Studying the Interrelationship amongst Various Metrics used by Health Care Facilities in India

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ABSTRACT
India's health care sector provides a wide range of quality of care from globally acclaimed hospitals to facilities that deliver care of unacceptably low quality. Technology is the best way to achieve the vision of a connected healthcare ecosystem . Present research work tries to explore various metrics commonly used by health care facilities or centers in developing countries like India . It further tries to find the inter-relationship amongst them using ISM methodology.

Keywords
Health care metrics, ISM methodology, health care facility

1. INTRODUCTION
Health care is one of the fastest growing sector in India and has made substantial progress, especially in the last decade. Between 2000 and 2014, there was a 370% increase in health expenditure.[1] Historically , health care delivery in independent India has been under the purview of government. Indian government is striving hard to provide world class and affordable health services to its citizens . On the policy side, Indian government has made a bold commitment to achieve universal health coverage through Ayushman Bharat (AB) which aims to provide affordable health care to entire population and reduce expenses on health care . On the implementation side, improving healthcare infrastructure takes time and money. There is an increasing emphasis from government to reduce drug prices and make medicines more affordable . For example, some of the critical dug for cancer treatments are now 86% cheaper whereas prices for diabetes drugs are down by 42% .

There is also a shift in government role in Indian healthcare from that of a provider to an insurer. With Union budget 2017 , the Indian government has pushed to make Aadhar card a health identifier for basic health services in the country. Another important action was the launch of insurance plan named Ayushman Bharat to provide the insurance cover to 10 crores families in India . Further , under the guidance of NITI Aayog , approximately 3,073 crore INR has been set to be allocated to create a digital economy with emerging technologies such as artificial intelligence (AI) , the Internet of things (IoT) , block chain and 3D printing , which are necessary to build a modern technology landscape in health care delivery. These technologies can reduce the burden and improve productivity greatly by minimizing human interventions in electronic medical records (EMR) / enterprise resource planning (ERP) . One of the striking features of India's health care sector is the range of quality in available services. India is home to global leaders in innovation and quality of health care such as the Narayana Hospitals, known for providing high-quality cardiovascular surgery at low cost, and the Aravind Eye Care System, whose hospitals provide a high volume of cataract surgery, as well as globally renowned medical teaching institutions such as the All India Institute of Medical Sciences, in New Delhi. Efforts to improve the quality of health care services in low-resource settings, including India, have typically focused on structural constraints. Objectives of paper are therefore to explore various KPIs and metrics used by health care facilities in developing countries like India for improving their performance , productivity and quality of health care services thereby increasing their patient traffic. Afterwards, it also tries to study the hierarchical relationships amongst them using the Interpretive Structural Modeling methodology. Paper is arranged as follows: Section 2 briefly details the literature available on the given topic and track different metrics as per literature. Section 3 explains the ISM methodology and explains it through the case example in section 4. Section 5 briefly provides the managerial implications on the given topic .

2. LITERATURE REVIEW HEALTH CARE AND ITS ASSOCIATED METRICS
This section focuses on the literature review on various health care metrics described in literature. Authors have used keywords such as "health care metrics" , "KPIs used by health facilities" , "health-care facilities in India" , " metrics for improving health care" etc. over the google search engine, Mendeley research database software to collect the relevant literature. Table 1. below lists the various commonly used metrics by health care facilities or organizations in developing countries such as India .

Table 1. Important metrics and sub metrics for health care facility [1-5]

S. No.	Metrics & their description	Sub metrics	Description	Purpose
1.	Volume metrics : This data refers to the flow of patients to your facility.	Number of patients (NOP)	This includes number of patients department wise as well as specialty wise	Tracking these metrics allows you to determine if current marketing and business outreach and development is as effective as the projections made ; to reassess
		Time of appointment and length of visit (TOA)	This includes appointment time and duration of visit	
		Number of inbound	This includes	

