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IMPACT OF DIGITIZATION OF HEALTHCARE SYSTEM IN SAUDI ARABIA

Nawaf Alharbe

College of Community
Taibah University
PO Box: 344, Universities Road, Medina, Kingdom of Saudi Arabia
nrharbe@taibahu.edu.sa

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Abstract. *It is evident that the patient, being the direct consumer of the healthcare facilities is the most affected by the digitization benefits in Saudi Arabia. The advancement in the field is expected to benefit the Saudi Arabia government in formulating schemes that reach out to maximum citizens and take preventive measures based on accurate estimation. The decisions to adopt, implement or reimburse new digital healthcare services, at different levels of the healthcare system, are ideally based upon their performances and effectiveness in the light of health system goals. In the same association, this work dowries an outline on the existing situation of digitization of healthcare system in Saudi Arabia. The article also estimates the impact of digitization of healthcare system in Saudi Arabia through a Fuzzy Analytical Hierarchy Process (FAHP) method. Furthermore, for measuring the influence of the outcomes, the contributor has tested the outcomes on local healthcare systems of Saudi Arabia. Presented outcomes of the projected work suggest a balanced approach as the best familiar method which can be employed by the specialists for making the guidelines and strategies for digitization of healthcare system in perspective of Saudi Arabia.*
Keywords: Healthcare system, Digitization, Fuzzy logic, AHP

1. **Introduction.** Digitalization in the healthcare sector ranges from paperless health records to the use of wearables, and further to the deployment of computer-aided decision and prediction systems. There has been an extreme impact of digitalisation of health services around the world and is expected to get even more extreme in the future. The digitization of the healthcare sector is shown in Figure 1. Similar to other services, it is important to evaluate the impact of such digital health services on the stakeholders. Especially, in a country like Saudi Arabia, where healthcare sector share of 2019 was the third largest of budget expenditure that accounts for 15.6% of the total, an assessment of the impact of digitization on the citizens and other stakeholders is obligatory [1,2].

The decisions to adopt, implement or reimburse new digital healthcare services, at different levels of the healthcare system, are ideally based upon their performances and effectiveness in the light of health system goals. It should be realized that the complete healthcare system includes hospital management, nursing facilities, telehealth, research and development, and if the ongoing advancements are followed by proper marketing of the healthcare services, the industry can increase its financial market exponentially.

Stakeholders may be defined as the ones (individual or organization) who are directly or indirectly affected by the reforms to a system. In the case of digitization of the healthcare system, they include patients, doctors, hospital employees, insurance providers, pharmaceutical companies [3-5]. They all are interdependent. Insurance companies provide healthcare plans to the people via schemes or employees. Similarly, the medicines manufactured by pharmaceutical companies are prescribed by the doctors to the patients.

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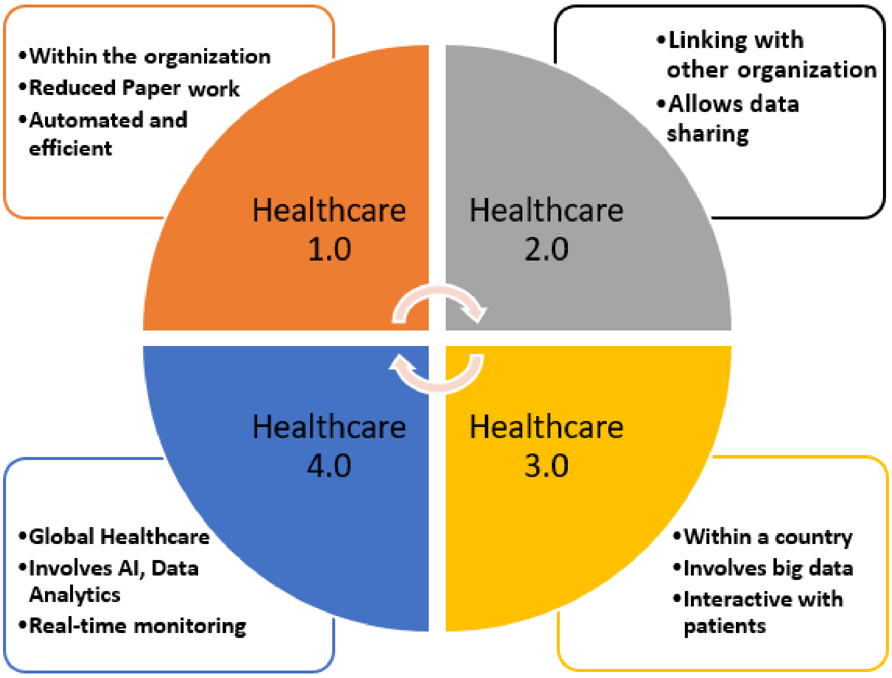

