ANTECEDENT-CONSEQUENCE RELATIONSHIPS BETWEEN EHR ADOPTION AND ERP IMPLEMENTATION WITH SERVICING CAPABILITY AND PERFORMANCE: A STUDY IN INDIAN HEALTHCARE

A thesis submitted to the
University of Petroleum and Energy Studies

For the Award of
Doctor of Philosophy
in
Logistics and Supply Chain Management

By
Tulika Chakravorty

June 2020

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DEDICATIONS

To Almighty God, my loving and supporting Husband, Parents In-laws and Parents…

For unconditional show of support, blessing and love showered on me.

2021-March

DECLARATION

I declare that the thesis entitled ***"Antecedent-Consequence relationships between EHR Adoption and ERP Implementation with Servicing Capability and Performance: A Study in Indian Healthcare"*** has been prepared by me under the guidance of *Dr. Karunakar Jha (Professor, School of Business, UPES); Dr. Sunil Barthwal (Sr. Associate Professor, School of Business, UPES) & Dr. Sunil Bharadwaj (Sr. Analytics Consultant, SAS India). No part of this thesis has formed the basis for the award of any degree or fellowship previously.*

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ABSTRACT

Healthcare services and its related aspects of operations and transactions have always held crucial importance and status of critical service sector since decades due to its complexity and high levels of criticality. With evolution of technology the operations in healthcare context has also evolved in nature. Technology usage in the healthcare sector happens to be the primary vision for growth and transformation (Deloitte Report, 2020; IBEF, 2019). Healthcare being a complex sector is struggling a lot to achieve improved quality care, maintain coordination among the stake-holding partners, providing value-based responsive care and at the same time managing costs (Fiaz et al., 2018). In this competitive service-oriented and satisfaction focused care-delivery scenario, it becomes vital for hospitals, suppliers, and other healthcare stakeholders to achieve competitive advantage and at the same time manage their performance and business outcomes (Sangode and Metre, 2019; Madanian et al., 2019). In this digital era, all sectors are transforming from a paper-based approach to electronic-mode and in India digital transition is growing at a tremendous pace; healthcare sector which stayed lagging for decades has gained momentum and special emphasis over the turn of millennium due to changing policies and government norms towards Digital-India (Sarbadhikari, 2019; Kim et al., 2017).

Over the years, digitalization of healthcare has shown pathway for connected, integrated and interoperable systems. Digitally managing the patient records, termed as Electronic Health Records (EHR) and integrating the healthcare operational sectors with platforms like Enterprise Resource Planning (ERP) have been the primary buzzwords for healthcare evolution over the past decade (Chakravorty et al., 2019). EHR and ERP are the technologies being embraced by hospitals, especially in their operational aspects to enhance real-time information sharing, interoperability, flexibility and responsiveness of their processes and care-delivery systems (Farhadi et al., 2019; Bates and Samal, 2018); thereby portraying EHR and ERP as the key emerging enablers

of healthcare digitalization (Chakravorty et al., 2019; Kim et al., 2017; Garefalakis et al., 2016).

Digital technology application like *Electronic Health Records* (EHR), also termed as Electronic medical/patient records is a digitized format of clinical data of the patients or relevant medical history of the patient with supporting reports and scanned images managed in the electronic format. EHR data primarily includes patient health-related information like medical history, medical problems, laboratory or diagnostic reports, etc. (Dobrzykowsky, 2019; Plantier et al., 2017; Dobrzykowski and Tarafdar, 2017). EHR Adoption has changed the age-old paper-based manual records system to a completely digitalized approach and extant literature highlights that it has been credited for bringing in various performance impacts in the healthcare and associated care-service delivery fields (Kim et al., 2017). This technology has helped in prompting healthcare organizations to shift away from paper-based record maintenance; thereby pushing the sector towards a new era of digitally enabled care-management. Another significantly discussed and used digital technology is that of *Enterprise resource planning* (ERP) system. These are platforms which provide integration platform using software-enabled processes connecting multiple business-silos and linking stakeholders in the systems (Garefalakis et al., 2016; Mucheleka and Halonen, 2015). ERP systems across sectors have proven itself as a helpful primary digital resource for integrating various intra and inter departmental connections and information sharing processes in organizations; thereby proving beneficial for forming unified systems (Fiaz et al., 2018). Technologies like EHR and ERP have emerged as potential solutions for collaborative, efficient, effective and better quality of care-delivery in healthcare (Velthoven et al., 2019; Garg and Agarwal, 2014); however, extant sector-specific reports highlight lacunae and critical shortcomings in the context of understanding and relevant implementation of these technologies across hospitals and hospital-suppliers in Indian healthcare sector (Kaur et al., 2019). Predominantly, Indian healthcare system shows dearth of standardized platforms, coordination and integration, besides exhibiting reluctance towards digital technology adoption for healthcare streamlining due to lack of understanding (Sarbadhikari, 2019).