		referrals (NIR)	number of inbound referrals	current service offerings and determine if you need to invest in other areas of expertise or improve and expand the existing lines of business.
2.	Revenue leakage metrics : This refers to the data related to the flow of patients through your facility with lost income opportunities	Cancelled appointments (CA)	This includes cancelled appointments due to patients not showing up	Tracking these metrics helps you gauge the effectiveness of your patient appointment and appointment reminder systems. These metrics also provide similar insight into the need to expand current business offerings.
		Number of outbound referrals (NOR)	This includes tracking the number of outbound referrals due to unavailability and un--supported specializations	
		Rescheduled appointment(RA)	This include cancelled or rescheduled appointments due to unavailability of provider	
3.	Utilization metrics : This data refers to the patient traffic and consumption of resources generated by each department , specialization, and service provider	Appointments completed per doctor (ACD)	This includes number of appointments seen or handles by each available doctor	More specialized than the volume or revenue leakage metrics, drilling data down on the dashboard to this level allows you to determine your most requested services and expand your capacity to meet the demographics and demands of
		Surgeries performed per surgeon (SPS)	This includes the number of surgeries performed per surgeon	
		Appointments scheduled per department and specializatio n (ASD/S)	This includes number of appointments scheduled department wise as well as specialization wise	your patient base. It also reflects whether all resources at your hospital are efficiently utilized or not .
4.	Quality metrics: This data relates to the effectiveness of your quality, safety, and access initiatives. It is the most extensive data-set that will be tracked on your dashboard	Employee Satisfaction (ES)	This calculates degree / level of employee satisfaction	These metrics track the impact of your services on the patients and your employees. There's no point in increasing traffic through your facility if your employees aren't providing high quality healthcare, and these set of metrics help you control quality of healthcare delivery.
		Patient Satisfaction and Engagement (PSE)	This includes degree or level of satisfaction and engagement of patient	
		Post-Treatment metrics (PTM)	This includes metrics such as Readmission rates for specific diseases (e.g. heart failure, pneumonia, etc.) , Clinical outcome rate statistics , Occurrence of hospital acquired infections , Clinical error ratios and outpatient wait time	
5.	Financial metrics : This is the data that is more finely tuned and focused on the fiscal performance of your healthcare facility	Revenue generated per doctor (RGD)	This includes the amount of revenue generated by each doctor in the health care facility	When drilling down into this data and cross-referencing it against the utilization metrics outlined above, you and the decision makers of
		Revenue generated by department (RGDe)	This includes the amount of revenue generated by each	

			department in the health care facility	your organization can better gauge how to increase profitability by expanding your most profitable channels of business .
		Revenue generated by specializatio n (RGS)	This includes the amount of revenue generated as per doctor / department specializati on	
6.	Miscellane ous metrics	Average Hospital Stay (AHS)	Evaluate the amount of time your patients are staying	These metrics are important to get an overview of the performance of the health care facility.
		Treatment Costs (TC)	Calculate how much a patient costs to your facility	
		Patient Wait Time (PWT)	Monitor waiting times to increase patient satisfaction	

3. INTERPRETIVE STRUCTURAL MODELLING METHODOLOGY

Interpretive Structural Modeling or ISM first proposed by [6] is a computer assisted learning process that enables the researcher to develop a map of the complex relationships between the many elements involved in a complex situation. In this technique a set of unique interrelated variables are structured in the form of a hierarchy graph called the diagraph. Its steps are as follows: Firstly, identify the relevant elements and establish a contextual relationship amongst them. Thereafter, develop a structural self -interaction matrix (SSIM) using V, A, X & O where the symbols have the following meanings i.e. V for the relation from i to j but not in both directions; A for the relation from j to i but not in both directions; X for both direction relations from i to j and j to i; and O if the relation between the variables does not appear valid. Using SSIM, initial reachability matrix can be formed which has all values in binary form. A final reachability matrix is formed after removing transitivity from initial reachability matrix. From the final reachability matrix, the reachability set and antecedent set for each criterion and for each element is found. The element for which the reachability and intersection sets are the same is the top-level element. At every iteration a top level element is identified which is removed in the next iteration. After all the elements have been identified at different level of hierarchy, a Mic-Mac analysis (based on the driving power and dependence power) and a diagraph can be formed.

