the architecture that will be used to develop and advance the hospital's data system. This paraphrased recommendation offers a framework and subject matter for strategic data management initiatives. The strategic plan portfolios for the hospital, which are made up of detailed plans meant to carry out the goals of the strategy, are built on the strategic data from the management plan. Plans like these are frequently [15].

2. METHODOLOGY

One effective way to determine the cause-and-effect connections in complex systems is through DEMATEL. It entails utilising a visual structural framework to evaluate the relationships between components and rank their significance. Numerous researches that looked at the use of DEMATEL over the last ten years have led to a variety of modifications and improvements that have been published in the literature. The Démodé technique, which was initially created by the Geneva Scientific Centre of the Patel Memorial College, allows for the visualisation of complex causal interactions using matrices or digraphs. This structural modelling method is especially useful for examining the dynamics of cause-and-effect among system components. By aiding the mapping of factor interdependencies, DEMATEL can be used to analyse and address complex, interrelated situations [16]. Modern global managers must have a broad variety of abilities and knowledge to successfully navigate the problems they encounter. Enhancing the skills of global managers is becoming a major priority as a result. Different competency models have been proposed by many academics and practitioners that highlight the essential abilities needed. It can be difficult to learn a wide range of talents at once, though. This begs the question of how to improve the skill set of global managers by segmenting the skills into smaller, more manageable pieces, allowing for gradual skill growth. We have suggested an efficient method that combines fuzzy logic with the Decision-Making Test & Evaluation Laboratory (DEMATEL) to handle this problem and get around the subjectivity present in human judgements. With a planned and methodical approach, this method seeks to segregate the talents required for optimising the skill growth of global managers [17]. Information fusion frequently makes use of the Dempster-Shafer evidence theory to manage ambiguous information. However, using the Dempster rule to combine contradictory evidence frequently results in unfavourable results. Source congruence is the main topic of recent study on conflicts in this field. However, the high computational complexity of present approaches makes it difficult to meet real-time system demands. Therefore, it is essential to research innovative and affordable methods. In this paper, we suggest a novel method built around DEMATEL that alters the source model for information to take into account the relative importance of each piece of information. The procedure entails calculating significance & importance, establishing the total-correlation matrix according to source similarity, and utilising Dempster's admission criteria to generate a weighted average admission result. This method presents a viable way to address the shortcomings of existing approaches and enhance the Dempster-Shafer evidence theory's assessment of evidence weights [18]. In several disciplines, a Decision Making Test and Evaluation Laboratory approach is used to pinpoint important elements in straightforward systems. Despite efforts to improve DEMATEL, it is only applicable to simple systems and has trouble dealing with decision-making issues in complicated systems. The Geneva Research Centre of the Battelle Memorial Institute created the initial DEMATEL approach (Fontela & Gabus, 1974). DEMATEL uses diagrams as a thorough method for examining connections between system components and emphasising important driving forces. It includes a graphic of an influence relationship that shows correlation links visually using numerical values to show the strength of the impact and arrows to show the direction of the influence. As a result, DEMATEL is praised for its efficiency in resolving complicated issues, especially those containing interrelated aspects, and it provides decision-makers with useful information about the decision-making process [19]. The Science – Human Affairs Programme of the Battelle Memorial Institute at Geneva created the Decision Testing - Evaluation Laboratory technique in its basic form between 1972 and 1976. Its goal was to tackle issue sets that were intricately interwoven and sophisticated. Since its inception, this method has been widely used in a variety of fields, including disaster preparedness, Internet advertising impact assessment, business resource planning audit as well as risk management, e-learning programme effectiveness evaluation, key success factor identification, and service quality evaluation in the mobile banking as well as auto parts industries. The capacity of the DEMATEL technique to use causal diagrams to discover interdependencies among system components and describe the degree of impact between them is one of its primary strengths. To clarify these relationships, it uses a fundamental idea of contextual interactions and hierarchical structures [20]. Using cause-and-effect diagrams to visually illustrate this structure, its Decision-Making Test and Evaluation Laboratory provides an effective method for accumulating collective knowledge. In the context of multi-criteria decision-making, DEMATEL's capacity to create connections and hierarchies among different variables is one of its main advantages. The problem of uncertainty, however, arises when interacting with complex systems, making the estimating process difficult. Instead than giving precise values, participants frequently give subjective evaluations based on their personal experiences. It becomes vital to use fuzzy logic and fuzzy techniques to successfully solve assessment difficulties when there is ambiguity and fuzzy language evaluations are involved [21]. The construction and analysis of a structural model that incorporates causal links among different criteria is done using the Experimental & Evaluation Laboratory (EEL) technique for decision making. It is crucial to understand that the majority of choice problems involve many criteria, many of which are contradictory and connected. To deal with these issues, many strategies have been developed in the multi-criteria decision making discipline. These approaches, which have their roots in multi-attribute utility theory, try to solve MCDM issues by grouping the criteria into a discrete dimension called the utility function, which makes it easier to assess different possibilities [22]. DEMATEL is useful in a variety of contexts, including team decision-making processes, global managers' competency enhancement, security issues, control systems, and marketing tactics. In order to revitalise conventional methods and explore new applications through hybrid approaches, it is frequently integrated with other techniques including Analytical Network Process, Multi-Criteria Decision Making, & Fuzzy Set Theory. The fundamental idea behind DEMATEL is to use an initial immediate interaction matrix to model the interdependencies between system components. Raising the first matrix to various powers symbolises how these interdependencies might spread through the system and affect other components. Calculating the overall impact of each component requires adding the matrices produced at various powers. It is expected that a matrix multiplied by infinity converges to a value of zero, yielding a thorough evaluation of overall influence [23]. Supply chain management (SCM) techniques have advanced significantly since the 1990s. Organisations have realised that the efficient and effective implementation of SCM practises has the potential to generate significant direct and indirect revenues. Supplier selection is one of these procedures that is crucial to building partnerships within an integrated supply chain. Companies must prioritise achieving effective and accurate choice of supplier's results if they are to improve their production, supply chain management and, eventually, their entire organisational performance. By using a Fuzzy Decision Making Experimental & Evaluation Laboratory methodology to pinpoint important variables in SCM supplier selection, this study presents a ground-breaking methodology. The DEMATEL method offers a novel information-driven strategy for making choices in SCM supplier selection by identifying critical criteria for increasing performance through the evaluation of supplier performance. A well-designed SCM system is necessary for establishing a competitive advantage in the modern global economy and rapidly changing information technology landscape [24]. The DEMATEL technique is a Multi-Criteria Decision Making (MCDM) strategy that is used to thoroughly understand, identify, and graphically express the direction and strength of causal linkages, both direct and indirect, among different criteria. This strategy is useful in understanding difficult problems and identifying workable solutions in a hierarchical structure in complicated endeavours like Carbon Capture and Storage, wherein elements demonstrate significant interdependencies and the adjustment of one aspect can affect all others. DEMATEL was initially created by the Science, Technology, and Human Affairs Programme of the Battelle Memorial Institute on Geneva between 1972 and 1979 with the goal of examining the intricate interconnections of world societies and pursuing comprehensive answers [25].