FIGURE 1. From Healthcare 1.0 to 4.0

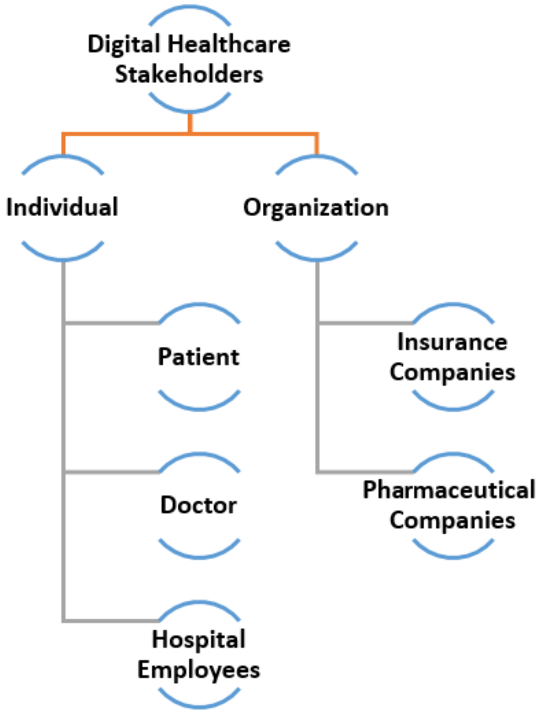

FIGURE 2. Stakeholders in healthcare scenario

It is evident that the interrelationship of the healthcare stakeholders is very confusing. Depending upon the role a stakeholder plays in the healthcare scenario, they may be classified as follows (Figure 2).

1.1. **Individual.** This category of stakeholders includes the individuals who are directly influenced by the reforms in the healthcare sector such as, patient, doctor/physician and the hospital employees [6].

1.1.1. *Patient.* They play the most important role in the healthcare sector. In the present world, they are not mere recipients of care but are actively involved in the process of care and treatment [7]. The advent of wearables and other IoT devices have made individuals participate in the proactive care process.

1.1.2. *Doctor.* The primary responsibility of a doctor must always be to provide better care to the patients [8]. The digitization of healthcare will help doctors treat persons in the remote areas and make the patient care more accessible and affordable.

1.1.3. *Hospital employees.* The hospital employees can also benefit from the digital healthcare scenario [9]. The digital solutions will help hospital administration in maintaining staff, doctors' appointments, managing appointments, etc. This strategic data management will prove beneficial in enhancing patient care and monitoring.

1.2. **Organization.** The organizations say, insurance companies and pharmaceutical companies involved in the healthcare management also benefit through digitization to a great extent. Digitization may help the organizations boom their profits through improved patient data analysis and digitized workflows.

1.2.1. *Insurance companies.* The rising cost of many healthcare services hinders the patients from getting proper care [10]. The insurance companies provide health insurance to the individuals to help them at the time of any urgency. Such companies need to maintain a trade-off between their shareholders and the patients. The maintenance of such a balance becomes easy with the advent of digital data management techniques.

1.2.2. *Pharmaceutical companies.* The pharmaceutical companies form a very integral part of the complete healthcare scenario [11]. The digitized healthcare environment has helped the pharma companies in supply chain and manufacturing efficiency. In addition, the automation, smart sensors, health applications, etc., can help them in measuring drug compliance and predicting region-wise demands.

2. **Factors Influencing Acceptance of Digitization in Healthcare.** Healthcare around the world is changing at a very high pace. The time has gone when a face-to-face conversation with a doctor was mandatory for treatment [12-14]. The advent of telehealth has made healthcare just a virtual conversation with the physician. With the advancement in digital communication, people are exploring more and more ways to get prompt remedies to their questions/needs. Nowadays, patients are not just passive recipients of care rather they have become active evaluators of the prescription and doctor's advice. There are several factors responsible for the acceptance of digitization in the critical field of healthcare around the world, such as reduced cost, fast diagnosis, and accurate prediction of diseases. Some of the factors driving such vast adoption of technology per stakeholder are discussed below (Figure 3).