4. DEVELOPMENT OF ISM MODEL

This section develops the ISM model for studying the interrelationships amongst the metrics in building and construction industry. The 20 metrics considered are Number of patients (NOP); Time of appointment and length of visit (TOA); Number of inbound referrals (NIR) ; Cancelled appointments (CA) ; Number of outbound referrals (NOR) ; Rescheduled appointments (RA) ; Appointments completed per doctor (ACD) ; Surgeries performed per surgeon (SPS) ; Appointments scheduled per department and specialization (ASD/S) ; Employee satisfaction (ES) ; Patient satisfaction and engagement (PSE) ; Post-treatment metrics (PTM) ; Revenue generated per doctor/surgeon (RGDS) ; Revenue generated by department (RGDe) ; Revenue generated by specialization (RGS) ; Average hospital stay (AHS) ; Treatment costs (TC); Patient wait time (PWT) .

4.1 Construction of Structural Self - Interaction Matrix (SSIM)

This matrix gives the pair-wise relationship between two variables i.e. i and j based on VAXO. SSIM has been presented below in Fig 1.

Explanation:

Number of inbound and outbound referrals lead to increase in number of patients . Patient satisfaction and engagement also increase number of patients . Number of patients lead to revenue generated by department , revenue generated by doctor or specialization . Patient wait time is associated with time of appointment and length of visit . Employee satisfaction may lead to inbound referrals . Similarly, patient satisfaction may lead to outbound referrals . Treatment costs may lead to revenue generated by department and as per specialization. Surgeries performed per surgeon leads to revenue generated by doctor / surgeon and specialization as well as department . Patient wait time may lead to cancelled appointments . Number of patients and time of appointment leads to appointments scheduled per department and rescheduled appointments also in many cases. Patient wait time leads to cancelled appointments and rescheduled appointments . Time of appointment also leads to increase in number of patients as usually patients avoid going in peak hours otherwise urgent. Employee satisfaction also lead to more referrals and hence may indirectly lead to increase in number of patients. Similarly, is the case with patient satisfaction and engagement and patient wait time. Number of inbound and outbound referrals may decide on may depend on time of appointment and length of visit. Number of inbound referrals may determine the post treatment metrics and patient wait time as it is quite possible that these referrals may not have to wait for long hours . Some outbound referrals may also cancel or reschedule their appointments . Outbound referrals could also be a part of surgeries performed by surgeon , appointments completed per doctor etc. Lesser the hospital re-admission rates , more could be the outbound referrals as this shows the positive and efficient services rendered by hospital . Treatment costs also determine appointments completed by doctor as high treatment costs may not be affordable by every patient. Long wait times negatively affects the revenue generation. Higher treatment costs lead to lesser wait time .

4.2 Construction of Initial Reachability Matrix and final reachability matrix

The SSIM has been converted in to a binary matrix called the initial reachability matrix shown in fig. 2 by substituting V, A, X, O by 1 or 0 as per the case. After incorporating the transitivity, the final reachability matrix is shown below in the Fig 3.

Fig 1: Structural Self- Interaction Matrix

Metrics		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		NOP	TOA	NIR	CA	NOR	RA	ACD	SPS	ASD	ES	PSE	PTM	RGDS	RGDe	RGS	AHS	TC	PWT
1	NOP		A	A	A	A	A	A	O	X	A	A	A	V	V	V	X	A	A
2	TOA			A	V	A	A	A	O	X	V	V	O	O	O	O	V	O	A
3	NIR				O	O	O	O	O	V	A	A	V	V	V	V	V	O	V
4	CA					A	V	X	X	A	A	A	A	O	O	O	A	A	A
5	NOR						V	V	V	V	O	A	V	V	V	V	A	A	A
6	RA							X	X	A	A	A	A	O	O	O	A	A	A
7	ACD								O	X	V	V	V	V	V	V	V	A	A
8	SPS									A	V	V	V	V	V	V	V	A	A
9	ASD										A	A	A	V	V	V	V	A	A
10	ES											V	V	V	V	V	A	A	A
11	PSE												V	V	V	V	A	A	A
12	PTM													V	V	V	V	A	V
13	RGDS														V	V	A	A	A
14	RGDe															V	A	A	A
15	RGS																A	A	A
16	AHS																	A	A
17	TC																		V
18	PWT																		

