Investigation of Issues in Operational Practices in the Health Care Establishments of Emerging Economies

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Abstract:

The present study investigates many operational challenges linked to the digital transformation process of the healthcare supply chain. This study aims to examine the effects of external and internal factors on the health care industry by employing the SWOT-AHP (Strength, Weakness, Opportunity, and Threat-Analytical Hierarchy Process) methodology. Furthermore, this study examines the various challenges and potential benefits associated with the incorporation of Industry 4.0 technologies, including blockchain technologies, the Internet of Things (IoT), and Artificial Intelligence (AI), into the conventional operational practices of healthcare sectors operating within the Indian context. This study also examined the primary obstacles that administrative personnel in the healthcare industry encounter in terms of adopting AI and other disruptive technologies using the ISM technique.

Keywords: *Health Care, SWOT, AHP, IoT*

1. Introduction

Receiving good medical treatment, regardless of age, gender, or cultural background, has become an absolute requirement in today's society, as an increasing number of people live unhealthy lifestyles and an increasing amount of pollution are both side effects of rapid industrialization. The provision of health care results in the generation of a significant amount of trash. These waste products include used paper and cardboard packaging, glass, food remains, bandages and syringes, human tissues, and microorganism-containing culture medium. These waste items are referred to together as "health care waste (HCW)" or "biomedical waste. HCW, or medical waste, are commodities that are discarded or unusable after being obtained from any type of healthcare institution. These items are generated in the normal course of business at these facilities, and HCW normally adds a negligible percentage by weight to municipal solid waste

(MSW) streams (Muduli and Barve, 2012; Hossain and Alam, 2013). Each HCW source's trash production volume determines whether it is a substantial or minor source. Research centres, basic health care facilities, blood banks, mortuaries, and autopsy centres, veterinary colleges and animal research institutes, and biotechnology organisations are also primary suppliers of health care waste management (HCWM). Waste generated by government hospitals, nursing homes, dispensaries, private hospitals, paramedical services, and private hospitals are all significant sources. Clinics for both physicians and dentists, blood donation camps, and immunisation clinics all contribute a tiny portion to HCWM's overall total. According to the conclusions of a 2015 World Health Organisation (WHO) study (Santos et al., 2019), only 15% of the total garbage produced by health care establishments contains potentially dangerous materials. These wastes are classified as hazardous waste, and they are further classified based on the likelihood that they will infect or hurt someone while being managed. Contaminated blades, needles, dressings, trash from pathological procedures, items contaminated with blood or other bodily fluids, anatomical body parts, microbiological cultures, devices containing mercury, radioactive waste, and so on are examples of this type of hazardous waste (Khan et al., 2013). It has been discovered that inappropriate regulatory application and a lack of knowledge are to blame for the misuse of supplied colour-coding drums, as well as the adoption of an unfair source segregation scheme. It induces the conversion of non-infected waste into infectious waste, limiting the opportunity for HCW treatment and recycling (Alam et al., 2013). The wastes generated by the healthcare sector have long-term effects on the air, water, and soil, posing serious environmental threats in addition to the dangers provided by injectable agents and viruses (Eren et al, 2019). The large amounts of "Organic Solid Waste" (OSW) found in HCW are thought to be the principal sources of leachates. Furthermore, it contains a small but significant amount of chemicals and medications, which, if disposed of improperly, could contribute significantly to the level of terrestrial ecotoxicity (TET) potential. Furthermore, the unauthorised disposal of considerable volumes of OSW, notably in landfills, might result in leachate emissions that contribute to TET potential. The transfer of hazardous substances to freshwater aquatic ecosystems via HCWM processes such as dumping and land filling causes freshwater aquatic ecotoxicity (FWAET). The phrase "human toxicity" refers to the negative impact on human health that toxic chemicals such as dioxins and heavy metals (HM) can have. Both open burning and incineration of HCW emit highly harmful air emissions containing dioxins and hazardous metals (HMs) such as mercury, lead, and cadmium.