The ***Business Problem*** that emerges and gets highlighted based on extant literature and practitioner research in this study happens to be: *Low adoption of Electronic Health Records (EHR) i.e. digitalization and Electronic Resource Planning (ERP) i.e. e-integration are affecting servicing capability, operational and financial performance of the Indian healthcare sector (hospitals & hospital-suppliers).*In the highlighted backdrop of healthcare digitalization context, this study attempts at digging deep into the research literature to identify the research problems. With extensive literature review on the above highlighted business problem, three major research-problems have been identified. They are:

Research Problem-1**:** Lack of empirical evidences linking EHR-Adoption and its impact on ERP and further their implications on servicing capability, operational and financial performance in Indian healthcare context (hospitals/ hospital-suppliers).

Research Problem-2**:** Lack of understanding on the business implications in terms of dynamic capabilities, servicing capability, operational and financial performance on the usage of ERP integrated systems in Indian hospitals and their suppliers.

Research Problem-3**:** Lack of well-established comprehensive framework highlighting antecedent-consequence relationship in the Indian healthcare context linking EHR-Adoption and ERP-Implementation with process level capabilities (transparency and interoperability) and dynamic capabilities (quality, delivery dependability, flexibility and responsiveness) with the competency like patient care servicing capability and outcome variables like operational and financial performance in hospital/hospital-suppliers' context.

In this backdrop, from the business problem, this study narrows down to set of research objectives that need to be operationalized in this research work. This study aims at operationalizing a framework for healthcare managers in order to provide a detailed understanding and nuanced view on this area of research. The narrowed down research objectives are as follows:

<u>Research Objective-1:</u> To examine the impact of EHR-Adoption on ERP-Implementation, transparency and interoperability in Indian healthcare context.

<u>Research Objective-2:</u> To study the impact of ERP-Implementation on Dynamic Capabilities, Servicing Capabilities, Operational and Financial performance in Indian healthcare context.

<u>Research Objective-3:</u> To establish antecedent-consequence relationships linking EHR-Adoption and ERP-Implementation with business outcomes (namely capabilities, competencies and performance) in Indian healthcare context.

Chapter-2 of this thesis highlights and discusses the details regarding the issues of healthcare sector, considered as 'Business Problem' linked with this research work, detailed explanations of research literature and discussions on the 'Research Problems', from which meaningful 'Research Questions', 'Research Gaps' and 'Research Objectives' have been finalized.

This research aims at analyzing the concepts of adoption of digital technologies which are Electronic Health Records (EHR) & Enterprise Resource Planning (ERP) in hospitals and their suppliers. The study aims at bridging the gap between healthcare digitalization visions and ground reality. The study focuses towards creating a nuanced understanding and proposing a framework for implementation of EHR and ERP and their level-wise analysis towards ability to influence process-level capabilities (Transparency & Interoperability). In turn this study further aims at analyzing the impact of process-level capabilities on major Dynamic capabilities (Quality, delivery-dependability, flexibility and responsiveness), which further examines the consequences of the antecedent capabilities towards impact on firm's competency like servicing-capability. The ultimate culmination of the entire antecedent-consequence relationships ends at understanding the impact of the aforesaid variables on the outcome variables like operational and financial performance of hospitals & hospital-suppliers in Indian healthcare sector through empirical investigation using two distinct research models for hospitals and their principal suppliers.

The study practically aims at conceptualizing research models based on theoretical underpinnings and exhaustive literature review; finally providing an empirical validation in Indian-healthcare context (hospitals and their suppliers). The primary objective of this study lies in establishing the antecedent-consequence relationships between the digital-technologies (EHR & ERP) and final business outcomes through the intermediary capabilities (variables eliciting the process-level and dynamic capabilities). This study examines the path linkages connecting digital resources and final outcome variables with empirical validations from Indian healthcare sector. This thesis aims at conceptualizing and operationalizing an outcome-based framework for the Indian private tertiary-care hospitals and their principle suppliers in two distinct research models using questionnaire driven empirical data from both hospitals and suppliers collected and analyzed separately for the hospital-side and supplier-side models respectively. This detailed level-wise analysis across the distinct hospital and supplier scenarios imbibing the healthcare concepts create this study's niche place in healthcare fraternity.