Fig 2: Initial reachability matrix

S.NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19
		NOP	TOA	NIR	CA	NOR	RA	ACD	SPS	ASD	ES	PSE	PTM	RGDS	RGDe	RGS	AHS	TC	PWT
1	NOP	1	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	0	0
2	TOA	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0
3	NIR	1	1	1	0	0	0	0	0	1	0	0	1	1	1	1	1	0	1
4	CA	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
5	NOR	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0
6	RA	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
7	ACD	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	0	0
8	SPS	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0
9	ASD	1	1	0	1	0	1	0	1	1	0	0	0	1	1	1	1	0	0
10	ES	1	0	1	1	0	1	0	0	1	1	1	1	1	1	1	0	0	0

11	PSE	1	0	1	1	1	1	0	0	1	0	1	1	1	1	1	0	0	0
12	PTM	1	0	0	1	0	1	0	0	1	0	0	1	1	1	1	1	0	1
13	RGDS	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
14	RGDe	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
15	RGS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
16	AHS	1	0	0	1	1	1	0	0	0	1	1	0	1	1	1	1	0	0
17	TC	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	PWT	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1

Fig 3 : Final reachability matrix

S.NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	D.P
		NOP	TOA	NIR	CA	NOR	RA	ACD	SPS	ASD	ES	PSE	PTM	RGDS	RGDe	RGS	AHS	TC	PWT	
1	NOP	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	13
2	TOA	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	14
3	NIR	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	15
4	CA	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	14
5	NOR	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	14
6	RA	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	0	14
7	ACD	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	0	14
8	SPS	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	14
9	ASD	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	14
10	ES	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	15
11	PSE	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	15
12	PTM	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	14
13	RGDS	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	03
14	RGDe	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	02
15	RGS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	01
16	AHS	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	13
17	TC	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
18	PWT	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	16
De.P.		15	15	06	15	07	15	10	14	15	14	15	11	16	17	18	14	01	04	

D.P : Driving power ; De.P : dependence power

4.3 Level Partition

Table 2 : Iteration I

S.No.	Reachability set	Antecedent set	Intersection set	Iteration/ Levels
1.	**15**	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15, 16,17,18	15	
2.	14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,16, 17,18	14	
3.	13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,16,17, 18	13	
4.	1,2,4,6,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,16,17,18	1,2,4,6	
5.	1,2,4,6,9,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,16,17,18	1,2,4,6,9	
6.	1,2,4,6,9,11,13,14,15	1,2,3,4,5,6,7,8,9,11,12,16,17,18	1,2,4,6,9,11	
7.	1,2,4,6,9,13,14,15,16	1,2,3,4,6,7,8,9,10,11,12,16,17,18	1,2,4,6,9,16	
8.	1,2,4,6,8,9,13,14,15,16	1,2,3,4,5,6,8,9,10,11,12,16,17,18	1,2,4,6,8,9,16	
9.	1,2,4,6,8,9,13,14,15,16	1,2,3,4,6,7,9,10,11,12,16,17,18	1,2,4,6,8,9,16	
10.	1,2,4,6,8,9,11,13,14,15,16	1,2,3,4,5,6,7,9,10,11,12,16,17,18	1,2,4,6,8,9,11,16	
11.	1,2,4,6,8,9,10,11,13,14,15,16	1,2,3,4,5,6,7,8,9,10,12,16,17,18	1,2,4,6,8,9,10,16	
13.	1,2,4,6,8,9,10,11,12,13,14,15,16	1,2,3,4,5,7,8,9,10,12,16,17,18	1,2,4,8,9,10,12,16	
14.	1,2,4,6,7,8,9,10,11,13,14,15,16	1,2,3,4,5,6,7,8,10,12,16,17,18	1,2,4,6,7,8,10,16	
15.	1,2,4,5,6,7,8,9,11,12,13,14,15,16	1,2,5,11,16,17,18	1,2,5,16	**I**
16.	1,2,3,4,6,7,8,9,11,12,13,14,15,16	1,2,3,5,11,16,17,18	2,3,11,16	
17.	3,12,18	3,12,17,18	3,12,18	
18.	18,17	17	17	