Greenhouse gas emissions from waste management operations such as open burning and/or incineration are a major source of environmental concern. Life cycle assessment (LCA) is the most extensively used tool for determining the environmental impacts of a product, service, or project over its full life cycle, from cradle to grave, taking into account all sorts of environmental loads. Throughout Papua New Guinea (PNG), various health care entities (HCE) frequently use open burning and incineration. The current way of disposing of medical waste in PNG hospitals and other medical facilities is inefficient. It has been observed that 80 percent of the provincial hospitals' incinerators are not operating properly. Because of the equipment's advanced age, deterioration, and lack of regular maintenance over time, Due to a lack of services in remote areas of Papua New Guinea, such as power supply and fuel to operate electric incinerators, health facilities in rural areas may resort to either burning and burying waste or employing rural incinerators to dispose of their waste. The National Department of Health is attempting to replace trash incinerators in all provincial hospitals through the health facility equipment replacement and maintenance programme. LCA can be utilised to improve HCWM decision-making and to select the most ecologically friendly solution. Although it cannot replace a decision-making process, it can assist public entities and enterprises in making more ecologically responsible decisions. If suitable HCW management methods and policies are not implemented and enforced, a considerably higher set of risks may befall both the persons directly associated with handling these HCW and the environment in which the wastes are disposed of over time. The International Organisation for Standardisation (ISO) has been trying to standardise the LCA principles and methodology, which comprise goal and scope, inventory analysis, impact assessment, and interpretation (ISO 14040), since 2006. Incorporating LCA to examine health care waste and the problems it brings in rural cities may help identify important issues affecting how efficiently health management systems handle the safe processing and disposal of HCW. This study is conducted to answer the four research questions. They are, (i) could HCUs improve their long-term operational performance by implementing intelligent technologies? (ii) What variables drive health care organisations to use smart technologies? (iii) What factors are preventing the efficient digitization of health care supply chain practises? and finally (iv) How do advances in intelligent technology affect health? To find the answer of these research questions the research is carried out with the three objectives, namely (a) to understand current state of operational practices of health care establishments in developing nations, (b) to explore the influential factors of Health 4.0 adoption in PNG and other developing nations, and (c) to investigate the interdependence of these influential factors of Health 4.0 on its adoption as well as among each other.

2. Management of waste produced by health care

The proper integration and implementation of HCWM are critical, and they must be enforced and practised in all health care facilities around the world. In recent years, an increasing number of scholars have endorsed this viewpoint. Rezaee et al. (2014) discovered in their investigation, “Analysis of Quality and Quantity of Health Care Wastes in Clinical Laboratories in Ilam”, that infectious and pharmaceutical wastes made up the majority of HCW in the seven different clinical laboratories studied, while sharps made up the smallest portion. The same study revealed that laboratories do not practise appropriate separation or segregation of chemical waste, resulting in infectious waste being mixed in with the chemical waste. Another study, on biological waste management practises at Balramapur Hospital in Lucknow, India, reached the same conclusion: there is no acceptable treatment facility for infectious waste (Gupta and Boojh, 2006). Pathogen transmission is possible in any hospital waste, according to Gupta and Boojh (2006). Based on the literature on HCWM practises in developing countries, we developed a framework in figure 1 to present diverse HCWM practises and their sequence in developing countries. Incorrect processes, according to WHO, are a common concern in many health facilities around the world. As a result, health care personnel, patients, and waste handlers are at risk of contracting infections, experiencing adverse effects, and suffering injuries that could have been avoided.