This research work is well-grounded with theoretical underpinnings and draws logical support and linkages from two base theories and two ancillary theories. The first base theory is ***'Core competence theory***' by Javidan (1998) that forms the logical flow of this research framework. The theory conceptualized that resources form the building blocks for developing firms' business competency which is external focused which is developed through internal stages of capability development (process and dynamic capabilities). Hierarchical flow, discussing about core competency, starts from resources, which forms capabilities that are usually inward facing or internal in nature to the business. Capabilities further leads to competencies that have outward manifestations that are externally visible to businesses. Capability in turn leads to core competencies which are instrumental for outcome performances.

Another base theory which finds relevance in the current study perspective is the well-known ***'Resource Based View'*** theory by Barney (1991), which suggests that firms compete based on bundle of resources that are valuable, rare, difficult to imitate, and non-substitutable; referred to as the VRIN concept. The resources, which meet one or more of the VRIN concepts, enable firms to achieve competitive advantage and superior long-term performance outcomes.

This study further draws support from the theoretical premises and juxtapositions of two ancillary theories which are Cybernetic control theory (CCT) proposed by Vancouver (1996) and Dynamic capability (DC) theory propounded by Teece et al. (1997).

'Cybernetic control theory' highlights on the concepts of how digital technologies or cyber-resources can improve the organizational processes, strategies and capabilities and further positively enhance organizational performance. ***'Dynamic capabilities theory'*** is based on the concepts of organizational capabilities which are unique or dynamic in nature to foster performance. The theory highlights, how resources can dynamically change capabilities and competencies of firms; thereby effectively enhancing performance. Thus, these theoretical underpinnings highlight the cyber/digital technology resources and consequences of dynamic capabilities, competencies and performance, which provides support to the study concept.

Therefore, drawing support from these theories two distinct research models, one of hospital-side and another of hospital-suppliers side has been derived in this study.

The ***'Hospital-side*** *model'* consists of 11 constructs that elicit the flow of model starting from the technology resources – EHR-Adoption and ERP-Implementation with process-level capabilities- Transparency and Interoperability; which further indicate the linkages with next level dynamic capabilities- Quality, Delivery-dependability, Flexibility and Responsiveness; and in-turn further linking the dynamic capabilities with Servicing capability and finally linked with outcome performance variables- Operational and Financial performance.

The ***'Supplier-side** model'* consists of 10 constructs that elicit the flow of model starting from the technology resource –ERP-Implementation with process-level capabilities- Transparency and Interoperability. The only technology resource considered in the supplier side model is ERP-Implementation as EHR deal with electronically managing the patient health/medical records which is beyond the purview of the supplier-side consideration. The next level of linkages which connect technology adoption and process-level capabilities with next level dynamic capabilities- Quality, Delivery-dependability, Flexibility and Responsiveness; and in-turn further linking the dynamic capabilities with Servicing capability and finally linked with outcome performance variables- Operational and Financial performance. This study not only focuses on the analysis of hospital-side but also focuses on the supplier-side perspective as well. The hospital-side framework, comprising of all the 11 constructs, highlighted in this research framework, focuses on the impact of digital technologies (EHR and ERP) and their consequent implications on capabilities, competencies and performance aspects. In-contrary, in case of supplier-side model, EHR construct and its subsequent linkages are not considered. It has been highlighted in extant literature and this decision of not involving EHR in the supplier-side model also found logical support and emerged during the focused group discussions involving supplier-side experts. The logic explained that electronically maintaining the health records of patients are only done in hospitals as hospital-suppliers are not managing the patient-records or data electronically.

The supplier-side focuses on ERP-implementation only because the focus of this study concentrates on supplier-integration aspects which are also highlighted in extant literature (Dobrzykowski, 2019; Fiaz et al., 2018; Garefalakis et al., 2016; Boyer and Pronovost, 2010; Schneller and Smeltzer, 2006). Therefore, the supplier-side study model considers the impact of ERP-Implementation only as it finds relevance in their system for analyzing the process-level capabilities (transparency, interoperability), dynamic capabilities (quality, delivery-dependability, flexibility, and responsiveness), servicing-capability and performance aspects (operational performance, financial performance) of business. Further justifications revolves around the fact that EHRs are only concerned with the electronically managed patient-records that are channeled for hospitals and customer/patient facing areas only and do not have its usage in the supplier-side business model (Wurzer, 2012). Therefore, ‘EHR’ construct is not considered in the supplier-side framework.

This study follows a hypotheses based empirical study approach for validation of the conceptual framework developed. After the detailed literature review of the aforementioned constructs and theories covered in chapter-3 and chapter-4 of this thesis. Further Chaper-5 discusses about hypotheses development involving the study model variables; further discussing their logical linkages. In the backdrop of Javidan’s competencies hierarchy, this study models hypothesize that technology resources- EHR-Adoption *(only for hospital-model)* and ERP-Implementation *(both for hospital-side and supplier-side model)* can positively impact transparency and interoperability of systems. These serve as a driving force towards enhancing quality, delivery-dependability, flexibility and responsiveness, which represent dynamic capabilities for hospitals and their principle-suppliers. This in-turn consequently impacts servicing capability of the firm (hospital/supplier); finally contributing towards their operational and financial performances.

