DIGITAL OPPORTUNITIES IN THE HEALTHCARE ENTERPRISES DURING COVID-19: AN EMPIRICAL ANALYSIS OF THE DEVELOPING COUNTRY

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Abstract

The health sector in Bangladesh is yet to develop and provide universal healthcare services. The aim of this study is to investigate whether the applicability of digitization especially medical robots and blockchain technology can help to improve healthcare enterprises in Bangladesh during the ongoing COVID-19 pandemic. The findings indicate that Bangladesh healthcare enterprises are in a vulnerable situation because of unethical work practices of health workers, the need for medical robots, artificial intelligence, and blockchain technology to improve healthcare management. The study suggests that large investment, pro-patient care, corruption-free and ethical services in the healthcare management and service delivery is required, through joint collaboration with the public and the private sectors and also collaborative effort from the foreign sectors to implement the fourth industrial revolution in healthcare enterprises of the country.

Keywords: Digitization, Medical Robots, Artificial Intelligence, Blockchain Technology, Healthcare Enterprises, Organizational Behavior, Health and Economic Development, Management of Technological Innovation and R&D

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1. INTRODUCTION

Healthcare enterprises for the economy in Bangladesh are yet to develop properly and provide universal healthcare services. The organizational behavior of the healthcare enterprises seems very poor and has yet to accomplish any sort of applicability of the digitization process in this industry. Due to the commercial and supernormal profit motive attitude of the doctors, nurses, and health service providers, regulators, private healthcare entrepreneurs, people in Bangladesh travel abroad for medical treatment (Ali, 2012).

Regional disparity, access to healthcare, and high concentration of medical facilities in the capital and port city of Bangladesh deny universal healthcare facilities to all citizens, and the Gini coefficient in the medical sector is highly imbalanced in Bangladesh. Patient-reported outcomes were normally ignored in the country, and healthcare quality is strongly correlated to the economic management of the country. Health and well-being are some of the basic fulfillments of the needs of the human being. In Bangladesh, government hospitals and health centers are missing rudimentary health managing skills, while private hospitals and nursing

centers are also frequently involved in making supernormal profits (Ali, 2012). Patients from Bangladesh are going to other countries of the world starting from India, Singapore, Thailand, the United Arab Emirates, Saudi Arabia, Sri Lanka, Malaysia, the United Kingdom, and the United States for quality treatment, due to non-availability, long waiting queues, high costs, the commercial attitude of Bangladeshi doctors, and corruption (Ali, 2012). However, during the pandemic, due to lockdown and closing borders, outbound medical tourists could not travel for medical treatment and surgery. Immoral and dishonest actions of the medical system are the greatest significant influence that pushes patients to travel outbound to India from Bangladesh for medical treatment and surgery (Ali & Medhekar, 2016). Most of the COVID-19 patients of the country either stay-put without treatment or alternatively travel abroad for treatment pre-COVID-19. During the pandemic situation, the quality of treatment in Bangladesh hospitals worsened, as patients were neglected by the health workers of the country.

Bangladesh government approved the Oxford-AstraZeneca COVID-19 vaccine on 4th January 2021, and a successful vaccination program was implemented to prevent COVID-19. However, the supply of vaccines was disrupted due to the Delta virus in India. Bangladesh government successfully managed vaccine supplies from different sources, during the second wave of COVID-19 which started in April 2021 of the country. Bangladesh is now classified as a lower middle-income country and is trying to become an upper-middle-income country, for which a development plan is required to meet the United Nations 17 Sustainable Development Goals. Brundtland concept of sustainable development has been based on three pillars of sustainability: economic, social, and environmental, and advocated for green growth (Kittiprapas, 2018). Some health workers and owners of private and public hospitals are selling false certificates and dated expired surgical instruments, false medicines, and instruments as detected by the law enforcement agencies and reported by different news agencies. The query is whether fraudulent activities can be checked if blockchain technology and diverse types of medical robotics services could be applied the healthcare enterprises.

Till 7th January 2021, nearly 126 doctors and 3 dentists died due to COVID-19 as per Bangladesh Medical Association (BMA) website[1]. Further, the BMA website also informed that till 18th January 2021 due to COVID-19, the total affected health workers are 8,159 out of which doctors were 2891, nurses were 1983, while support staff was 3285. Meanwhile, the density of doctors, nurses, and midwives per 10,000 population in Bangladesh was 8.3, and the global benchmark was 44.5. The health workforce ratio (Doctor:Nurse:Allied professional) in Bangladesh was 1:0.6:0.3 while the global benchmark was 1:3:5 as per the Ministry of Health and Family Welfare, Government of Bangladesh (GOB, 2019). In the country, health insurance is not popular at all.

RQ: Does the applicability of digitization, especially medical robots and blockchain technology, can help to improve healthcare enterprises in Bangladesh's economy during the ongoing COVID-19 pandemic?

[1] https://bma.org.bd

The study has been undertaken with the following objectives: 1) To evaluate the present status of the healthcare enterprises and future development perspective by the community due to COVID-19 giving equal significance to the male and female respondents; 2) To see whether medical robots can improve the scenario of the health management as ongoing COVID-19's impact in future on Bangladesh economy; 3) To observe how does blockchain technology can work through ongoing COVID-19 in the health sector; 4) To provide some implications from the study.