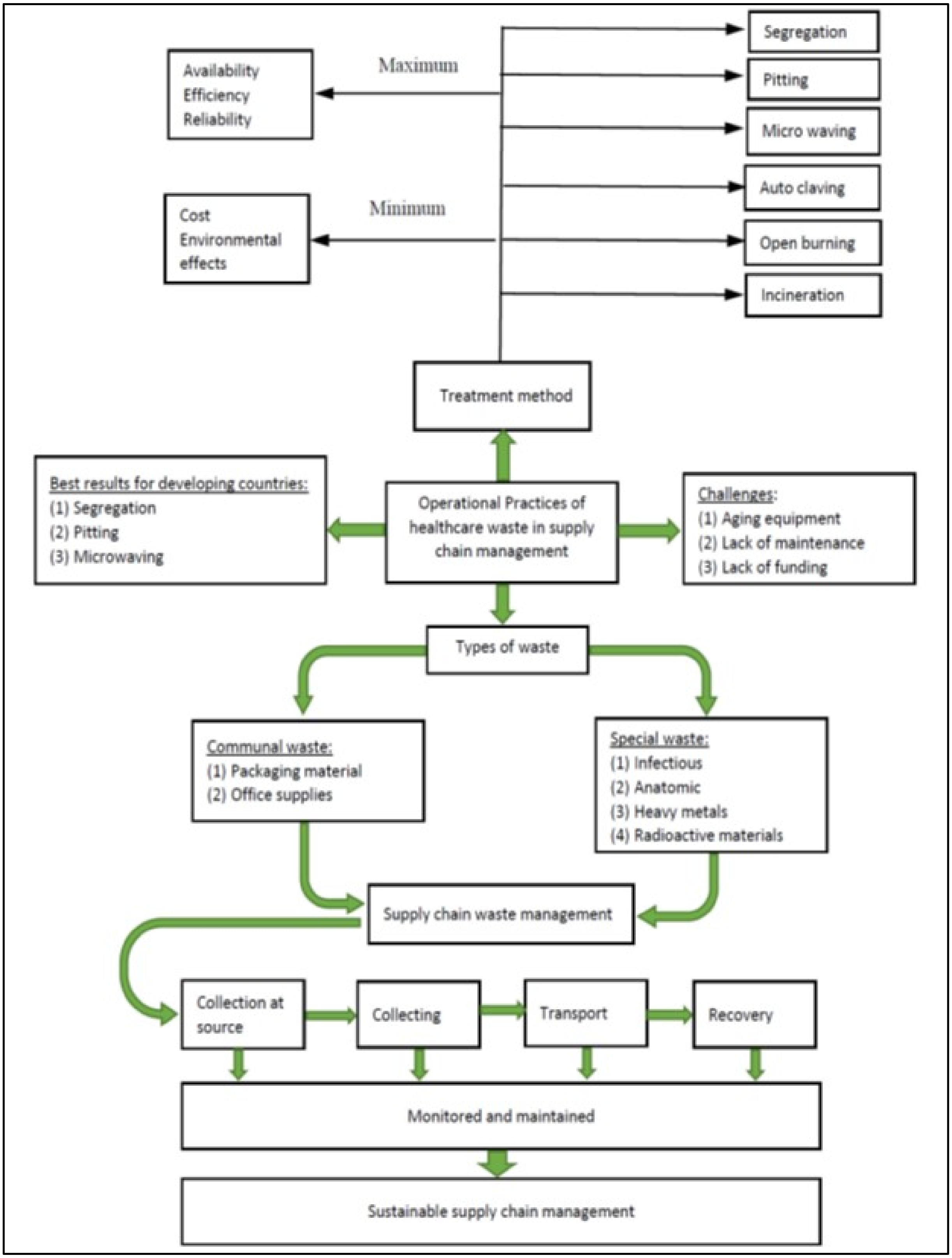

Fig. 1 Flow diagram of operational practices of healthcare waste management

2.1 Industry 4.0

The term "revolution" refers to a sudden and drastic transformation. Revolutions have happened throughout history whenever new innovations and digital ways of interpreting the world cause significant changes in economic services and social arrangements. The agricultural society revolution, which is regarded as the mother of all industrial era, started the snowball effect in the world of supply by creating the transition from forage to farming, which occurred around 10,000 years ago and was made feasible by animal domestication. Animals were used in common tasks to increase production, delivery, and information exchange. The agricultural revolution inspired industrial revolutions, which originated in the second half of the eighteenth century and marked a significant shift in industrial processes from muscular to mechanical power, eventually leading to the industrial revolution 4.0, which launched the cyber-physical world. Between 1760 and 1840, the first industrial revolution was ushered in by the development of railroads and the advent of steam engines. Electricity and assembly lines sparked the second industrial revolution in the twentieth century. The introduction of semiconductors, computer technology, personal computing and internet prompted the third industrial revolution in the 1960s. We are on the cusp of the fourth industrial revolution, which will usher in cyber-physical systems into the manufacturing sector (Schuh et al., 2020).

2.2 Health 4.0

The Health 4.0 technique is one of the primary concepts evolved from Industry 4.0, which serves as a bridge for socioeconomic conditions. It has its origins in innovation as well; nevertheless, it has a wider societal scope (Wehde, 2019). Health 4.0 also entails a significant shift in stakeholder relationships. In other words, it is built not only on Industry 4.0 infrastructure but also on an integrated version of customers and suppliers. Providers and consumers must collaborate closely in order to adapt. This will alter the potential and challenges, as well as ensure the socio-economic factors (Nair and Dreyfus, 2017). Companies interested in and investing in Industry 4.0 have brought significant breakthroughs to the market in the recent decade, and many suppliers are participating in offering innovative solutions for the healthcare sector based on Industry 4.0 outcomes (Hudson, 2017). The advancement of patient-specific and specific instance devices, advanced analytical models, high-tech manufacturing methods, cloud-based applications, data science methodologies, and machine learning and decision-making procedures all contribute to the Health 4.0 concept's enormous benefits (Thuemmler and Bai, 2017). Industry 4.0 allows software-enhanced equipment to exchange data into intelligence, allowing self-management as well as optimization of a wide range of fields in the healthcare and medical products industries, from production lines to clinical research intelligence to real-time patient monitoring and personalized medical treatment. The medical Internet of Medical Things (m-IoT) combines technology, medical equipment, and applications to provide individualized patient-specific devices and treatment plans.