The hypothesized relationships are empirically tested and validated with large-scale data analysis done from both hospitals’ and hospital-suppliers’ perspective. This study takes into account the data collected in the context of private-sector tertiary-care hospitals in Indian context and their principle suppliers. The two models have been validated with data collected from hospital-side and supplier-side using questionnaire-based survey approach. The research design involves pre-pilot study done by focused group discussions, pilot study done by Q-sort technique and further survey instrument development i.e. questionnaire development both in hospital-side and suppliers’-side. For the large-scale data collection, in order to obtain a complete uniform representation of entire Indian healthcare context, *Stratified* *systematic sampling* technique has been used to collect representative data across four major Indian metropolitan cities and their adjoining areas. The method of analysis involves *exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and structural equation modelling (SEM)* for checking the validity and reliability measures of scale. The EFA results include *item loadings, average variance extracted (AVE) values and Cronbach's alpha values* that confirms unidimensionality, validity and reliability of the measurement items. The CFA results include model fit indices *(C_{MIN}/DF, CFI, IFI, TLI, GFI, RMSEA),* convergent validity measures, discriminant validity measures and reliability measures *(squared multiple correlations, composite reliability).* Structural equation modelling (SEM) results finds the interrelationships between the constructs, which provide accepted model-fit indices from the structural model [($\chi 2$ / d.f).; CFI; IFI; TLI; GFI; NFI; RMSEA]. The estimates and the path-coefficients, from the structural model result, illustrate the significance level of the linkages and highlight the hypotheses outcomes (supported or not-supported hypotheses); thereby confirming the linkages between constructs. The detailed explanations of research design, research methodology, data-analysis and testing of hypotheses have been presented in chapter-6, chapter-7 and chapter-8.

In the hospital-side, this study has analyzed the usage of two major digital technology usages i.e. EHR & ERP in the hospitals and their antecedent-consequence linkages with business outcomes moving from four fold levels of Process-level capabilities (Transparency, Interoperability); Dynamic-capabilities (Quality, Delivery-dependability, Flexibility, Responsiveness); Servicing Capability and finally Performance (Operational, Financial). Results depict that EHR-Adoption positively impacts and supports ERP-Implementation; EHR implementation also was identified to support the concept of 'Interoperability' in the hospitals. In the subsequent stage, ERP-Implementation was found to further support 'Transparency, Quality, Delivery-dependability and Responsiveness'. In the next level, transparency exhibited positive impact on Quality and Delivery-dependability constructs, which further supports Servicing Capability of hospitals and in turn Serving

Capability further supported both Operational and Financial Performance of the hospitals. On the other hand ‘Interoperability’ in-turn positively impacted ‘Flexibility’ and ‘Responsiveness’. In the hospital-side study model, some hypotheses were not supported and not significant based on the empirical validation. The prominent not supported hypotheses were the linkages between EHR-Adoption and Transparency, ERP-Implementation and Interoperability, Transparency and Flexibility, Transparency and Responsiveness, Interoperability and Quality, Interoperability and Delivery-dependability and further Flexibility and Responsiveness further did not support Servicing Capability of the hospital based on the empirical data considered.

On the other hand, the supplier-side study has analyzed the impact of ERP-Implementation and their antecedent-consequence linkages with business outcomes moving from four fold levels of Process-level capabilities (Transparency, Interoperability); Dynamic-capabilities (Quality, Delivery-dependability, Flexibility, Responsiveness); Servicing Capability and finally Performance (Operational, Financial). Results depict that ERP-Implementation has a positive significant impact on Transparency, Interoperability; Quality, Delivery-dependability, Flexibility and Responsiveness. Further Transparency positively supported Quality, Flexibility and Responsiveness; Quality in turn supported Servicing Capability and Finally Servicing Capability supported Operational Performance of the hospital-suppliers and not the financial performance construct. The hypotheses relationships which turned to be not significant and not supported, according to the supplier-side empirical data, were: Transparency and Delivery-dependability, Interoperability and Flexibility, Interoperability and Responsiveness, linkages between Delivery-dependability, Flexibility, Responsiveness and Servicing Capability, and finally the relationship hypothesis between Servicing Capability and Financial Performance as per the supplier-side sample data collected in this study.