3. EVALUATION PARAMETERS

C1: number of people who utilise the e-Health information systems. C2: Annual data redundancy in the creation and encoding of electronic invoices. C3: At the start of the implementation phase, interoperability rates increased on a monthly basis. C4: monthly rate of return on communication infrastructure investments in the year that electronic health records are implemented. C5: Monthly percentage rise in the use of big data using a cloud approach and a web-centric approach.

4. RESULTS AND DICUSSION

TABLE 1. Health Management Information Systems

	C1	C2	C3	C4	C5	Sum
C1	0	3	4	3	3	13
C2	3	0	2	3	4	12
C3	4	2	0	2	3	11
C4	2	3	2	0	2	9
C5	4	1	3	2	0	10

Table 1 show the values for evaluation parameters and sum value is got by adding the values in row wise.

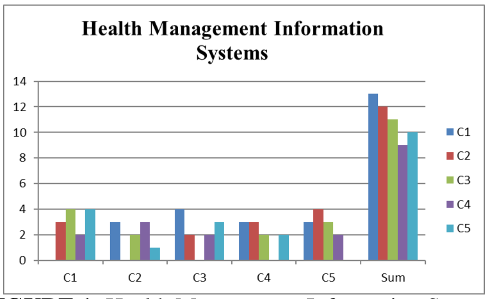

FIGURE 1. Health Management Information Systems

Figure 1 displays the schematic view of evaluation parameters of health management information system.

TABLE 2. Normalisation of direct relation matrix

	C1	C2	C3	C4	C5
C1	0.000	0.231	0.308	0.231	0.231
C2	0.231	0.000	0.154	0.231	0.308
C3	0.308	0.154	0.000	0.154	0.231
C4	0.154	0.231	0.154	0.000	0.154
C5	0.308	0.077	0.231	0.154	0.000

Through table 2 we will get the results of Normalisation of direct relation matrix.