3. Research methodology

3.1 Survey and case development

The methodology followed to conduct this research is summarized in figure 2. The methodology adopted to identify and short list relevant previous studies are presented in figure 3.

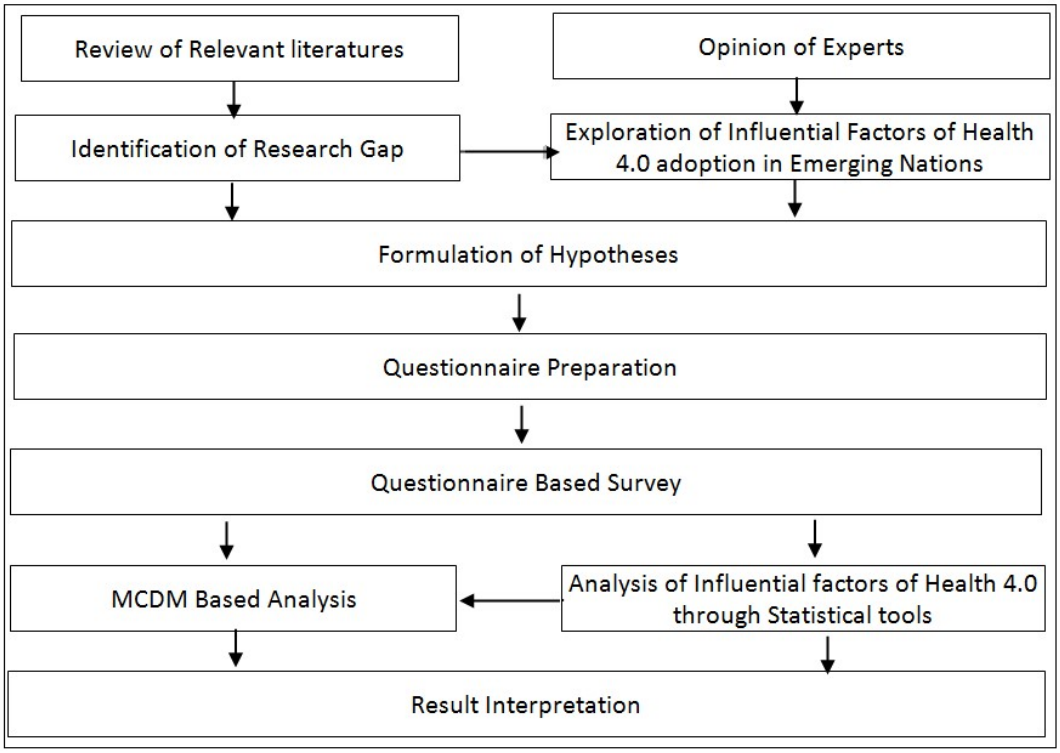

Fig. 2 Research Methodology

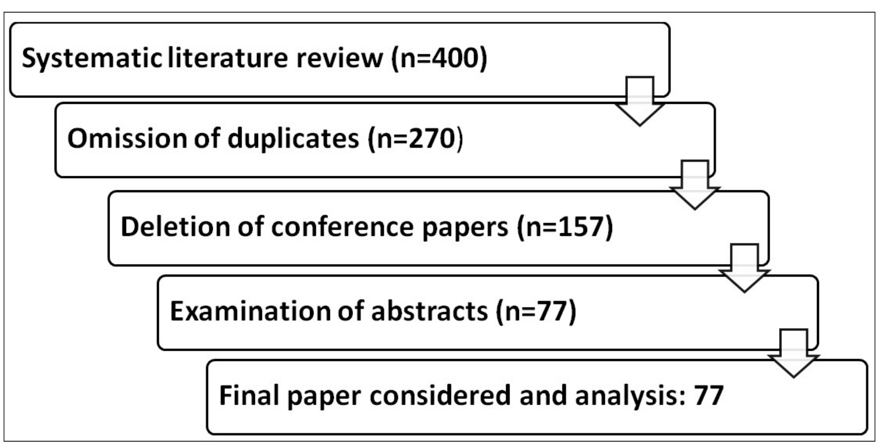

Fig. 3 Process of systematic literature review of the problem

The questionnaire included questions about demographic characteristics, as well as knowledge, and practices of HCWs about healthcare waste management. Observational checklist was used to collect the real practice on waste segregation, wastes collection material, treatment of infectious wastes. This is aimed to support the quantitative findings and to provide additional information about the healthcare waste management operations and working conditions, as well as to identify the main hazards to human health and safety as well as to the environment, resulting from the existing practices. The questionnaire used in this research contained 113 straight-forward questions requiring Yes/No and closed-end responses questionnaire in a five-point Likert scale (i.e. 1 = totally disagree, 2 = partially disagree, 3 = no opinion, 4 = partially agree, 5 = totally agree). They are arranged in categories of the respondent's age, qualification and gender, the awareness and the assessment of barriers affecting mobile health Practices in healthcare management. From the filled-out questionnaires, significant results based on issues that affect mobile healthcare have been discussed. In this case analysis, 130 people responded to the survey after it was distributed to 210 individuals. Nonetheless, 113 of the 130 responses were chosen to be investigated further. As a direct consequence of this, the response rate of 53.8% percent was targeted and attained. It is regarded to be an appropriate degree of involvement because the present response rate has a greater rate of participation than that of in the same field. This is the reason why the current response rate was used.