The uniqueness of this research lies in the level-wise analysis of technologies adoption towards process-level capabilities (Transparency & Interoperability). The study also checked the impact of process-level capabilities on major

Dynamic capabilities (Quality, delivery-dependability, flexibility and responsiveness) with further checking of consequences towards firm's competency like servicing-capability and finally the outcome variables like operational and financial performance in Indian healthcare sector (hospitals & hospital-suppliers). This research work contributes to the field of healthcare and provides insight to professionals, helping them understand the impact of EHR and ERP on the performance outcomes; thereby analyzing the intervening stages with different capability levels. The study also paves the path for motivating managers of non-digitized healthcare centers in India to adopt the digital practices like EHR and ERP and be able to make decisions regarding the choice of shifting towards implementation of enabling digitized practices and their subsequent operational and financial outcomes quantitatively. Therefore, this research work can significantly make a difference towards awareness of healthcare digitalization concepts and also provide necessary insight towards adoption of digital technologies in Indian-healthcare sector.

Keywords: Electronic health records (EHR), Enterprise resource planning (ERP), Healthcare, Hospitals, Hospital-suppliers, Transparency, Interoperability, Dynamic capability, Quality, Delivery dependability, Flexibility, Responsiveness, Servicing capability, Operational performance, Financial performance, Capability-versus-competency theory, Resource based view, Cybernetic control theory, Dynamic capability theory.

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Tulika Chakravorty **Date: 10- June-2020**

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ABBREVIATIONS

EHR: Electronic Health Records

EMR: Electronic Medical Records

ERP: Enterprise Resource Planning

E-Health: Electronic Health

M-Health: Mobile Health

IoT: Internet of Things

NHPI: National Health Policy of India

WHO: World Health Organization

IBEF: India Brand Equity Foundation

CAGR: Compound Annual Growth Rate

GDP: Gross Domestic Product

EFA: Exploratory Factor Analysis

CFA: Confirmatory Factor Analysis

SEM: Structural Equation Modelling

ICU: Intensive care unit

ITU: Intensive therapy unit

CHAPTER-I

1 INTRODUCTION

Health has always been an important aspect across the globe and with the turn of the millennium healthcare has evolved as one of the most critical and important sectors in the backdrop of increasing aging population, increased life expectancy, increased prevalence of life-style diseases, and lot of other socio-demographic factors across the globe (Accenture Report, 2019; WHO Report, 2016; 2015; 2012; 2007). As per the universal standards and defined by World Health Organization (WHO), healthcare system is defined as: "*A health system consisting of all organizations, people and actions whose primary intent is to promote, restore or maintain health*."[1]Indian healthcare market is expected to reach US$ 372 billion by 2022. IBEF (2019) healthcare report highlighted that Indian healthcare is expected to have a threefold rise at CAGR of 22% and has got immense opportunities in terms of quality and accessibility. Major drivers to this growth are rising income level, greater health awareness, increased precedence of lifestyle diseases and improved access to insurance (IBEF Report, 2019; IBEF Report, 2017).

Due to immense global exposure with increasing consumer awareness and increasing income, there is a strong demand for better quality and value care for the patients. Healthcare in India is gradually providing a unique opportunity for innovation, differentiation and profits. Healthcare system comprises hospitals, medical devices, clinical trials, outsourcing, telemedicine,

[1] *"Everybody's business. Strengthening health systems to improve health outcomes: WHO's framework for action". WHO. 2007.*

medical tourism, health insurance and medical equipment.[2] Worldwide healthcare comprises of various stakeholders of which hospital activities forms the largest (Schneller and Smeltzer, 2006). India is no exception; hospitals form the largest share in the healthcare supply chain network in India (IBEF Report, 2019; IBEF Report, 2016). India requires 600,000 to 700,000 additional beds over the next five to six years, indicative of an investment opportunity of US$ 25-30 billion. Given this demand for capital, the number of transactions in the healthcare space is expected to witness an increase in near future. The average investment size by private equity funds in healthcare chains has already increased to US$ 20-30 million from US$ 5-15 million[3]. Medical tourism is also expanding in India triggering the need for digitization of the Indian healthcare sector[4].In a country like India whose population is 1.39 billion[5] *(approx. as on 1-Jan-2020)* , the major concern lies in the health of people. As compared to other developed western countries, India is still lagging in terms of medical facilities and standing at a crucial crossroad today.