The remainder of this paper is structured as follows. Section 2 describes the relevant literature review. Section 3 delivers the methodology of the study. Section 4 discusses the analysis of the findings. Section 5 portrays the discussion, while Section 6 describes the conclusion.

2. LITERATURE REVIEW

Japanese robotic manufacturing by Hitachi has enormous capability and is trying to rearranging its robotic feasible by inward bound through the medical robot market (Kusuda, 2003). Okamura, Matarić, and Christensen (2010) argued that the robotics adoption plan requires social drivers, inspiring circumstances, predicted arrangement capabilities, and energetic investigators to apply the tactic of healthcare robots. Payne and Yang (2014) mention that hand-held devices can have an expressively edited cost to healthcare benefactors as they do not necessitate the multi-layered, multi-degree-of-freedom connections that are trapped with robots' demand. Therefore, virtual certainty situation may deliver an equivalent or bigger screen part than what is provided with the practice of manifold conservative exhibitions through outstanding relatively economical and more movable creation it an outstanding option for investigative radiology application (King et al., 2016). Taylor, Menciassi, Fichtinger, Fiorini, and Dario (2016) depicted that impression of the technology of medical robot schemes and deliberate instances of straightforward scheme standards, with transitory extra conversation themes of remote telesurgery and robotic surgical simulators can provide better outcomes. Cresswell, Cunningham-Burley, and Sheikh (2018) opined that there are noteworthy forecasts for filtering the safety, brilliance, and capability of healthcare through robotics. However, they recognized four main essentials to be successful: 1) no vivacious pull from specialists and patients; 2) influx of robots and related expectations and anxieties; 3) disturbance of the way work is prearranged and disseminated, and 4) innovative moral and legal contests demanding elastic responsibility and ethical sketches. Troccaz, Dagnino, and Yang (2019) described those interventional robots and deliberates in the way that mixing of imaging, sensing, and robotics can affect the patient upkeep trail to exactness interference and patient-specific management. Amalgamated actions are generating the robot to resolve works that would not have been solvable or else, e.g., multifaceted book grasping with a reduced numeral of base behaviors or loom disassembly (Hangl, Dunjko, Briegel, and Piater, 2020). Wang, Ramamoorthy, Gal, and Guez (2020) argued that dissimilar fall detection schemes

that presently exist through their aids, matters, trials, and tendencies can be recognized. Dangprasith and Suwanrumpha (2020) described how "ninja robots" can aid virus battle in Thai hospitals.

The significant assistances for presumptuous blockchain ability in biomedical and healthcare entitlements include 1) disseminated organization, 2) unchallengeable audit track, 3) data provenance, 4) toughness/convenience, and 5) safety/confidentiality (Kuo, Kim, & Ohno-Machado, 2017). Despite the fact that patient-driving interoperability is a stimulating trend in healthiness, assumed these trials, it remains to be understood whether blockchain can ease the evolution from institution-centric to patient-centric data allotment (Gordon & Catalini, 2018). Diverse belonging for the application of blockchain in healthcare is applicable; though, there is the nonexistence of satisfactory instance operations and studies to represent the worth of planned workout instruments (Agbo, Mahmoud, & Eklund, 2019). Manifold workflows are complicated in the healthcare ecology via blockchain technology aimed at improved data management (Khatoon, 2020). Mackey, Bekki, Matsuzaki, and Mizushima (2020) argued that blockchain solutions must also be adaptive to opportunities and barriers unique to Japan's national health and innovation policy, including its regulatory sandbox system. Blockchain uses cryptographic proof to validate records (Vazirani, O'Donoghue, Brindley, & Meinert, 2020). Blockchain technology has wide significance in health concerns be collect concerned information this, in turn, will help countries to gather their countrywide health schemes (Tsai, Chang, & Kuo, 2020). Blockchain know-how can recover telehealth and telemedicine facilities via contributions made by distant healthcare facilities in a way that is distributed, tamper-proof, clear, noticeable, dependable, trustful, and safe. It allows fitness experts to exactly classify deceptions connected with doctors' enlightening permits and health challenging kits usually castoff for home-based findings (Ahmad et al., 2020). It is urgent to accelerate the construction of a blockchain platform and to promote exploration of the practical application of a "blockchain plus medical treatment" (Liu & Liu, 2021). Llamas Covarrubias and Llamas Covarrubias (2021) argued that the connection among the various governments, private sectors practices of good governance, and blockchain technological systems is an important support in controlling the process with unvarying transparency. Velmovitsky, Bublitz, Fadrique, and Morita (2021) described that blockchain technology has the possibility to optimize procedures, minimize inefficiencies, and upsurge confidence altogether in healthcare enterprises. Vaghela (2019) shows the benefits of blockchain technology in the health sector.

Digitization is a guide to significant act as an influential tool for getting evidence of skills in a detached style, to join a practice with procedures, on behalf of the all-inclusive measurement (Katz, Koutroumpis, & Callorda, 2013). Through arranging to evolve a creative architectural indispensable diagram, upper management, and IT-enabled expert procedures, which ideas may be built, and as a consequence to implement accurately (Morabito, 2013). Net skill is grounded on worldwide values that somewhat businesses can customize, aimed at

competitors to go into the market providing value (Laudon & Laudon, 2017). In the digital era, most economic and social behaviors leave behind a huge digital footprint with forecasting purposes (Blazquez & Domenech, 2018). Online can be applied to convey health statistics in eHealth, which can successfully distract and divest the information circulation by internet (Chen, Chen, & Cui, 2019). Bangladesh is accomplished with receipts of assistances of the digital interference methods, fitted collaboration amidst government and private institutions, as well as academies would be required to get the maximum paybacks (Islam & Islam, 2020).