2.1. **Patient.** Needless to say, that the patients are the ones who are directly affected by any change in the process of healthcare facilities. Digitization has made doctor-patient coordination better. Now, patients need not to keep their files and reports physically with them. They can upload all the related documents to the cloud and share the same with intended persons. According to a report in November 2019, more than 74% patients in Saudi Arabia are satisfied with the health services being provided to them [14]. Various factors contributing to such huge adherence of technology in case of patients are as follows.

2.1.1. *Cost.* Healthcare costs have reduced much due to automation of various services at hospitals. The ability to connect better with doctors leads to better decision making and cuts down healthcare costs as well. The prevalence of IoT devices also reduces the

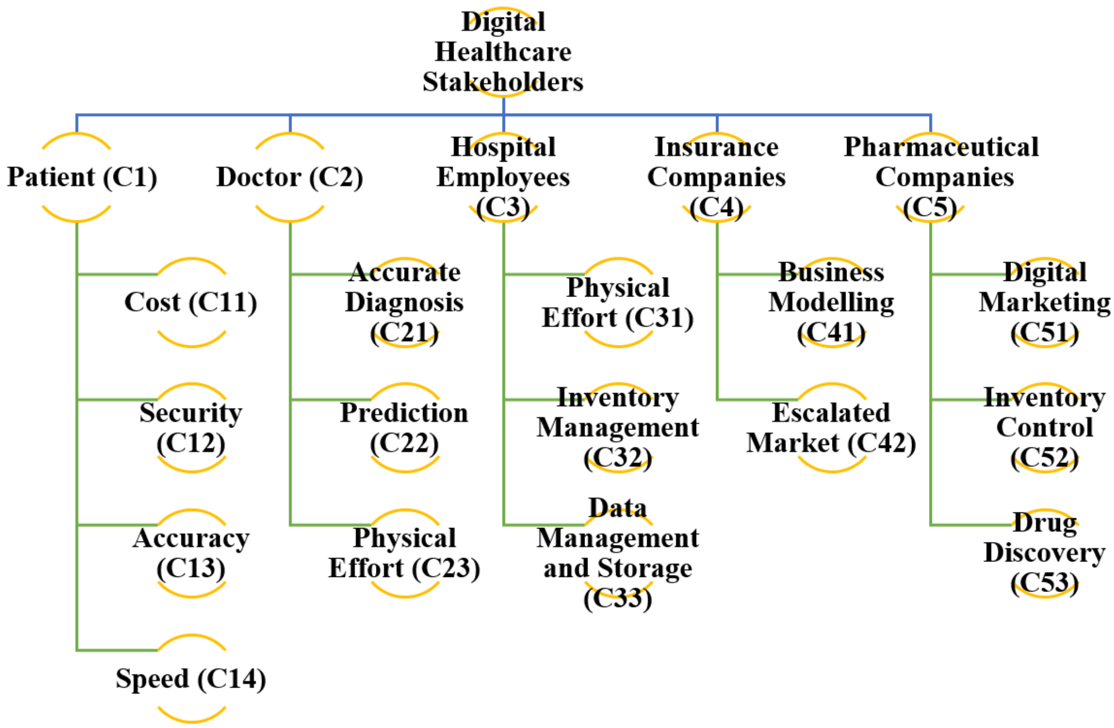

FIGURE 3. Factors influencing acceptance of digitization in healthcare

cost by eliminating the need of a person for monitoring the patient's vital signs at regular intervals of time.

2.1.2. *Security.* The vulnerability of the digital data to several attacks does not make the physical files impenetrable. The possibility of losing the medical data remains always. It may be due to any natural disaster or carelessness. However, in case of digital data storage system, the records can be accessed from anywhere by the intended person which ensures the safety and availability of data at the time of any emergency.

2.1.3. *Accuracy.* The automation of various healthcare jobs helps in accurate and timely decisions when it comes to patient care and monitoring. Artificial intelligence techniques may be deployed to provide reminders and advices to the patients.

2.1.4. *Speed.* It has been estimated that less than 27% of a doctor's time is spent on actual patient treatment [15]. Most of the time is wasted in doing administrative jobs. With the adoption of digital methods by hospital management and automation of services, doctors will be able to spend comparatively more time in treating patients and thus the care will reach more people. Also, real-time health data is available to the patients which help them adopt proactive methods when needed [16].