Recently on 15-Mar-2017, National Health Policy of India (NHPI, 2017) has been approved by the central cabinet, government of India and formally declared by Hon’ble Prime Minister ‘Shri Narendra Modi’. The policy has highly emphasized on a need for digitalization of healthcare in India and envisioned towards better affordability, universal access, patient-centeredness, quality of care, accountability, and usage of e-technology platforms and ensuring well-integrated functioning system. It primarily suggests distribution of family health cards, with special emphasis on digitalized access of patient’s medical history and to make patient records available and integrated across the platforms. This policy emphasizes on engaging private sectors as strategic partners and providing access and financial protection at secondary and tertiary care levels. The policy envisages private-sector collaboration for strategic purchasing, capacity-building, skill-development, awareness generation, developing sustainable networks for community to strengthen

[2]IBEF Report –Jan 2019; IBEF Report- Jan 2016
[3]As per PriceWaterHouseCoopers (PWC report-2015)
[4]Accenture-India-In-FY2016-Report.pdf
[5] https://countrymeters.info/en/India *(accessed on 23-05-2020)*

mental health services, and disaster management.[6] Thus in a nutshell, it is very evident that NHPI (2017) envisions healthcare integration, digitalization, quality care provisions, universal access through enhanced adoption of e-technologies; thereby making healthcare affordable to common masses. Sarbadhikari (2019) analyzed the NHPI-2017 and discussed that effective handling of digital technologies with digital health is primarily needed for better consequences like access, efficient monitoring, quality-care and affordability. Identifying the essential role of digital technologies for e-health, m-health, Internet of things (IoT), medical wearables, etc. in case of healthcare delivery, adoption of digital technologies can be much smoother; so as to make India as a global player of digital healthcare provider (Bajaj et al., 2021; Sarbadhikari, 2019).

India is growing and heading towards becoming a developed nation from being a developing nation, India is expected to rank amongst the top three healthcare markets in terms of incremental growth by 2020 (Srinivasan, 2010). India has been the sixth largest market globally in terms of size in 2014 and Indian healthcare sector happens to be one of the fastest growing industry, expected to advance at a CAGR of 22.87 per cent during 2015–2020 to reach USD-372 billion in 2022 (IBEF Report, 2019). In 2017, Indian healthcare sector came up as the fourth largest employer in the market. There is immense scope for enhancing healthcare services penetration in India; thereby presenting ample opportunity for development of the healthcare industry. The strong fundamental healthcare growth drivers in India are increasing income levels, ageing population, growing health awareness and changing attitude towards preventive healthcare.[7] The growth in Indian healthcare sector can be very much attributed to the infusion of private equity & foreign investments on one hand and also importantly the shifting focus and emergence of India as a cheap and lucrative medical tourism destination on the other. Although, percentage of GDP spend in healthcare sector in India has changed from meager 1-2 % in the late 90s to that of 4.4% in 2012, 4.5% in 2013 and 4.7%

6http://www.pmindia.gov.in/en/news_updates/cabinet-approves-national-health-policy-2017/?comment=disable
[7]www.ibef.org

in 2014, and Indian healthcare has been highlighted as one of the fastest growing sectors, expected to reach ~USD 275 Billion in next 10 years[8] (IBEF Report, 2016), the healthcare sector in India is marked by various issues namely offering affordable yet state of the art responsive healthcare delivery and associated servicing capability, supplier-hospital linkages, digitalization and mobility of healthcare data/records, physical dependencies on process and people and last but not the least lagging operational performance and financial performance (Deloitte,2016; PWC,2011). Srinivasan (2010) highlighted 'Vision 2020' as per the Planning Commission report, which highlighted that ideally healthcare systems should have a vision to provide universal access to adequate level of care and that too access without excessive cost burden, fair distribution of financial costs for access, fair distribution of burden in rationing care and capacity and finally a constant search for improvement towards developing a more just system. They also emphasize in providing training towards betterment of competency, empathy and accountability, pursuit of quality care and cost effective use of the results of relevant research.

However, the current Indian healthcare ecosystem is afflicted by various issues, of which some are systemic, while others need urgent attention. Issues which are spiraling up in health organizations, predominantly hospitals, broadly come under issues concerning quality, cost, servicing capability. Major focus areas hover across creating a well-functioning system, characterized by enhanced coordination and integration, across various stakeholders and offering provisions of interoperability; thereby envisioning a well-connected, information-rich and patient-centric healthcare management system[9] where technology plays a pivotal role.

1.1 BACKGROUND OF STUDY: The Healthcare Domain

World Health Organization (WHO) has primarily envisioned complete digitization of healthcare by 2030, with specific focus towards health data

[8]http://data.worldbank.org/country/indiaRetrieved on 2016-09-28
[9]http://www.pwc.in/industries/healthcare.html

collection, analysis and communication in an integrated manner. It has been highlighted that disaggregated data will seek much greater attention and consequently increasing the strength of health information systems to bring in integration in the system (WHO report, 2016). In healthcare domain, especially with the hospital sector, major barriers exist in terms of communication, integration, information gathering and processing; creating functional barriers among chain partners (Schneller and Smeltzer, 2006; Boyer and Pronovost,2010).