When measuring product quality, managers must be specific as to which of the many quality dimensions are concerned with such as reliability (Anupindi, Chopra, Deshmukh, Van Mieghem, & Zemel, 2014). As the health sector in Bangladesh is worsening, with negligence of duty by health professionals and health workers towards patients, therefore, to receive quality healthcare, Bangladeshis travel abroad for surgery and arrange money by selling their land and assets (Ali & Medhekar, 2018). The importance of new business models is most essential innovations during the Fourth Industrial Revolution has increased (Marques, Serrasqueiro, & Nogueira, 2020; Costa, Dias, Pereira, Santos, & Capelo, 2019; Romanova, 2018). The stream of human actions stops for several months and is cautiously redefined to bring into line with strategies and suggestions to stay away from the extend of the novel coronavirus (Kalla, Hewa, Mishra, Ylianttila, & Liyanage, 2020). A patient and family advisory council can be comprised for all hospitals, which force them to take care of patients' anxieties, counting needless diagnostic tests and events and organized with the organization board of hospitals (Ali, 2019; Dang, 2020; Mohiuddin, 2020). COVID-19, with its extremely infectious character and rising fear amid nations, countries need newer management solutions and a possible new vaccine (Rahman & Bahar, 2020). Hossain (2021) argued that in Bangladesh, the organizational weakness of the healthcare system and the delivery problems were prevailing.

From the aforesaid literature reviews, in different countries applicability of digitization, especially medical robots and blockchain technologies, were discussed but they did not cover the impact on the pandemic situation of COVID-19 in the health sector in Bangladesh, identifying the research gap. Though in Bangladesh some journalistic reports were published, academic research-based discussions were scanty. Moreover, some research works were done to assess the impact of COVID-19 on the country but still, they are not mainly related to the digitization process in the health sector and organizational behavior in Bangladesh. As such, the study has been undertaken.

3. RESEARCH METHODOLOGY

Considering the research question and objectives of the study, both quantitative and qualitative research methodology was adopted. The study prepared a closed-end questionnaire to collect demographic data. Quota sampling, which is a non-probability sampling technique was used. Furthermore, an open-ended questionnaire was also prepared and given to

the respondents to assess their perception of the current healthcare enterprise management system. Variables were identified based on the target population's diverse nature so that subgroups could be recognized. A quota was set for each subgroup and the sample was advanced on the basis of the customary quota. For this purpose, the study was divided into the following subgroups: 1) age, 2) income, 3) contact with the health sector in Bangladesh, 4) perception of robotics and blockchain technology in Bangladesh, 5) occupation, which was shown in Table 1.

1) The study did not distribute any questionnaire to participants less than 20 years of age. Given the 72.32 years life expectancy of Bangladeshis, due to pandemics, the study chose participants up to 67 years. The reason was that those respondents who were more than 67 years, some of the probable respondents informed by cell phone that they were in isolation while the research work was started.

2) For those who did not have any contact with the health sector in Bangladesh, the questionnaire did not consider them as respondents, because they could not give a true picture and awareness of health sector of Bangladesh.

3) Those who did not have any perception of robotics and blockchain technology in Bangladesh were not given any scope to receive the questionnaire as their knowledge may not give a true picture. In the case of sub-group occupation, the study took diverse nature of respondents, but they must fulfill aforesaid criteria. As such before distributing the questionnaire aforesaid subgroups were carefully tried to examine by a pilot survey so that criteria of quota sampling can be fulfilled.

4) The study also divided sample size on the basis of gender to do Fisher's exact test criteria. The reason behind using the quota sampling technique is to ascertain samples who truly represent the population though it is a subjective nature based on the thought of gender equality, i.e., men and women. As such, during the pandemic situation, the study collected questionnaires' responses through using email, WhatsApp, LinkedIn, and even in some cases visiting different hospitals, maintaining social distances and health safety measures for both the researcher and the respondents. The physical visit was done only in hospitals in the Dhaka, Cumilla, and Rajshahi districts. For other areas of the country, responses were received virtually even from Panchagarh, Khagrachari, Jhalokathi districts in Bangladesh.

5) The study performed Fisher's exact test criteria tests for each subgroup 56 participants each for males and females. Though the study distributed a total of 160 questionnaires among different subgroups considering 80 for male and 80 for female, respondents' numbers received for male were 61 while for female were 64. From male respondents, 56 questionnaires were found duly filled up while for female respondents' 59 questionnaires were duly filled up. Out of them, the study kept only 56 of each gender totaling 112 samples. This was done for ascertaining gender balances. As a result, the study kept equal numbers of 56 responses from men and women for each gender to determine whether there is any sort of nonrandom association between categories of a variable by men and women. The study used Fisher's exact test to analyze the data.

6) The Fisher's exact test was done at a significance level of 0.05, i.e., if the p-value is less than 5 percent of the time then the alternative hypothesis will be accepted, otherwise, if the p-value is greater than 5 percent of the time then null hypothesis will be accepted. Qualitative data was also collected from different hospitals in Dhaka, Cumilla, and Rajshahi districts to assess the status of the patients and nurses, and to gather knowledge and perceptions from talking with hospital authority, doctors, nurses, patients, and their attendants.