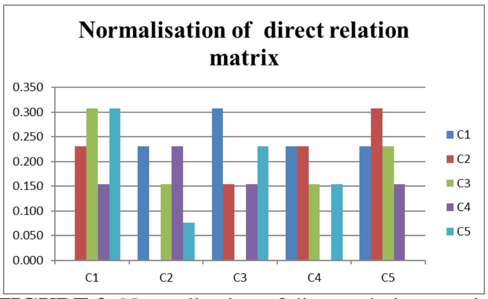

FIGURE 2. Normalisation of direct relation matrix

Figure 2 displays the Normalisation of direct relation matrix in a graphical manner for C 1 to 5.

TABLE 3. Calculation of the total relation matrix

	C1	C2	C3	C4	C5
C1	0.000	0.231	0.308	0.231	0.231
C2	0.231	0.000	0.154	0.231	0.308
C3	0.308	0.154	0.000	0.154	0.231
C4	0.154	0.231	0.154	0.000	0.154
C5	0.308	0.077	0.231	0.154	0.000

Table 3 provides calculation value of the total relation matrix for the given C 1 to 5 evaluation parameters.

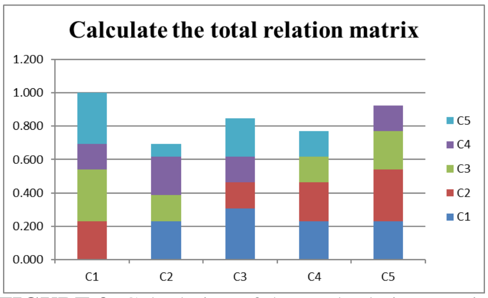

FIGURE 3. Calculation of the total relation matrix

Figure 3 provides the schematic view of Calculation of the total relation matrix for the given C 1 to 5 evaluation parameters.

TABLE 4. I matrix

1	0	0	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	1

Table 4 provides the I matrix value for the evaluation parameters C1, C2, C3, C4, C5.

TABLE 5. Y matrix

0.000	0.231	0.308	0.231	0.231
0.231	0.000	0.154	0.231	0.308
0.308	0.154	0.000	0.154	0.231
0.154	0.231	0.154	0.000	0.154
0.308	0.077	0.231	0.154	0.000

Through table 5 we will get the data value Y matrix .

TABLE 6. I-Y Matrix

1.000	-0.231	-0.308	-0.231	-0.231
-0.231	1.000	-0.154	-0.231	-0.308
-0.308	-0.154	1.000	-0.154	-0.231
-0.154	-0.231	-0.154	1.000	-0.154
-0.308	-0.077	-0.231	-0.154	1.000

Table 6 value are calculated by subtracting I and Y matrixes.

TABLE 7. (I-Y)-1 matrix

2.318108	1.144149	1.403703	1.231835	1.401839
1.412317	1.887794	1.220627	1.161044	1.368451
1.405536	0.98027	2.03815	1.059116	1.260519
1.102534	0.896018	0.989026	1.772927	1.032155
1.317195	0.862187	1.149452	0.986492	1.987269

Through table 7 we will get the value for (I-Y)-1 matrix value for the evaluation parameters C1 to C5.

TABLE 8. Total Relation matrix (T)

C1	1.318108	1.144149	1.403703	1.231835	1.401839
C2	1.412317	0.887794	1.220627	1.161044	1.368451
C3	1.405536	0.98027	1.03815	1.059116	1.260519
C4	1.102534	0.896018	0.989026	0.772927	1.032155
C5	1.317195	0.862187	1.149452	0.986492	0.987269

Table 8 provides value: total relation matrix (T) for c1,c2,c3,c4,c5 in alternative parameters.

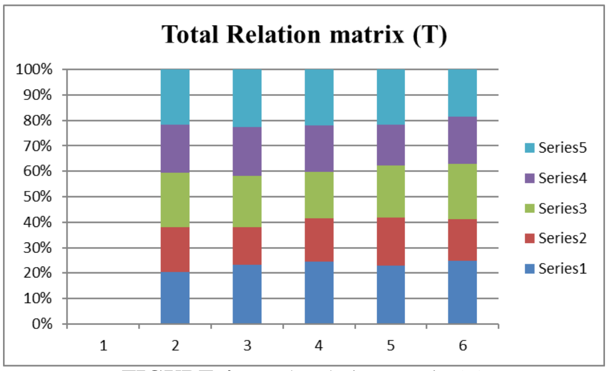

FIGURE 4. Total Relation matrix (T)

Figure 4 displays the total relation matrix values in a schematic view by graph.

TABLE 9. Ri, Ci Value

	Ri	Ci
C1	6.499633	6.555691
C2	6.050232	4.770417
C3	5.743592	5.800958
C4	4.79266	5.211414
C5	5.302594	6.050232

Table 9 provides Total Relation Matrix (T) Ri, Ci Value for alternative parameters c1 to c5.