2.2. **Doctor.** The technology provides doctors with the chance to expand their reach. Now, the online availability of doctors helps them reach a larger group of people and provide the services. Different factors contributing to acceptance of digitization to doctors are listed as follows.

2.2.1. *Accurate diagnosis.* The wide use of artificial intelligence techniques helps in accurate diagnosis of several chronic diseases. According to Kumar et al. [5], the technological advancements have demonstrated 100% accuracy in detection of recurrence of an atrial arrhythmia.

2.2.2. *Prediction.* The artificial intelligence techniques are being deployed for prediction of cancer [6], chronic kidney diseases [7], cardiovascular diseases [8], etc. The prediction of diseases saves a lot of energy and time. Early prediction helps doctors in providing proper and timely medication to the patient.

2.2.3. *Physical effort.* The automation of several administrative jobs helps doctors by reducing their job of evaluating the reports of the patients again and again after every diagnosis. The major observations of a session may be saved digitally and later be deployed for clinical purposes.

2.3. **Hospital employees.** The advancement in management of patient data proves to be of great importance to the hospital management [17]. The hospitals and nursing homes can now provide the patients with fast and better healthcare benefits and care.

2.3.1. *Physical effort.* The digitization has reduced the physical effort of the hospital employees to a large extent [18]. The automated collection, storage and management of patient readings helps in improving the overall patient experience.

2.3.2. *Inventory management.* The process of inventory management, records of patients admitted in the hospital, availability of medical equipment, beds, etc., is self-managed by the digital system and the staff need not to worry about any kind of error in the process [19]. It helps in increasing the hospital's ratings and better revenue management.

2.3.3. *Data management and storage.* The management and storage of data in a digital form help the medical staff in making decisions on the patient's treatments and provide timely care [20]. This reduces the possibility of error and helps in making the hospital clinically advanced.

2.4. **Insurance companies.** The insurance companies play a leading role in the expansion of digital healthcare. The health insurance executives may prove helpful in reducing costs and inefficiencies and improve the complete healthcare system [21].

2.4.1. *Business modelling.* Making the use of advanced analytics, the insurance companies can build an efficient customer relationship management system that will help them in providing targeted services to a particular patient.

2.4.2. *Escalated market.* Providing the services to targeted groups will automatically attract more consumers to the insurance companies. This will consequently lead to escalated market.

2.5. **Pharmaceutical companies.** The pharmaceutical companies are the most benefitted if they utilize the advancements the healthcare sector is undergoing [21-23].

2.5.1. *Digital marketing.* The launch of digital pharmacy or online availability of the medicines is a great step of the pharma industry. Now the medicines are not just available at a chemist shop but they can be ordered online through a mobile application. In addition, they can also measure the popularity of a certain drug and mark its manufacturing accordingly.

2.5.2. *Inventory control.* The strategic and planned management of sales helps in better inventory management at the pharmacy.

2.5.3. *Drug discovery.* The consumption of a certain drug by the certain group greatly affects its manufacturing. The detailed analysis of the sale of individual drug or its combination with another gives a clear picture about its manufacturing.

3. **Methodology for Assessment of Digitization Impact.** For assessment of the impact of the digitization of the healthcare system, Analytical Hierarchy Process (AHP) is adopted [24-26]. The factors obtained through literature survey and discussion with various experts are arranged in the form of hierarchy (Figure 3). The attributes are named level-wise. The attributes at level 1 are named as C1, C2, C3, ...; while those at level 2 are named as C11, C12, ... Next step is to prepare pairwise comparison matrix that helps in calculating the overall impact of digitization of healthcare on observed stakeholders easily. The input proposes pairwise comparisons to produce the judgment matrix. Number a_{ij} indicates the relative importance of criterion i (A_i) in comparison with criterion j (A_j). Khan proposed pairwise comparisons to create the judgment matrix that is used in AHP technique [27-30] and shown in Equation (1).

$$A = [a_{ij}] = \begin{array}{c} \\ L_1 \\ L_2 \\ \vdots \\ L_n \end{array} \begin{array}{c} \begin{array}{cccc} L_1 & L_2 & \dots & L_n \end{array} \\ \begin{bmatrix} 1 & a_{11} & \dots & a_{1n} \\ 1/a_{21} & 1 & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ 1/a_{n1} & 1/a_{n2} & \dots & 1 \end{bmatrix} \end{array} \tag{1}$$

where $i = 1, 2, 3, \dots, n$ and $j = 1, 2, 3, \dots, n$ and $a_{ij} = 1$: when $i = j$; and $a_{ij} = 1/a_{ij}$, when $i \neq j$, where $[a_{ij}]$ denotes the relative importance of two criteria L_i and L_j. Corresponding linguistic scale for membership functions (1 to 9) is given in Table 1.