7) Furthermore, fieldwork was done on Development Research Network (D.Net), a telemedicine service provider, to observe their claims about the patient services during pandemic which was mentioned in case study 1.

8) Open-ended questionnaires were given to the respondents to obtain the qualitative results from all the respondents. Actually, the study through these open-ended questions wanted to gather important information regarding the health industry in Bangladesh along with information obtained from the field visits by the researcher which were summarized and given in the Appendix.

The time period of the study was from 2nd April 2020 to 28th February 2021.

Following six hypotheses were considered for the study which is shown in Table 1.

Table 1. Hypotheses of the study

No.	Null hypothesis	Alternative hypothesis
1	*Healthcare enterprises in Bangladesh are not in a vulnerable situation.*	*Healthcare enterprises in Bangladesh are in a vulnerable situation.*
2	*Health workers are not working ethically.*	*Health workers are working ethically.*
3	*Medical robots are not being needed.*	*Medical robots are being needed.*
4	*Blockchain technology does not need to be used in healthcare management.*	*Blockchain technology needs to be used in healthcare management.*
5	*Bangladesh is ready for the modernization of healthcare facilities.*	*Bangladesh is not ready for the modernization of healthcare facilities.*
6	*Beginning of the pandemic health workers provides their services properly.*	*Beginning of the pandemic health workers did not provide their services properly.*

Source: Author's elaboration.

4. ANALYSIS OF THE FINDINGS

4.1. Demography of the respondents

From Table 2, it is revealed that the highest number of respondents was 49 between the age of 36 and 51. The second position goes to the age between 20 and 35. The highest level of income of the respondent's group is between taka 60,001 and taka 105,000 per month whose numbers were 47. From the income level, taka 105,001 and taka 150,000, the study got the second-highest respondents. Acquaintance with the health sector in Bangladesh, the study observed that 56 respondents have moderate acquittance while sufficient acquittance was 41 respondents. In the case of perception of robotics and blockchain technology in Bangladesh, 81 respondents had moderate perception, while 26 respondents had sufficient perception. On the sub-group, the study observed that in the case of occupation entrepreneurs were highest in number (12), while the second-highest respondents were nurses (11).

Table 2. Demography of the respondents (Sub-group)

No.	Category	Number of respondents
	Age	
1	20–35	43
	36–51	49
	52–67	20
	Income	
2	Below taka 15,000 per month	13
	Taka 15,001–taka 60,000 per month	21
	Taka 60,001–taka 105,000 per month	47
	Taka 105,001–taka 150,000	23
	Above taka 150,001	8
	Acquaintance with health sector in Bangladesh	
3	Neutral	15
	Moderate acquittance	56
	Sufficient acquaintance	41
	Perception of robotics and blockchain technology in Bangladesh	
4	Neutral	5
	Moderate perception	81
	Sufficient perception	26
	Occupation	
5	Policy levels	3
	Politicians	6
	Various regulatory bodies	7
	Academicians	6
	Entrepreneurs	12
	Business personnel	5
	Computer scientists	6
	Journalists	5
	Bankers	7
	Ngo workers	8
	Doctors	7
	Nurses	11
	Physiotherapists	3
	Bio technologists	4
	Lab technicians	5
	Mechanical engineers	8
	Civil engineers	5
	Others	4

Source: Author's elaboration.

4.2. Quantitative analysis

The findings of the quantitative analysis are given in Table 3.

1. The study obtained the result in serial no. 1 of Table 3 that the Fisher exact test statistic value was 0.0373. As such, the result was significant at $p < 0.05$ and the study rejected the null hypothesis and accepted alternative hypothesis, i.e., *Healthcare enterprises in Bangladesh are in a vulnerable situation.*

2. The study obtained the result in serial no. 2 of Table 3 indicated that the Fisher exact test statistic value was 0.6988. As such, the result was insignificant at $p < 0.05$ and the study accepted the null hypothesis and rejected the alternative hypothesis, i.e., *Health workers are not working ethically.*

3. The study obtained the result in serial no. 3 of Table 3 that the Fisher exact test statistic value was 0.0407. As such, the result was significant at $p < 0.05$ and the study rejected the null hypothesis and accepted the alternative hypothesis, i.e., *Medical robots are being needed.*

4. The study obtained the result in serial no. 4 of Table 3 that the Fisher exact test statistic value was 0.0001. As such, the result was significant at $p < 0.05$ and the study rejected the null hypothesis and accepted the alternative hypothesis, i.e., *Blockchain technology needs to be used in healthcare management.*

5. The study obtained the result in serial no. 5 of Table 3 that the Fisher exact test statistic value was 0.7045. As such, the result was insignificant at $p < 0.05$ and the study accepted the null hypothesis and rejected the alternative hypothesis, i.e., *Bangladesh is not ready for modernization of healthcare facilities.*

6. The study obtained the result in serial no. 6 of Table 3 that the Fisher exact test statistic value was 0.3042. As such, the result was insignificant at $p < 0.05$ and the study accepted the null hypothesis and rejected the alternative hypothesis, i.e., *Beginning of the pandemic health workers did not provide their services properly.*