Table 3 : Iteration II

S.No.	Reachability set	Antecedent set	Intersection set	Iteration
2.	**14**	1,2,3,4,5,6,7,8,9,10,11,12,13,14,16, 17,18	**14**	**II**
3.	13,14	1,2,3,4,5,6,7,8,9,10,11,12,13,16,17, 18	13	
4.	1,2,4,6,13,14	1,2,3,4,5,6,7,8,9,10,11,12,16,17,18	1,2,4,6	
5.	1,2,4,6,9,13,14	1,2,3,4,5,6,7,8,9,10,11,12,16,17,18	1,2,4,6,9	
6.	1,2,4,6,9,11,13,14	1,2,3,4,5,6,7,8,9,11,12,16,17,18	1,2,4,6,9,11	
7.	1,2,4,6,9,13,14,16	1,2,3,4,6,7,8,9,10,11,12,16,17,18	1,2,4,6,9,16	
8.	1,2,4,6,8,9,13,14,16	1,2,3,4,5,6,8,9,10,11,12,16,17,18	1,2,4,6,8,9,16	
9.	1,2,4,6,8,9,13,14,16	1,2,3,4,5,6,7,9,10,11,12,16,17,18	1,2,4,6,8,9,16	
10.	1,2,4,6,8,9,11,13,14,16	1,2,4,5,6,7,9,10,11,12,16,17,18	1,2,4,6,8,9,11,16	
11.	1,2,4,6,8,9,10,11,13,14,16	1,2,3,4,5,6,7,8,9,10,12,16,17,18	1,2,4,6,8,9,10,16	
13.	1,2,4,6,8,9,10,11,12,13,14,1 6	1,2,3,4,5,7,8,9,10,12,16,17,18	1,2,4,8,9,10,12,16	
14.	1,2,4,6,7,8,9,10,11,13,14,16	1,2,3,4,5,6,7,8,10,12,16,17,18	1,2,4,6,7,8,10,16	
15.	1,2,4,5,6,8,9,11,12,13,14,16	1,2,5,11,16,17,18	1,2,5,16	

16.	1,2,3,4,6,8,9,11,12,13,14,16	1,2,3,5,11,16,17,18	1,2,3,11,16	
17.	3,12,18	3,12,17,18	3,12,18	
18.	18,17	17	17	

Table 4 : Iteration III

Sr. No.	**Reachability set**	**Antecedent set**	**Intersection set**	Iteration
3.	**13**	1,2,3,4,5,6,7,8,9, 10,11,12,13,16,17, 18	13	**III**
4.	1,2,4,6,13	1,2,3,4,5,6,7,8,9,10 ,11,12,16,17,18	1,2,4,6	
5.	1,2,4,6,9,13	1,2,3,4,5,6,7,8,9, 10,11,12,16,17,18	1,2,4,6,9	
6.	1,2,4,6,9,11, 13	1,2,3,4,5,6,7,8,9, 11,12,16,17,18	1,2,4,6,9, 11	
7.	1,2,4,6,9,13, 16	1,2,3,4,5,6,7,8,9, 10,11,12,16,17,18	1,2,4,6,9, 16	
8.	1,2,4,6,8,9, 13,16	1,2,3,4,5,6,8,9,10,1 1,12,16,17,18	1,2,4,6,8,9, 16	
9.	1,2,4,6,8,9, 13,16	1,2,3,4,5,6,7,9,10,1 1,12,16,17,18	1,2,4,6,8,9, 16	
10.	1,2,4,6,8,9,1 1,13,16	1,2,3,4,5,6,7,9,10,1 1,12,16,17,18	1,2,4,6,8,9, 11,16	
11.	1,2,4,6,8,9, 10,11,13,16	1,2,3,4,5,6,7,8,9, 10,12,16,17,18	1,2,4,6,8,9, 10,16	
13.	1,2,4,6,8,9, 10,11,12,13, 16	1,2,3,4,5,7,8,9,10,1 2,16,17,18	1,2,4,8,9, 10,12,16	
14.	1,2,4,6,7,8,9, 10,11,13,16	1,2,3,4,5,6,7,8,10,1 2,16,17,18	1,2,4,6,7,8, 10,16	
15.	1,2,4,5,6,8,9, 11,12,13,16	1,2,5,11,16,17,18	1,2,5,16	
16.	1,2,3,4,6,8,9, 11,12,13,16	1,2,3,11,16,17,18	2,3,11,16	
17.	3,12,18	3,12,17,18	3,12,18	
18.	18,17	17	17	