TABLE 1. Linguistic variable and corresponding numeric value

Relative importance of criteria	**Corresponding numeric value**
Equal	1
Intermediate value	2
Weakly important	3
Intermediate value	4
Essential important	5
Intermediate value	6
Very strongly important	7
Intermediate value	8
Extremely important	9

Table 1 shows the linguistic values and defines corresponding numeric values. After constructing pairwise matrix of expert input, Consistency Ratio (CR) is calculated to control the results of the AHP method. CR is calculated with the help of Equation (2).

$$CR = \frac{CI}{RI} \tag{2}$$

where, Consistency Index (CI) is calculated from Equation (3).

$$CI = \frac{\lambda}{(n-1)} \tag{3}$$

where, n denotes the number of total responses and Random Index (RI) is given by Khan [10] and shown in Table 2.

If CR is less than 0.1, then weight of each input is calculated. If CR is greater than or equal to 0 then refined pairwise matrices are prepared and the process is repeated

TABLE 2. Random index

N	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Random index (RI)	0.00	0.00	0.58	0.90	1.12	1.24	1.35	1.41	1.49

again. Aggregate the pairwise comparison matrix from Equation (4), after verifying the CR value.

$$m_{ij} = (B_{ij1} \cdot B_{ij2} \cdot \cdots \cdot B_{ijk})\, 1/k \tag{4}$$

where B_{ijk} represents the judgment of experts k for the importance of two criteria, i.e., L_i and L_j. While, the aggregated pairwise comparison matrix is shown in Equation (5).

$$\rho_{\alpha,\beta}\left(\tilde{A}\right) = \begin{array}{c} \\ L_1 \\ L_2 \\ \vdots \\ L_n \end{array} \begin{array}{c} \begin{array}{cccc} L_1 & L_2 & \dots & L_n \end{array} \\ \begin{bmatrix} 1 & \rho_{\alpha,\beta}(\tilde{a}_{11}) & \dots & \rho_{\alpha,\beta}(\tilde{a}_{1i}) \\ 1/\rho_{\alpha,\beta}(\tilde{a}_{21}) & 1 & \dots & \rho_{\alpha,\beta}(\tilde{a}_{2i}) \\ \vdots & \vdots & \vdots & \vdots \\ 1/\rho_{\alpha,\beta}(\tilde{a}_{n1}) & 1/\rho_{\alpha,\beta}(\tilde{a}_{n2}) & \dots & 1 \end{bmatrix} \end{array} \tag{5}$$

After aggregating pairwise comparison matrix, CR is calculated and verified, again. The next step is to determine the eigenvalue and eigenvector of the pairwise comparison matrix. The purpose of calculating the eigenvector is to determine the aggregated weightage of particular criteria. Assume that W denotes the eigenvector, I denotes unitary matrix while λ denotes the eigenvalue of pairwise comparison matrix $\tilde{A}$.

$$\left[\left(\rho_{\alpha,\beta} \times \tilde{A}\right) - \lambda \times I\right] \cdot W = 0 \tag{6}$$

where $\tilde{A}$ is a matrix containing numeric value of $\rho_{\alpha,\beta}\left(\tilde{A}\right)$. Equation (6) is based on the linear transformation of vectors. By applying Equations (1)-(6), the weightage of particular criteria with respect to all other possible criteria can be acquired. The eigenvectors of associated attributes of security durability were then calculated using Equation (6) as shown in Equation (7).

$$\left[\left(\rho_{\alpha,\beta} \times \tilde{A}\right) - \lambda \times I\right] \cdot W = \begin{bmatrix} 1 & \rho_{\alpha,\beta}(\tilde{a}_{11}) & \dots & \rho_{\alpha,\beta}(\tilde{a}_{1i}) \\ 1/\rho_{\alpha,\beta}(\tilde{a}_{21}) & 1 & \dots & \rho_{\alpha,\beta}(\tilde{a}_{2i}) \\ \vdots & \vdots & \vdots & \vdots \\ 1/\rho_{\alpha,\beta}(\tilde{a}_{n1}) & 1/\rho_{\alpha,\beta}(\tilde{a}_{n2}) & \dots & 1 \end{bmatrix} \tag{7}$$