Table 3. Summary of Fisher's exact test

No.	Hypothesis	Male	Female	Fisher exact test statistic value	P-value < 0.05 Significant/Insignificant
1	*Healthcare enterprises in Bangladesh are in a vulnerable situation.*	11	22	0.0373	Significant at p < 0.05
	Healthcare enterprises in Bangladesh are not in a vulnerable situation.	45	34		
2	*Health workers are working ethically.*	23	21	0.6988	Insignificant at p < 0.05
	Health workers are not working ethically.	33	35		
3	*Medical robots are being needed.*	23	12	0.0407	Significant at p < 0.05
	Medical robots are not being needed.	33	44		
4	*Blockchain technology needs to be used in healthcare management.*	10	30	0.0001	Significant at p < 0.05
	Blockchain technology does not need to be used in healthcare management.	46	26		
5	*Bangladesh is ready for the modernization of healthcare facilities.*	27	24	0.7045	Insignificant at p < 0.05
	Bangladesh is not ready for the modernization of healthcare facilities.	29	32		
6	*Beginning of the pandemic health workers provides their services properly.*	36	42	0.3042	Insignificant at p < 0.05
	Beginning of the pandemic health workers did not provide their services properly.	20	14		

Source: Author's elaboration.

From Table 3, the study found that the digitization process ought to be helpful for a paradigm shift in the healthcare enterprises of the country. There is ample scope to modernize the health sector throughout the country but was not still ready for that. The introduction of medical robots and blockchain technology would be helpful for improving the healthcare enterprises of the country. On the basis of the estimated results shown in Table 3, a summary table of the hypotheses accepted or rejected was shown in Table 4.

Table 4. Summary of hypothesis testing: Accepted or rejected

No.	Null hypothesis	Alternative hypothesis
1	*Healthcare enterprises in Bangladesh are not in a vulnerable situation.* — Rejected	*Healthcare enterprises in Bangladesh are in a vulnerable situation.* — Accepted
2	*Health workers are not working ethically.* — Accepted	*Health workers are working ethically.* — Rejected
3	*Medical robots are not being needed.* — Rejected	*Medical robots are being needed.* — Accepted
4	*Blockchain technology does not need to be used in healthcare management.* — Rejected	*Blockchain technology needs to be used in healthcare management.* — Accepted
5	*Bangladesh is ready for the modernization of healthcare facilities.* — Accepted	*Bangladesh is not ready for the modernization of healthcare facilities.* — Rejected
6	Beginning of the pandemic health workers provides their services properly. — Accepted	*Beginning of the pandemic health workers did not provide their services properly.* — Rejected

Source: Author's elaboration.

4.3. Quantitative analysis

Case study 1: Observations
D.Net has promised a vision towards the society where information and knowledge can facilitate the participation of all the stakeholders in its balanced delivery to alleviate poverty. The mission of the organization is to promote innovative and sustainable solutions integrating models that impact marginalized lives in Bangladesh and beyond. While doing this research study, a telemedicine service provider of the country "D.Net" was visited by the researcher for two days giving more than a one-month gap. One day was Friday and another day was Monday in two different months. On Friday (19 June 2020), at 10 a.m., the researcher visited the office. The entire office was under lock and key. And on another Monday, around 12 a.m., in next month (27 July 2020), the researcher again went to the office and found that only one attendant was in the office. When enquired about telemedicine services for the patients, the attendant could not say anything. She was a little bit confused and commented that she came for only that day to work. As such, when the call was made on the telephone number given on the website, nobody received the call. From the field study, it was evident that reality and claiming about providing different sorts of services under pandemic situation are far from the truth. Clean image may be uploaded on the website, but the reality on the ground indicated different stories.

The field study was experienced that they have not been truly providing any authentic telemedicine

services. It was found that the organization what was claiming and what was really provided was totally different — they were claiming untruth and fictitious reality and without arranging proper help for the treatment purposes during the pandemic. D.Net practically does not fulfill the vision and mission of their organization. In the name of providing telemedicine, they were actually not doing their right job. D.Net provided deceitful claims regarding telemedicine services, as investigated and observed from the fieldwork. Strong steps against D.Net should be initiated due to their immoral and unethical practices, especially for vulnerable patients.

5. DISCUSSION

From the observations, the study found that medical robots are very much needed to improve healthcare enterprises and removing the commercialization profit-driven attitude of doctors, nurses, diagnostic centers, public and private hospitals. More investment, as a proportion of the gross domestic product in the health sector, is required. Even the portion which is allocated in the national budget remains unutilized in each fiscal year due to non-capacity building. Blockchain technology can be used in the healthcare industry of the country. Medical technologist position: physiotherapist and biotechnologist positions should be created in different hospitals in the country to facilitate the treatment. Doctors and nurses who did not want to go to the remote villages or even from the Dhaka city to other districts or casually going for one day per week and practicing at the Dhaka city must be retrenched from the government hospital job. Blockchain technology can take care of real-time sharing in the health sector, fake medical commodities, help to get rid of fake medicine, false diagnostic reports can be checked, reduce patient harassments, keeping e-records of the patients for further monitoring and evaluation, easy accessorily to get treatment, interest in doing health insurance by the people, transparency, answerability, and impartiality in the health sector may be ensured. The relationship between health and economic development is highly correlated from the viewpoint of micro- and macro-factors of the country. Welfare and health of the citizens of the country is being related to the inclusion of access to receive standard health services. As such, organizational development in the health industry of the country from the grass-root level hospitals to tertiary medical institutes are being required for which a scientific approach is needed to develop through target-based and focused-based development starting from the plans, arrangements, procedures, and executions. To build up the capacity, blockchain technology may be integrated into healthcare management and robotic application for primary healthcare services for investigation and caring should be engaged. Modernizations of the lab equipment, as well as proper maintenance, are required.