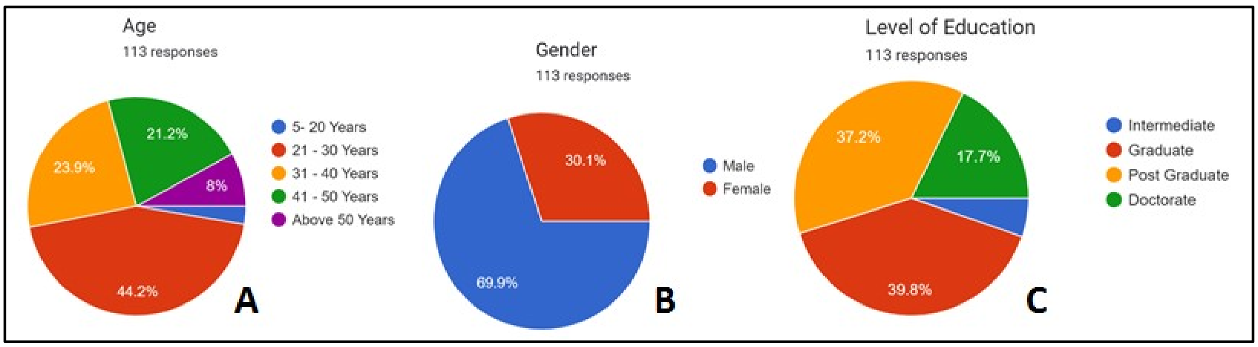

Fig. 4 Percentage of respondents Age wise (A); Percentage of respondent's gender wise (B); Percentage of respondent's level of education wise (C)

As shown in the above figure (Figure 4A) only 8% of the 113 legitimate responses came at the age of above 50 years. This compares to 44.2% of those who responded at the age of (21 to 30) years, age of (31 to 40) years responded 23.9%, age of (41 to 50) years responded 21.2% and the rest percentages were (5 to 20) years of people. For checking of education level, the survey respondents were maximum of 39.8% Graduates, 37.2% Postgraduates, 17.7% doctorate, and the rest of the Intermediates (Figure 4C).

3.2 Grey Relational Approach

Grey Relational Approach (GRA) approach is mainly used when there is an uncertainty in decision making. It performs assessment by measuring the association of each factor to a perfect solution (Jiang, 2017). In this study the degree of influence of various barriers on Sustainable Development practices in healthcare waste management sector was examined using GRA methodology.

3.3 Interpretive Structural Modelling (ISM)

ISM is designed to be used when logical and coherent thinking is necessary in order to handle a complex problem. It can be used to impose order and purpose on the complicated interrelationships between variables. ISM is generally meant for use in groups, but it can also be used alone. ISM, on the other hand, is capable of developing an early model using management practices like brainstorming and nominal groups methods and concept development. Here an interrelationship between the intelligent technology barriers of mobile health in the healthcare sector has been developed.