Multiplying eigenvalue λ with unitary matrix I produces an identity matrix that cancels out each other. Thus, the notation λI is discarded in this case. Applying the results obtained from Equations (6) and (7), the final weights are calculated by Equation (8).

$$\begin{bmatrix} 1 & \rho_{\alpha,\beta}(\tilde{a}_{11}) & \dots & \rho_{\alpha,\beta}(\tilde{a}_{1i}) \\ 1/\rho_{\alpha,\beta}(\tilde{a}_{21}) & 1 & \dots & \rho_{\alpha,\beta}(\tilde{a}_{2i}) \\ \vdots & \vdots & \vdots & \vdots \\ 1/\rho_{\alpha,\beta}(\tilde{a}_{n1}) & 1/\rho_{\alpha,\beta}(\tilde{a}_{n2}) & \dots & 1 \end{bmatrix} \times \begin{bmatrix} W_1 \\ W_2 \\ \vdots \\ W_n \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix} \tag{8}$$

The aggregated results in terms of weights are shown in Equation (7). After calculating the independent weights, this work evaluates the dependent weights and ranks through the hierarchy. Further, Table 3 shows the linguistic values into numeric values of the rating.

After calculating the weights and ratings of digital healthcare stakeholders, authors calculate the overall impact by Equation (9).

$$\text{Overall Impact of Digitization} = R_1 \times W_1 + R_2 \times W_2 + \cdots + R_n \times W_n = \sum R_i \times W_i \tag{9}$$

where R denotes the rating values, W denotes the weight of associated attribute and i denotes the number of factors that affect the acceptability of digitization of healthcare. The implementation of this methodology is described in the following section.

TABLE 3. Linguistic rating scale

Linguistic value	Numerical value of ratings
Very low	0.1
Low	0.3
Medium	0.5
High	0.7
Very high	0.9

4. **Results and Discussion.** As per the methodology discussed in Section 3, the assessment of the different attributes on each other is calculated and shown in Table 4. By applying Equation (6), the weightage of particular criteria with respect to all other possible criteria is obtained. After that, the local weights for all levels of the hierarchical tree to evaluate digitization impact attributes are calculated, which are shown in Table 4 to Table 9. Overall CR calculations are also shown in these tables.

Followed by the analysis of the factors at different levels, the final weights (here, impact) of each factor per stakeholder are calculated. Based upon the percent-wise impact of contributing factors, ranks are given to the attributes (Table 10). It is found that the Pharmaceutical Companies is the most benefitted by the digitization in the formulation

TABLE 4. Matrix of deterministic values for the first level

	Patient (C1)	**Doctor (C2)**	**Hospital employees (C3)**	**Insurance companies (C4)**	**Pharmaceutical companies (C5)**	**Weights**
Patient (C1)	1	1.5157	0.6372	0.5743	0.2871	**0.0999**
Doctor (C2)	0.6598	1	0.6657	0.3936	0.3521	**0.0995**
Hospital employees (C3)	1.5693	1.5022	1	1.3195	0.4352	**0.2577**
Insurance companies (C4)	1.7413	2.5407	0.7579	1	0.9143	**0.2644**
Pharmaceutical companies (C5)	3.4831	2.8401	2.2978	1.0937	1	**0.2785**
						CR = 0.040254

TABLE 5. Matrix of deterministic values for the second level for factor 1

	Cost (C11)	**Security (C12)**	**Accuracy (C13)**	**Speed (C14)**	**Weights**
Cost (C11)	1	2.3498	1.9575	1.5543	**0.3881**
Security (C12)	0.4256	1	0.7860	0.7195	**0.1663**
Accuracy (C13)	0.5109	1.2723	1	0.8123	**0.2024**
Speed (C14)	0.6434	1.3899	1.2311	1	**0.2432**
					CR = 0.0006

TABLE 6. Matrix of deterministic values for the second level for factor 2

	Accurate diagnosis (C21)	**Prediction (C22)**	**Physical effort (C23)**	**Weights**
Accurate diagnosis (C21)	1	1.8180	1.9651	**0.4856**
Prediction (C22)	0.5500	1	1.1087	**0.2694**
Physical effort (C23)	0.5089	0.9020	1	**0.2450**
				CR = 0.00617