Purchase order and procurement policy of the products in the health sector should be based on own country's law and ethically, otherwise, any departure should be strongly investigated by the Anti-Corruption Commission Bangladesh (ACC) and those who are culprits must be brought under the law. Ethical values among the health personnel and managers and owners of the private sector are tremendously requiring managing the economy of the health which may be authenticated and verified by the use of blockchain technology. Some NGOs are doing satellite and telemedicine, mHealth-businesses but their impact on the health sector is very insignificant. They need to bring under strict compliances.

If robots and blockchain technology can be used in the healthcare enterprises in Bangladesh, then a huge amount of investment will be needed initially. Bangladeshi pharmaceutical company, Globe Biotech, claimed that they prepared an anti-COVID-19 vaccine "Bangavax" but it is still to complete the human trial. However, the two local companies, "Minister" and "Walton", prepared ventilation machines. However, Director General of Health Services still did not take appropriate measures to procure on an emergency basis of local ventilation machines rather than purchasing from abroad under pandemic situation has been occurring as the second wave of COVID-19 has been currently going on. Entrepreneurs, angel investors, and through bootstrapping medical robots and blockchain technology can be operated in the health sector of the country. Gordon and Catalini's (2018) comments should be considered for public-private-foreign initiatives for blockchain technology in the healthcare management process of the country. This will, in turn, help inbound medical tourism to rise and outbound medical tourism may be stopped which can assist the government to earn foreign exchange, as well as save the foreign exchange. Nurses should do their duty properly. Some private hospitals owners' attitude is only profit motive, and they harass not the only patient party but also asked doctors and nurses to write false reports and confined the patient even after death with a dead body in the hospital for more days without valid reasons to suck money. This is a horrible and unbearable situation prevailing in the medical sector of the country. Kuo et al. (2017) observed that the proposal towards medical robots can be arranged in the health sector of the country. The introduction of robots in the health sector will be beneficial starting from the doctors to the patients including other health professionals and also a patient party. Government hospitals of the country should come forward with a specific proposal where medical robots can be used and entrepreneurs in the private sector may come forward to adopt robots in the health sector.

Bangladesh Medical Association, Bangladesh Dental Society, and Bangladesh Nursing and Midwifery Council should set together with the Health Ministry for the betterment of the services using medical robotics and blockchain technology. Education of the private medical colleges, which are far below the international standard, should be improved by cautious monitoring with honesty and integrity. Nowadays a section of wealthy students can easily get admitted into private medical colleges where even minimum facilitates to learn are not being provided. As proper treatment depends on the quality education of doctors and nurses so their behavioral patterns and commitment should be friendly towards patients. Capacity building of the private sector medical colleges and hospitals, nursing homes are needed to drastically humanizing

services through rigorous strategies to organizational development in the private sector. Private medical colleges and hospitals should refrain from taking supernormal profit by a section of the owners and they must be bound to come out from unethical practices in the hospitals while dealing with the patients and patient parties. Taylor et al.'s (2016) and Tsai et al.'s (2020) suggestions are needed to be applied in Bangladesh. The country's healthcare enterprises are not transparent and accountable even at the time of the ongoing COVID-19 pandemic. This, in turn, allows people's perception of transformation to assistance from robots and blockchain technology for medical purposes. Health workers of the country who want to deliver services sincerely are in a vulnerable situation, as well as a section of health workers who are reluctant to act as front liners due to COVID-19, have been creating huge gaps in the healthcare enterprises of the country. To some extent, in the private sector, management thought that they can make a supernormal profit. As a result, patients are suffering. Consequently, the country needs to come out of the current crisis. Bureaucratic mannerism by maximum health workers, as well as health controlling authorities of the country, should be bound to arrange to provide quality health services. Moreover, the procurement system in the health sector of the country needs to be transparent, fair, and accountable.

6. CONCLUSION

Huge investment initially will be required for arranging the medical robots and blockchain technology in the Bangladesh healthcare enterprises. For this purpose, the government, private and foreign sectors should come forward cooperatively to collect assistance from foreign countries, local findings, and donor agencies post-pandemic, then the government can put a surcharge on public and include it in the forthcoming Ninth Five-Year Plan which will start from July 2025. In sixty-four districts main government hospitals of each district should come forward with the use of medical robots and blockchain technologies and initiatives should be supported by the Health Ministry of the country. Government can involve Bangabandhu Sheikh Mujib Medical University (BSMMU), the University of Dhaka, and Bangladesh University of Engineering and Technology (BUET) for arranging proper research and development of well-planned health concern supervision along with producing robots locally and utilize blockchain technology suitably, as well as a negative side of use, may also be considered so that threat can be turned into opportunities. A foreign collaborative effort in the digitization process in the healthcare enterprises of the country may also be arranged. Virtually, management of technological innovation and continuous process of research and development in the health sector of the country is being required to come out from the low level of health sector services ad deliveries by the healthcare industry.