3.4TOPSIS Analysis

TOPSIS initially developed by Hwang and Yoon (1981), a multi-decision making method uses qualitative and quantitative criteria in order to prioritize or rank, similarity and the distance to the ideal solution. The most ideal option would be the option with the shortest distance to the ideal solution. When there are a number or criteria to consider for making a decision, this method is useful.

3.5 SWOT based Analysis

This method is used to find out the strength, weaknesses, opportunities and threats of any healthcare sector for better decision-making of healthcare employees. This research focused on Health 4.0 implementation as well as current scenario in the healthcare sector. By applying SWOT method to the healthcare sector, we identified various supportive and non-supportive issues that were faced in the healthcare organizations (Shown in Table 2).

3.5 SWOT-AHP based Analysis

The SWOT-AHP integrated frame work proposed in this research employs the features of SWOT analysis initially to categorizes the influential factors in mobile healthcare sector by association with Health 4.0 technology as ‘strength’, ‘weakness’, ‘opportunity’ and ‘threat’ and then employs principles of AHP framework to assess the degree of impact of each category of the factors on Industry 4.0 practices. We concluded in this paper that 15 external factors (8 positives, 7 negative) and 10 internal factors (5 positives, 5 negatives) influencing mobile healthcare services by adopting Health 4.0 technology.

4. Findings of opportunities and challenges

Through review of 77 research papers published in various indexed journals this study identified various challenges and opportunity of Blockchain technology in healthcare sector considering Covid-19 Pandemic which are summarized below:

Challenges of Blockchain technology: Integration with existing system, Scalability, Scarcity of skilled Blockchain expert, Energy, Blockchain ecosystem, Data reliability, Privacy, Interoperability, Perceptions, Standardization, Regulatory clarity.

Opportunities of Blockchain technology: Transparency, Data security, Decentralization, Data ownership, Data access, Immutability, Anonymity, Efficiency, Data availability, Auditable.

Critical factors (challenges) of Blockchain technology during Covid-19 situation: 13 factors were considered, such as Scalability, Privacy leakage, Selfish mining, Personal identified information, Security, Fork problems, Time confirmation, Regulation problems, Integrated cost, Energy consumption, Public perception, Technical maturity, Integration barriers.

Critical factors (encouraging adoption) of Blockchain technology during Covid-19 Situation: Anonymity andprivacy, Auditability, Decentralized database, Immutability, Improved risk management, Provenance, Reduced transaction cost, Reduced settlement lead time, secured database, Shared database, Smart contracts, Traceability, Transparency.

4.1 Challenges and Success Stories of the Internet of Things (IoTs) Application during the Pandemic

The major keywords used (IOT, Coronavirus, Covid-19, AI, and Pandemic) to identify the challenges and opportunities. Such challenges are, (a) Unreliability of network as more people are using more than one IoT device, (b) Huge numbers of data are flowing at one time which is difficult for analysis, (c) Use of multiple devices creates confusion in tracking, detecting, and preventing the rapid spread of Covid-19, and (d) Elimination of human components of the healthcare sector affects patients who have the virus.

Successful application areas were found: (a) Manufacturing efficiency increases by reducing bottlenecks, (b) Energy efficiency increases by applying sensors, (c) Agricultural efficiency increases by smart irrigation systems for eliminating water wastage, and (d) Inventory efficiency increases by putting RFID tags on every product to track the movement of product location.

4.2 SWOT based analysis of influential factors of Health 4.0 adoption in PNG

SWOT based analysis of influential factors of Health 4.0 adoptionin PNG revealed 8 factors as strengths, 8 weaknesses, 5 opportunities, and 6 as threats. Table 1 summarizes the SWOT analysis based results.

Table 1. SWOT analysis of healthcare sector

Strengths	Weakness
• Easily available low budget smart mobile phones • Data plans are easily available at low tariff • Cloud data availability for remotely accessibility. • Patient willingness towards m-health to avoid long queues. • Treatment cost is low compared with physical mode. • Rapid diagnosis • Emergency air	• Regular calibration of sensors and gadgets required. • Chances of privacy of personal information leakage. • Varying sensors in different smart mobile phones • Poor internet connectivity and unreliable power supply. • Lack of skilled healthcare people • No incentives, benefits or other types of financial or non-financial benefits. • Resistance of employees to adopt this.