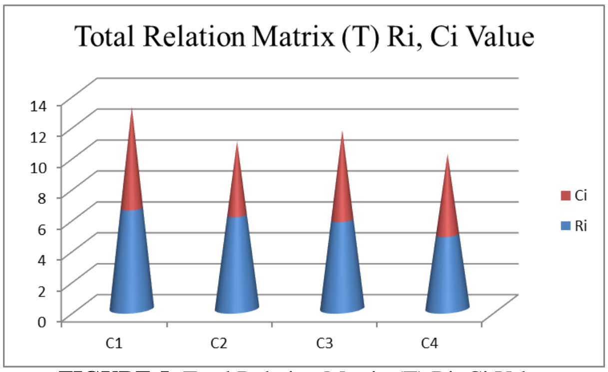

FIGURE 5. Total Relation Matrix (T) Ri, Ci Value

Through figure 5 we can see the value of Total Relation Matrix (T) Ri, Ci in a schematic view.

TABLE 10. Addition of Ri and Ci, subtraction of Ri and Ci

	Ri+Ci	Ri-Ci	Rank	Identity
C1	13.05532	-0.05606	1	effect
C2	10.82065	1.279815	4	cause
C3	11.54455	-0.05737	2	effect
C4	10.00407	-0.41875	5	effect
C5	11.35283	-0.74764	3	effect

Table 10 add and subtract the Ri and Ci through we will find the rank of the data set and we will find the identity of the data set by giving cause for the negative values and effect for the positive values.

TABLE 11. Rank

	Rank
C1	1
C2	4
C3	2
C4	5
C5	3

Table 11 shows the rank of the parameters C1 TO C5 from 1 to 5.

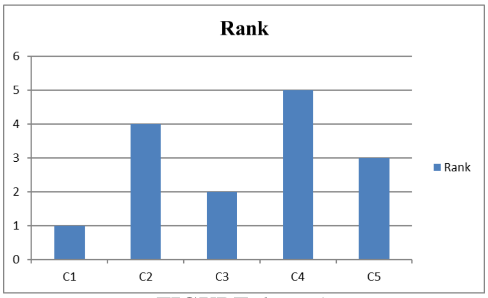

FIGURE 6. Rank

Through figure 6 we will see the rank of the data set in a schematic view .

5. CONCLUSION

In order to assess and improve the calibre and accessibility of healthcare services, information systems are becoming increasingly important. Consolidating disparate medical information systems into a single, comprehensive Health as well as Management Information System is necessary due to the worldwide transition from curative to preventive care, to hospital-based care to public and community health services, and from a project-based to a departmental approach to healthcare. The adoption of primary care as an international approach to achieve universal health coverage has been a major driving force behind the reorganisation of healthcare information systems to more connected and coherent entities (Campbell 1997). Yet, the procedure of restructuring or improving systems of information is a lifelong learning experience because there isn't yet a universally applicable standard package that is appropriate for all situations. Simple feature phones with reporting apps worked well for uploading data to the DHIS2 database. However, since these phones lacked data visualisation and analysis capabilities, they were unsuitable for monitoring and using C-DHIS2 data at the health centre, district, and central levels. These people must have access to cell phones, laptops, or personal computers in order to undertake data analysis. It was found that Community Health Workers (CHWs) needed routine technical assistance to deal with hardware- and software-related problems with phones and SIM cards. This assistance was required to help CHWs navigate the technological obstacles they encountered when using mobile phone apps on a daily basis. Although there were challenges with mobile internet and network connectivity in some parts of the district, filing weekly reports went without a hitch. The DEMATEL (Decision Making Test & Evaluation Laboratory) method is well known for its efficiency in determining the components of complex systems and the causal connections between them. It focuses on utilising a visual structural model to assess the relationships between components and determine their importance. Numerous research that looked at the use of DEMATEL over the last ten years have led to a variety of modifications and improvements that have been published in the literature. The Démodé technique, which was created by the Geneva Research Centre of the Patel Memorial Institute, uses matrices or digraphs to graphically express the complicated causal links seen in complex systems. This method, which is based on structural modelling, is especially useful for examining the cause-and-effect relationships between system components. The DEMATEL method is a useful method for understanding and dealing with complicated issues that contain interrelated aspects. It facilitates the recognition and visualisation of the interdependencies between various components, enabling a thorough comprehension of their interactions. A framework that incorporates the causal linkages between different criteria is constructed and analysed using the experimental and assessment laboratory technique of decision making. It is critical to understand that the majority of choice problems involve numerous criteria, many of which clash and interact with one another. In the area of multi-criteria decision making, numerous techniques have been developed to deal with such issues. These techniques, which are based on the multi-attribute utility hypothesis, provide answers to MCDM issues by grouping criteria into distinct dimensions, such the utility function, which makes it easier to compare alternatives.

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