Table 7. Matrix of deterministic values for the second level for factor 3

	Physical effort (C31)	**Inventory management (C32)**	**Data management and storage (C33)**	**Weights**
Physical effort (C31)	1	0.8860	0.2762	**0.1793**
Inventory management (C32)	1.1287	1	0.3892	**0.2179**
Data management and storage (C33)	3.6206	2.5694	1	**0.6028**
				CR = 0.0047

Table 8. Matrix of deterministic values for the second level for factor 4

	Business modelling (C41)	**Escalated market (C42)**	**Weights**
Business modelling (C41)	**1**	**0.8900**	**0.4710**
Escalated market (C42)	**1.1236**	**1**	**0.5290**
			CR = 0.000

Table 9. Matrix of deterministic values for the second level for factor 5

	Digital marketing (C51)	**Inventory control (C52)**	**Drug discovery (C53)**	**Weights**
Digital marketing (C51)	1	0.9502	1.4385	**0.3632**
Inventory control (C52)	1.0524	1	1.5826	**0.3880**
Drug discovery (C53)	0.6952	0.6319	1	**0.2488**
				CR = 0.000019

Table 10. The final weights of each criteria through hierarchy

The first level	**Local weight of first level**	**The second level**	**The local weight of the second level**	**The final weight of the second level**	**Percentage**	**Final rank**
C1	**0.0999**	C11	0.3881	0.0465	4.65%	11
		C12	0.1663	0.0289	2.89%	14
		C13	0.2024	0.0394	3.94%	12
		C14	0.2432	0.0493	4.93%	8
C2	**0.0995**	C21	0.4856	0.0469	4.69%	10
		C22	0.2694	0.1493	14.93%	1
		C23	0.2450	0.0186	1.86%	15
C3	**0.2577**	C31	0.1793	0.0493	4.93%	9
		C32	0.2179	0.0384	3.84%	13
		C33	0.6028	0.0954	9.54%	2
C4	**0.2644**	C41	0.4710	0.0842	8.42%	6
		C42	0.5290	0.0948	9.48%	3
C5	**0.2785**	C51	0.3632	0.0877	8.77%	5
		C52	0.3880	0.0927	9.27%	4
		C53	0.2488	0.0786	7.86%	7

of schemes and secondly in taking certain preventive measures. The least impact of digitization is on the security of patient digital records.

Further, for the validation of the obtained results, the five hospitals (H1-H5) in KSA, located at distinct locations were taken into account. The hospitals were evaluated on the basis of the different factors per stakeholder. The global weights of the hospitals per factor are shown in Table 11. The graphical representation of the overall impacts of the digitization per stakeholder per hospital is shown in Figure 4.

TABLE 11. Impact of the identified factors on the hospitals of KSA

Stakeholders	Factors	H1	Avg. impact (H1)	H2	Avg. impact (H2)	H3	Avg. impact (H3)	H4	Avg. impact (H4)	H5	Avg. impact (H5)
Patient	C11	0.612	0.566	0.750	0.854	0.409	0.547	0.484	0.470	0.800	0.724
	C12	0.521		0.650		0.411		0.415		0.750	
	C13	0.610		0.580		0.395		0.421		0.670	
	C14	0.750		0.780		0.431		0.505		0.580	
Doctor	C21	0.670	0.658	0.850	0.724	0.482	0.445	0.551	0.445	0.810	0.753
	C22	0.570		0.640		0.425		0.410		0.750	
	C23	0.522		0.580		0.385		0.371		0.670	
Hospital employees	C31	0.813	0.678	0.720	0.695	0.478	0.458	0.461	0.455	0.612	0.578
	C32	0.574		0.570		0.379		0.365		0.570	
	C33	0.600		0.750		0.421		0.498		0.610	
Insurance companies	C41	0.622	0.658	0.610	0.458	0.531	0.854	0.405	0.389	0.750	0.746
	C42	0.573		0.560		0.421		0.372		0.670	
Pharmaceutical companies	C51	0.564	0.701	0.540	0.658	0.627	0.256	0.358	0.658	0.570	0.658
	C52	0.621		0.590		0.531		0.392		0.520	
	C53	0.661		0.660		0.413		0.438		0.810	

Table 11 and Figure 4 represent that the impacts of the digitization per stakeholder for different hospitals are acceptable.