Opportunities	Threat
• Using block chain technology, the data can be accessed. • Using digital technology and innovative techniques delivery system the patient-centric care can be taken. • Hospital chains can be increased rapidly. • Support from government sources in technologically or financially. • In order to reach the medical facility to rural areas public-private partner initiative can be taken.	• Migration of qualified and talented person. • Country's economic condition. • Shortage of political interest. • Absenteeism of regulating authority. • Poor ratio of population to doctor ratio. • Socio cultural issues.

4.3 TOPSIS based ranking of HCWM Practices in PNG

In this research, 5 numbers of accountability factors had taken to prioritize the waste management operations that were cost (0.1), availability (0.3), reliability (0.2), environment (0.2), effectiveness (0.1), and efficiency (0.1) for weightage analysis. The ranking of different HCWM operation methods found out by TOPSIS method is presented in Table.2.

Table 2. Ranking of different HCWM operations by TOPSIS Analysis

HCWM Operations	Yc (Higher value taken as rank 1)	Rank
Segregation	0.6749	1
Pitting	0.6428	2
Microwaving	0.5454	3
Autoclaving	0.4964	4
Open Burning	0.3176	5
Incineration	0.2526	6

4.4 GRA Based Analysis HCWM Barriers

Current research analyses 14 numbers of waste management barriers Using GRA technique. By the help of GRA method, we observed that two healthcare waste management barriers 'Poor segregation practices' (value: 1) and 'Improper reuse of healthcare waste' (value: 1), impacted heavily on healthcare sector and another two barriers 'Accountability of healthcare facilities towards HCWM is very less (value: 0.33)' and 'Shortage of awareness and training program' (value: 0.33) have least impact on the effective implementation of HCWM in emerging economies.

4.5 Structural Equation Modeling (SEM) based Analysis of HCWM Barriers

In this research, 15 numbers of barriers have been taken for analysis to realize the implementation of AI and Disruptive technology in the healthcare sector faced by administrative employees. Again by exploratory factor analysis, these barriers have been grouped under three factors for dependent construct, such as **Factor-1** Problems in Implementing Technology (Tech), **Factor-2** Data Security Problems (Data) and **Factor-3** Additional Workload (Workload). Then the model has been made according to according to survey responses taken from 83 hospitals and 434 samples. After that by taking these data, Confirmatory factor analysis (CFA) has been done and measurement model has been created results are shown in table 3. Lastly Structural equation modelling (SEM) has been done to validate the measurement model and also to check the values significant or not.

Table 3. Convergent and Divergent validity

	CR	**MSV**	**AVE**	**MaxR(H)**	**Tech**	**Data**	**Workload**
Tech	0.849	0.334	0.600	0.761	**0.875**		
Data	0.962	0.003	0.716	0.975	0.050	**0.824**	
Workload	0.971	0.334	0.859	0.961	0.578	0.035	**0.917**

Table 4. Model fitness

Model	**Chi-square value (χ^2)**	**Df**	**Normed Chi-Square**	**P-Value**	**GFI**	**AGFI**	**CFI**	**RMESA**
Study model	111.3	51	2.53	0	0.93	0.9	0.97	0.06
Recommended Value			Below 3	> 0.05	> 0.9	> 0.9	>0.9	<0.08

Here, this research made clear that chi-square value, see table 4, is 2.53 which is in between 2 to 3. So the model is good and also in 95% confidence level the factor values are significant. To taste four hypotheses (H1 to H4), a SEM analysis was performed to check the path diagram of dependent factors very clearly with significant empirical values. These hypotheses are:

H1: There are no significant differences in problems encountered by the administrative male and female employees with Health 4.0 Practice.
H2: There are no significant difference problems encountered by the administrative employees belonging to different age categories with Health 4.0 Practice.
H3: Implementing technology will directly contribute to data security issues.
H4: Additional workload affects high capital requirement, maintenance of support system, and resistance to change by the employers in healthcare.

Table 5. Regression Estimates and SEM interpretation

Regression Estimates		Estimates	S.E	C.R	P
Tech	Data	-0.269	0.046	-5.806	0.001
Tech	Workload	-0.174	0.047	-3.665	0.001
Data	Workload	-0.291	0.046	-6.315	0.001

The regression estimates shown in table 5 indicate that all factors are statistically significant with 0.001 levels and by looking the composite reliability values of three factors, there exist negative relationship between the factors. Data Security Problems (Factor-2) and Additional Workload (Factor-3) have a substantial impact on the rate at which AI is adopted in the health care industry, as seen through the eyes of the administrative employees in that area.