Local electronics manufacturing companies like Walton, Minister Hi-Tech Park Electronics Ltd., etc., require assistance to invent medical robotics and blockchain technology in the healthcare management of the country to manufacture and supply at a fair price. Through a collaborative effort, the health sector needs to be corrupt-free especially in the procurement and purchasing process. Fraudulent activities by a vested quarter by some miscreants in the health sector should be stooped by the introduction of the use of blockchain technology and robotics. Under a new normal situation, the health sector needs to reshuffle for a better contribution towards the economic management of the country. Inbound medical tourism can be created, which, in turn, can stop the outflow of large capital flights from the country. Though Bangladesh has 51 government universities, besides a good number of private universities, but no scientist from the academic side is interested to invent a COVID-19 vaccine in the country for the well-being of the community of the country. They must do it for the sake of the country through maintaining WHO protocol, as well as government protocol.

Telemedicine should be developed in a true sense to provide better services. As such, access to the primary healthcare services where artificial intelligence and ChatBot software may also be employed for primary investigation. The invention of a vaccine against COVID-19 should get priority and the vaccine ought to be sold in the free market which requires to be prioritized by every country, and intellectual property rights are supposed not to be a trouble to right of entry in procuring and producing quality vaccine across the world. Pharmaceutical companies of the country should contact the inventor of vaccines so that they can be produced locally. The patient-reported outcome should be arranged in Bangladesh in all health facilities giving hospitals, nursing centers, and diagnostic centers. Health Ministry and Director General of Health Services of the country ought to make plans and actions to provide better health services taking into cognizance of the patient-reported outcome. All vacant posts of the doctors, nurses, technologists, and other health professionals of the government medical hospitals need to be filled. Health professionals of the country should be more pro-patient to provide patient-centered care. They should come out from unethical practices and refrain from receiving commissions from different diagnostic and lab tests. Private hospitals of the country must come out from excessive greediness and the chronic drought of specialized doctors. Behavioral economics may be used, because it is moving parts with psychosomatic trialing, insight of worth, expressed inclination of both demand for and supply of the health service providers can play a vital role through matching between both groups to solve the problem of the health sector for which strong political, ethical, legal, social, and economic determination are being required. High powered compliance committee needs to inquire about irregularities of Gonoshahthaya medical college and hospital.

The study is based on primary data using a quota sampling technique and hypothesis testing. Moreover, qualitative analysis through field visits and considering responses of the open-ended questionnaires and collected data through field visits from the patients and their attendants and other personnel were discussed in the Appendix. A case study was also prepared based on the fieldwork. The limitation of the study was a shortage of time, lack of funds, and research work

was undertaken during the pandemic situation, within a confined COVID-19 regulated system maintaining social distancing. Moreover, a separate research study will be needed among owners of the private medical college hospitals, nursing homes, and diagnostic centers to ascertain how they can involve in the process of utilizing robots and blockchain technology for their organizations for which both qualitative and quantitative research work simultaneously being done. Furthermore, the study did not investigate exhaustive organizations' behavioral weaknesses of the hospitals, nursing homes, laboratory training of the health personnel, and medical education systems during COVID-19. As such, a simultaneous equation model by using instrumental variables may be done in a future study to investigate thoroughly the health industry's weakness. In future post-pandemic situations, a more in-depth study can be repeated, with the key healthcare stakeholders. For the sake of the country, a proper healthcare policy framework, regulations, and implementations considering sixty-four districts should be undertaken where the use of medical robots and blockchain technology can work as a pathfinder to overcome the current crisis for which huge cost to conduct the study is required. A strategy needs to develop in the health sector management for upgrading may be studied by the researchers and to plan for proper development combining Fourth Industrial Revolution, digitization process, artificial intelligence, Internet of Thinking, medical robotics, and blockchain technology. To get rid of regional health disparity and the Gini coefficient of medical facilities all over the country need to be assessed using cluster sampling technique in future research work.

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APPENDIX

Summary of the findings from the open-ended questionnaires and field visits

The researcher found that excellent medical services during the pandemic have been provided by the Combined Military Hospital (Dhaka). Doctors-nurses were well equipped and tried to provide very smart and good services to the patients. But most of the other cases while visiting different hospitals were full of flaws and loopholes.

Gonoshahthaya Nagar Private Hospital at Dhanmondi, Dhaka, visited during the study period, found that they were not well equipped, and no good doctors-nurses were available as complained by the patients and attendants. Moreover, outdoor patients were charged a very high rate without health insurance. Serious allegations were made against them but none to monitor and supervise in the true sense.

In the Bangabandhu Sheikh Mujib Medical University, few young doctors were available during duty time and senior doctors come only for a while during their duty hours. A very cumbersome situation was observed at the Cumilla Medical College Hospital during the visit. Patients were getting annoyed but not getting any service. Out of three government medical colleges hospitals in Dhaka and one in Cumilla, — one similarity was found that was during the office/visiting times most of the specialized doctors were not available. Most of the senior doctors are staying outside Cumilla town. When asked the hospital authority, they mentioned that they cannot disclose their identity.