5. **Conclusion.** This paper outlines the impact of healthcare system digitisation in Saudi Arabia. Furthermore, large-scale impacts of healthcare system digitization in Saudi Arabia are penetrating the healthcare sector. Specific methods pose major challenges for experts who are actively working on approaches to minimize the disadvantages of digitization. Healthcare sector needs a common-sense technique to tackle suggestions in this type of situation. In the sense of healthcare, author has discussed the digitization of Saudi Arabia's healthcare system which plays a crucial role. The study then evaluates the ranking of factors by Fuzzy AHP approach according to their weights and enlists alternatives for assessing them. The evaluation of the proposed study will ensure that the techniques developed in this work are an effective mechanism for practitioners seeking solutions to make healthcare system digitization in Saudi Arabia. The analysis provides a systematic, priority-based ranking result to identify which types of factors in a digital healthcare organization are of greater importance and top priority in terms of solutions.

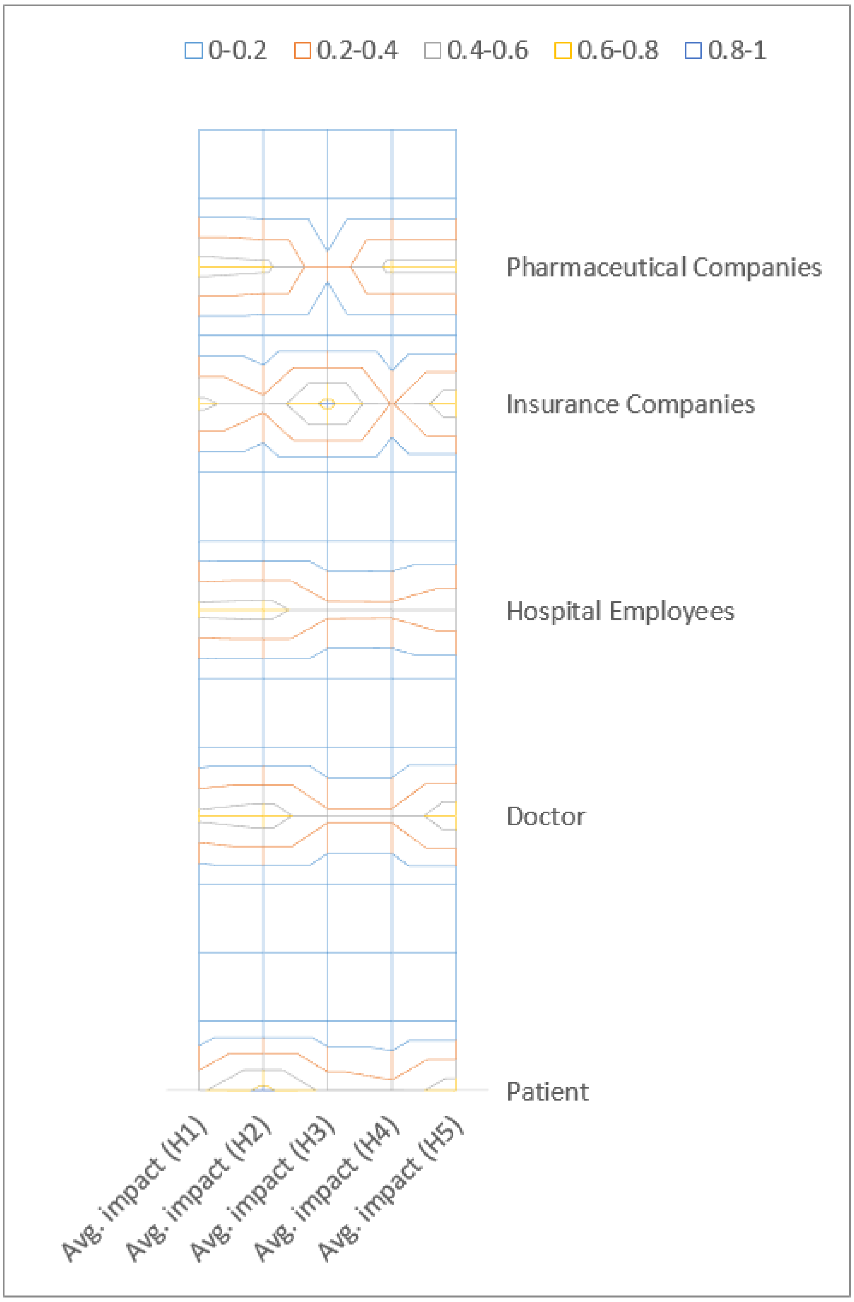

FIGURE 4. (color online) Impact of digitization for different hospitals at KSA

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