4.6 ISM Based Analysis of m-Health Practices in Emerging Economies

The 15 mobile health barriers found from the literature are: Stable electricity availability and web access (m-HB 1), Devices must be calibrated on a regular basis (m-HB 2), Large technological gap with the users (m-HB 3), Lack of political willpower (m-HB 4), Weak relationship of doctor-to-populace ratio (m-HB 5),A scarcity of qualified health-care workers (m-HB 6), Different cell phone companies have different sensors (m-HB 7),Competent personnel/talents emigrating (m-HB 8), Privacy issue (m-HB 9), Security attachments are required (m-HB 10), Staff apprehension and habitual change (m-HB 11), Physicians do not have significant advantages, rewards, or assistance (m-HB 12), The government's economic condition (m-HB 13), Lack of supervisory agency (m-HB 14), Social and cultural problems (m-HB 15). The interplay existing among these barriers were anlysed employing ISM technique.

Table 5. Final level partitioning

Barriers	Reachability set	Antecedent set	Intersection set	Level
m-HB 1	1, 2, 7, 11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	1, 2, 7, 11	1
m-HB 2	1, 2, 7, 11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	1, 2, 7, 11	1
m-HB 3	3, 5, 9	3, 5, 9, 10, 13	3, 5, 9	5
m-HB 4	4, 6, 14	3, 4, 5, 6, 8, 9, 10, 12, 13,14, 15	4, 6, 14	2
m-HB 5	3, 5, 9	3, 5, 9, 10, 13	3, 5, 9	5
m-HB 6	4, 6, 14	3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15	4, 6, 14	2
m-HB 7	1, 2, 7, 11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	1, 2, 7, 11	1
m-HB 8	8, 12	3, 5, 8, 9, 10, 12, 13, 15	8, 12	3
m-HB 9	3, 5, 9	3, 5, 9, 10, 13	3, 5, 9	5
m-HB 10	10	10,13	10	6
m-HB 11	1, 2, 7, 11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	1, 2, 7, 11	1
m-HB 12	8, 12	3, 5, 8, 9, 10, 12, 13, 15	8, 12	3
m-HB 13	13	13	13	7
m-HB 14	4, 6, 14	3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15	4, 6, 14	2
m-HB 15	15	3, 5, 9, 10, 13, 15	15	4

Four barriers like Stable electricity availability and web access, Devices must be calibrated on a regular basis, Different cell phone companies have different sensors, and Staff apprehension and habitual change have resulted highest rank in the ISM analysis.

5. Conclusion

The findings from the preceding research that explores the points of view held by waste management operations in the healthcare sector, such as segregation, pitting, open burning, incineration, microwaving, autoclaving, and so on, are summarised here. The most significant activity in waste management is segregation, which should be carefully organised among the preceding procedures. Furthermore, inadequate segregation practices and incorrect reuse of healthcare waste have been identified as top hurdles in the healthcare industry that must be addressed in the near future by healthcare organisations. The research then evaluated all positive and negative consequences of all developing healthcare organisations and methodically documented the healthcare organisations' strengths, weaknesses, opportunities, and threats. So that decision-makers might quickly recognise and correct their error. The implementation of Industry 4.0 technology in the healthcare sector creates both opportunities and obstacles. In previous COVID-19 instances, the research on these aspects was critical to the healthcare industry. In the future, the healthcare sector may profit from technologies such as blockchain technology, the Internet, artificial intelligence, cloud computing, big data analysis, and others. Finally, this research has shown mobile healthcare and its barriers in relation to Industry 4.0 technology. All points of view are considered in relation to the issues that arise during the process of digital transformation of health care supply chains in emerging nations. This could be beneficial for the decision-makers to quickly observe the prominent barriers of health 4.0 relevant to their value chain and formulate strategies to eliminate them or reduce their impact. This research attempted to establish a set of operational practices that will improve the effectiveness of HCWM in PNG and other developing nations particularly when they try to integrate the traditional practices with industry 4.0 technologies. This research further, attempted to assess the degree of inhibiting impact of the influential factors on health 4.0 adoption, this will help decision makers to decide the course of action and rationale resources to address the key issues in order to optimize their sustainable performance.

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