India is heading towards digitization and has a vision for electronic health (E-health) and mobile health (M-health) (Deloitte, 2016). IBEF Report (2019) reported rising digital or IoT/Artificial intelligence based technology adoptions to enable patients to communicate directly with physicians and experts from any location, IT developments in medical care, medical electronics integration for high quality care with cost-affordability as notable trends in the Indian healthcare sector. Digital Health Knowledge Resources, Electronic Medical/Health Record, Mobile Healthcare, Hospital Information System, PRACTO, Technology-enabled care, telemedicine and Hospital Management Information Systems are some of the major technologies gaining wide acceptance in the sector. India’s medical technology sector is estimated to reach US$ 9.60 billion by 2022 (IBEF Report 2019). India’s unique needs should drive priorities for healthcare technologies: increasing affordability through low-cost products and services, overcoming access barriers and engaging patients through digital health, improving care coordination through IT and addressing tropical diseases through India-focused R&D (Srinivasan, 2010). Weak health integration systems are a major obstacle in most of the developing countries including India which is leading to inadequate preparedness for health emergencies. These deficiencies will require major investments in strengthening country's health information and statistical systems (WHO report, 2016).

IT implementation in every field is the need of today’s scenario. Increased focus on digitalization, especially focusing on connected-health (c-health) and digital-health care technology in India *(Deloitte Report, 2016)* are making the need for standardized connected healthcare system so strong. IT implementation across the supply chain, standardized IT packaged connectivity and electronic health records are at a very nascent stage in Indian healthcare sector (Kalpa, 2012) and that to limited mostly to Tier-1 cities[10]. Health-enabling and ambient assistive technologies form an important field in future (Haux et al., 2016).

One of the largest emphases given in the healthcare sector post 2015 is to strengthen the health information system for increasing the efficiency (WHO Report, 2016; Health data collaborative report, 2015). There is vision till 2030, that India needs transparency among the healthcare partners and high quality, comprehensive approach using integrated technologies for disaggregated data. To improve services and performance, India needs to have effective, real-time systems in place and link data using interoperable, interconnected electronic reporting systems within the country. It is emphasized that by 2030, India need to have established mechanisms to make health data available to users through electronic dissemination and easy access to a central data repository (Health data collaborative report, 2015). Digital transformation of healthcare is significantly increasing the incorporation of electronic technology in healthcare settings, especially towards patient records documentation, better collaboration, transparent system, and interoperable platforms among the hospital administrations, nurses, staff and physicians (Mollart et al., 2020; Williams et al., 2020).

Most of IT implementation in healthcare is concentrated mostly in the private sector hospitals due to the large investments by private sector players, which comprises of around 80% of the total healthcare market (IBEF Report, 2017; Mc Kinsey report, 2012). Private healthcare accounts for almost 74 % of the country's total healthcare expenditure in India as of 2015 and public sector hospitals, which have been lagging in terms of technology and investment, constitute a meager 19% shares in healthcare. Healthcare investment in India

[10] *http://www.greenbook.org/marketing-research/emr-market-india-growth-challenges-40073*

is set to rise, benefiting both hospitals and infrastructure (IBEF report, 2017). Healthcare Information Technology (HIT) has been growing in India, but a large proportion of its population living in rural areas are still not under its coverage as they suffer from limited access to health care services because most of the IT enabled systems in healthcare are predominantly present in tertiary care hospitals which are largely concentrated around the major urban hubs with specific presence around the major metro cities[11,12].

For digitization and integration of the healthcare systems in order to achieve e-health, c-health and tele-health, Enterprise Resource planning Systems (ERP Systems) and Electronic Health Records (EHR) are coming up as buzzwords (PWC report, 2015) and forming key resources in healthcare analytics (Priyanka and Kulennavar, 2014).

Enterprise Resource Planning Systems (ERP Systems) has been used as technological infrastructure in many sectors and gradually creeping in healthcare sector as well (Garefalakis et. al, 2016). There is a high significance of ERP implementation in healthcare as it is strictly aligned in providing high quality of healthcare delivery, operational efficiency, cost reduction and optimizing back-end operations. Special care needs to be taken in healthcare as the information is related to human lives. Need of ERP implementation is crucial but should be done carefully. Appropriate ERP implementation leads to significant increase in productivity as operating costs of healthcare can be optimized. Major benefits of ERP implementation are highlighted as faster and more reliable medical information reaching doctors, suppliers and key stakeholders on a real-time basis enabling monitoring of warehouse stocks, medical supplies status and managing order lead times; thereby minimizing stock out situations (Garefalakis et. al, 2016).