In most of the cases, the doctor's oath and promise to provide treatment to the patients were violated though there are some exceptional cases. While talking with the patients and their attendants, in some cases by some lower grade health workers pilferage of medicine and food of the patients have been done as complained which are really unfortunate. In a private medical college hospital at Cumilla-Eastern Medical College & Hospital situation is such that it was hard to believe it as a medical college hospital and needs to develop before giving treatment to the patients. They do not have full-time specialized doctors and nurses. However, some doctors and nurses commented that Personal Protective Equipment (PPEs) was the main reason not to do duty properly and some also commented that patients did not try to cooperate with them before giving treatment whether they were COVID-19 patients or not. Some doctors of visited different private hospitals also blamed some hospital authorities as in the private sector most of the owners only want to satisfy their pockets with high fees even during the pandemic. Some also said that due to inappropriate medical technological support system, they could not deliver proper services despite they have the wishes. It is important to note that on weekly holidays, there have been no doctors in most of the hospitals even though on a roster basis duty should be assigned. Many patients of the country have fairly expressed during the pandemic while doing the research work that they would want to die at home peacefully rather than die in a hospital due to not getting appropriate services and rough and tough attitude of the health sector management people.

The study observed from the open-ended questionnaires that Bangladesh is not yet ready for modernization of the healthcare facilities. It is increasingly evident during the pandemic situation of the country. Normal patients generally cannot trust doctors and health workers. Even telemedicine and satellite clinics are not properly functioning in the country. Though a large number of young doctors and nurses are wanting their jobs mainly in the capital city or, divisional metropolitan area or in lucrative district towns or as Bangladesh Civil service cadre. Moreover, those who are doing jobs are not doing justice to the patients and attendants. Some patients do not trust young and middle-aged doctors. Educations in private medical colleges through accredited but low-quality standards. No one is properly supervising their education. After graduating, doctors and nurses want to work in metropolitan cities and not in remote villages. If some of them join the government medical colleges or medical hospitals which are situated outside the Dhaka city, then their target is to transfer to the capital of the country, i.e., Dhaka city or at least port city as soon as possible.

Corruption and nepotism are prime loopholes in the health sector. The Director General of the Health Services office in Bangladesh is indulging in corruption since the eighties. But the group is now strong by creating an oligopolistic market nature of "Cartel". A vicious circle cannot be now broken despite several government initiatives and the health management system of the country has become inefficient, incapable, and ineffective to deal with any health crisis pre, during, or post-pandemic. They purchase low-quality products at a higher rate. A vested quarter of corrupt people, brokers, owners of low-quality hospitals, nursing homes, pathologists, lab technicians, a group of doctors and health professionals are associated with false and fabricated treatments, giving commission to the doctors, billing, procurement, purchase and making false reports of COVID-19 like using BCG matrix of cash cow flow. Excessive greediness of some vested quarters is worsening the situation. Even in the health sector, it is worse than the theory of the second-best which apprehension the circumstances when single or further optimality conditions cannot be satisfied.

Some respondents commented that extensive, uncaring, and illogical use of antibiotics to the patients by the doctors were being happening during the treatments. Some respondents lodged misuse or not being the use of the medical equipment by the authority of the hospital. For example, some respondents informed that in Rajshahi Medical College Hospital for more than two years ICU facility ambulance was bought but never being used. As such, this aforesaid statement was verified by the author and found true. Non-installment of medical devices and equipment especially in government hospitals were not properly done in different places were opined by quite a good number of respondents which included even doctors,

nurses, etc. as respondents. Some respondents commented that they became ultra-poor from the middle-income group to get treatment either for themselves or their family members to recover from deadly disease COVID-19.

For the study purpose, through an open-ended questionnaire, the researcher asked questions to the patients and patient parties of the government hospitals, they all commented that the food quality is so poor without any nutritional value, that the patient cannot take the food. They alleged that they have to take alternative measures to purchase the food or bring it from home. When the matter was enquired with the various government hospitals' superintendents, they alleged that due to ongoing COVID-19 patient number is very high. But when the pandemic is low it was found that half of the hospital beds were empty. One of the hospital superintendents alleged that if anyone writes against the true picture, he will lodge a complaint under The Digital Security Act 2018. Even private medical college hospitals, namely Popular Medical College Hospital in Dahanmondi 2, Dhaka, it was observed that patients were bound to take the low-quality food from the canteen. Moreover, the nurses declined to give medicine directly to the patient and/or help the patients to eat or to use catheters rather referred to go to the critical care unit to use a catheter which means extra money for the owners. Another important point was found from the open-ended questionnaires that most of the government hospitals lack basic medicine which was supposed to be given free.

From the open-ended questionnaires, the researcher found that there is a broker and middle person who act to transfer patients from the government medical hospitals to private medical hospitals in exchange for a commission. They also commented that treatment of COVID-19 patients is abnormally high in the private sector and the Director General of Health Services failed to perform their duty properly towards pro-people. However, most of the respondents argued that the government is trying hard to implement universal primary health services for a long time nicely though a vested quarter created some problems not to properly execute. All commented that the anti-COVID-19 vaccine must be public good as demanded by the prime minister of Bangladesh Sheikh Hasina in different forums.

Even a very up-market quality some private medical hospitals put incompetent nurses who cannot draw blood for which patient lodge complain but with no effect. Rather in Square Hospitals Limited, Panthapath, Dhaka, they have three to four stages of security measures which even in any Southeast Asian countries like Thailand or a neighboring country, India, were not ever found even in JCI accredited hospitals. This is actually misdeed and giving support to them by the Director General of Health. As most of the respondents found that maximum public and private medical hospitals are filled with the corruption and nepotism in the healthcare enterprises was working like trickledown effect. Another important allegation by the patients and patient families was that to get a hospital bed they need either to bribe, lobby, or use extortion techniques of power from high-ups' even during the ongoing pandemic.