Table 5 : Iteration IV

S. No.	**Reachability set**	**Antecedent set**	**Intersection set**	**Iteration/ Levels**
4.	1,2,4,6	1,2,3,4,5,6,7,8,9, 10,11,12,16,17,18	1,2,4,6	**IV**
5.	**1,2,4,6,9**	1,2,3,4,5,6,7,8,9,	**1,2,4,6,9**	
		10,11,12,16,17,18		
6.	1,2,4,6,9,11	1,2,3,4,5,6,7,8,9, 11,12,16,17,18	1,2,4,6,9, 11	
7.	1,2,4,6,9,16	1,2,3,4,5,6,7,8,9, 10,11,12,16,17,18	1,2,4,6,9, 16	
8.	1,2,4,6,8,9, 16	1,2,3,4,5,6,8,9,10,1 1,12,16,17,18	1,2,4,6,8, 9,16	
9.	1,2,4,6,8,9, 16	1,2,3,4,6,7,9,10, 11,12,16,17,18	1,2,4,6,8, 9,16	
10.	1,2,4,6,8,9, 11,16	1,2,3,4,5,6,7,9,11,1 2,16,17,18	1,2,4,6,8, 9,11,16	
11.	1,2,4,6,8,9, 10,11,16	1,2,3,4,5,6,7,8,9, 10,12,16,17,18	1,2,4,6,8, 9,10,16	
13.	1,2,4,6,8,9, 10,11,12,16	1,2,3,4,5,7,8,9,10,1 2,16,17,18	1,2,4,8,9, 10,12, 16	
14.	1,2,4,6,7,8,9, 10,11,16	1,2,4,5,6,7,8,10, 12,16,17,18	1,2,4,6,7, 8,10,16	
15.	1,2,4,5,6,8,9, 11,12,16	1,2,5,11,16,17,18	1,2,5,16	
16.	1,2,3,4,6,8,9, 11,12,16	1,2,3,5,11,16,17, 18	2,3,11, 16	
17.	3,12,18	3,12,17,18	3,12,18	

Table 6 : Iteration V

Sr. No.	**Reachability set**	**Antecedent set**	**Intersection set**	Iteration
6.	11	5,7,8,11,12,16, 17,18	11	
7.	16	3,7,8,10,11,12, 16,17,18	16	
8.	8,16	3,5,8,10,11,12, 16,17,18	8,16	
9.	8,16	3,7,10,11,12,16 ,17,18	8,16	
10.	**8,11,16**	3,7,10,11,12,16 ,17,18	**8,11,16**	
11.	8,10,11,16	3,5,7,8,10,12,1 6,17,18	3,8,10,16	
13.	8,10,11,12,1 6	3,5,7,8,10,12,1 6,17,18	3,8,10,12,16	

14.	7,8,10,11,16	7,8,10,12,16,17 ,18	7,8,10,16	**V**
15.	5,8,11,12,16	5,11,16,17,18	5,16	
16.	3,8,11,12,16	3,11,16,17,18	3,11,16	
17.	3,12,18	3,12,17,18	3,12,18	
18.	18,17	17	17	

Table 8 : Iteration VI

Sr. No.	**Reachability set**	**Antecedent set**	**Intersection set**	Iteration
11.	10	3,5,7,10,12,17, 18	10	
13.	**10,12**	3,5,7,10,12,17, 18	10,12	
14.	**7,10**	3,5,7,10,12,17, 18	7,10	
15.	5,12	5,17,18	5	
16.	3,12	3,17,18	3	**VI**
17.	3,12,18	3,12,17,18	3,12,18	
18.	18,17	17	17	

Table 9 : Iteration VII

Sr. No.	**Reachability set**	**Antecedent set**	**Intersection set**	Iteration
15.	**5**	5,17,18	5	
16.	3	3,17,18	3	
17.	**3,18**	3,17,18	3,18	**VII**
18.	18,17	17	17	

Table 10 : Iteration VIII

Sr. No.	**Reachability set**	**Antecedent set**	**Intersection set**	Iteration
18.	**17**	17	17	**VIII**

4.4 Classification of factors

The critical success factors described earlier are classified in to four clusters viz. autonomous factor, dependent factors, linkage factors and independent factors (mentioned in Table XII below). Fig. 4 below shows the driving power and dominance diagram

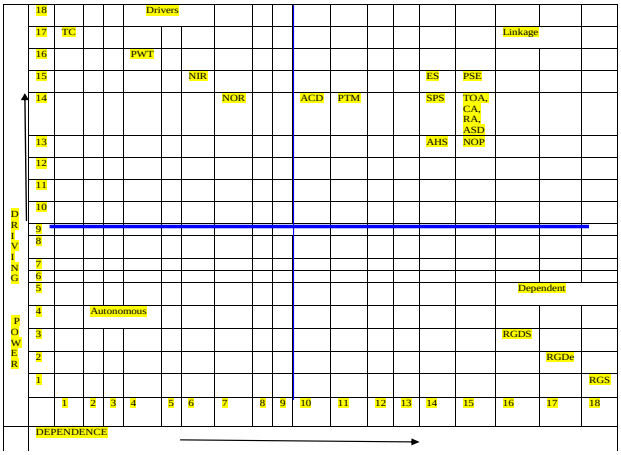

Fig . 4: Driving power and dependence diagram

4.5 ISM Model

An ISM model is developed (as shown in fig. 5 below) after arranging the elements as per their interaction or dependence relationships.

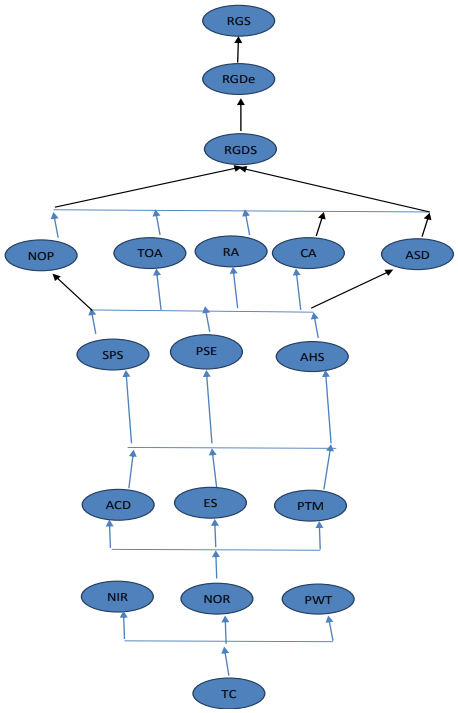

Fig 5: ISM diagraph

5. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

1. **Use of health care dashboards** : Now days health care centers also make use of health care dashboards . These dashboards are customized as per customer's need and are 100% HIPAA compliant. They are primarily used to track healthcare information data, KPIs and other essential metrics . These are further used to analyze the data of a particular healthcare department, a specific medical process in a hospital, or a private clinic. Through this analysis, management can standardized the processes across the practice to reduce variations in health care delivery experience and further used to improve the ability to identify the trends and patterns and accordingly make necessary business changes.

2. **Handling huge and valuable data** : The sheer amount of data generated by a business as complex as a hospital or medical treatment facility can be staggeringly overwhelming. So, it is quite mandatory now days to closely monitor the data and measure the appropriate metrics that can improve the overall health of the organization , the metrics which can generate more revenue for the facility and provide more financial opportunities for the health acre facility.

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7. REFERENCES

[1] https://www.datapine.com/kpi-examples-and-templates/healthcare

[2] https://kaysharbor.com/blog/healthcare/5-healthcare-dashboard-metrics

[3] Manoj Mohanan , Katherine Hay and Nachiket Mor , Quality of health care in India : Challenges , priorities and the road ahead . https://www.healthaffairs.org/doi/full/10.1377hlthaff.2016.0676

[4] Gupta , I. and Bhatia , M. (2016) . The Indian health care system . The commonwealth fund -International health care system profiles. http://internationalcommonwealthfund.org/countries/India

[5] Reimagining the possible in the Indian healthcare ecosystem with emerging technologies, the Bengal chamber report , 2018 , www.pwc.in.

[6] Warfield, J., N. 1974. Developing interconnection matrices in structural modeling. IEEE Transactions on System, Man, and Cybernetics (SMC) .4 (1), 81-87.