Tarn et al., 2002 elicited a nuanced view highlighting the development of Supply Chain Management (SCM) and ERP systems linkages and the industrial trend toward their integration. The study explored the rationales of ERP implementation and their impact on SCM integration assisting enterprises

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[11] *CII-McKinsey and Company Report, 2012,*
12 CII-PwC Report, 2013

in automating and integrating corporate cross-functions such as inventory control, procurement, distribution, finance and project management. Through information sharing, SCM enables supply chain partners to work in close coordination to facilitate supplier -customer interactions and minimize transaction cost. Although ERP implementation has shown success in various sectors and showing potential in healthcare sector as well, but some studies rose the points that ERP can be challenging and needs strong top management commitment during the implementation phase but later simplifies and standardizes the system by improving information response (Abukhader, 2015), needs training and testing of the integrated software (Wailgum, 2008). Apart from some of the mixed challenges ERP has success stories in improving efficiency, quality of service and profitability in healthcare sector as well (Mucheleka and Halonen, 2015).

Electronic Health Records (EHR), also known as electronic patient records or electronic medical records is also coming up in a very big way due to larger emphasis on mobility of healthcare records of patient across healthcare infrastructure (Deloitte, 2016). In the healthcare context EHR, EPR and EMR are often interchangeably used. EHR is a digital version or electronic record of patient health information and medical history maintained over time (longitudinal data). EHR information includes demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, radiology reports, etc. EHR provides real time access to patient information across clinicians' workflow (Kavitha et al., 2016; Dobrzykowski and Tarafdar, 2015; Fong et al., 2015). Recent survey of KPMG has highlighted that EHRs are the top priority list for healthcare CIOs in optimization of population health. They emphasized that beyond implementation of EHR, it is essential to optimize EHRs to maximize results[13].

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[13]https://www.healthitoutcomes.com/doc/ehrs-top-priority-list-for-healthcare-cios-0001?vm_tId=1988096&user=5b9e163e-9217-4592-afa8-e0d69838c40b&utm_source=et_6231164&utm_medium=email&utm_campaign=HCIT_03-21-2017&utm_term=5b9e163e-9217-4592-afa8-e0d69838c40b&utm_content=EHRs+Top+Priority+List+For+Healthcare+CIOs

Despite ERP and EHR being so largely emphasized and hyped, their impacts on the operational, financial performance and servicing capability of the hospitals and their suppliers remains yet to be investigated with clarity in the Indian context. Contemporary literature indicates that ERP and EHR in healthcare should be instrumental in facilitating capabilities like transparency (Mucheleka and Halonen, 2015), interoperability (Zdravkovic et al., 2017), dynamic capabilities (Lengnick-Hall et al., 2004; Chaniotakis and Lymperopoulos, 2009; Wahlgren and Persson, 2011; Schobel et al., 2016; Kritchanchai 2012) and servicing capability (Zhang and Chen, 2008; Aliman and Mohamad, 2016; Chang, 2010).

Haux et al., 2016 conducted a systematic review of healthcare-technology literature, and commented that technologies remain an important field for future while considering a study timeline from past (1992), present (2012-2015) and future (2016-2041) of health information systems and the assertive role that the enabling technologies like EHR and ERP will be playing at the enterprise level and highlighted that although IT has evolved in other sectors in the past, but in healthcare it is still nascent due to complexity, lack of awareness among healthcare stakeholders, apprehensions by physicians/clinicians to use it and human interventions. It remained difficult to accept this advancement in medical/health care services, because clinicians do not want to be superseded in their position by artificial intelligence systems. But now, EHR and ERPs are gaining a lot of importance gradually in the healthcare sector and they highlighted that in future it is expected to be an integrated part of the health system. They emphasized that technologies like EHR and ERP overcome the issues of standardized data integration and interoperability. The study recommended that patients should have full access to this information via EHRs and should be able to share it with healthcare professionals via ERP integrations fostering transparency and visibility, since future includes visions of seamless patient monitoring and consulting as well as home treatment enabling interoperability at an affordable cost.

Quality issues are major concerns in healthcare for reasons like life or death decisions depending on having the right information and quality of healthcare data are mostly unstructured data, is highly variable and often incorrect due to unreadable handwritten prescriptions (Feldman et al., 2012). In extant literature, some of the relationships of ERP and EHR with operational, financial performance and servicing capability have been emphasized (Feldman et al., 2012). But based on arguments in the extant literature the servicing capability is a consequence of some mid-level dynamic capabilities. So, it will not be out of bounds to propose a rational framework emphasizing that ERP and EHR initially leads to certain capabilities which results in higher order capabilities and which in turn leads to the culmination of the competency like servicing capabilities and outcome variables like operational and financial performance. This study aims at creating a nuanced view, elaborating the intermediary stages from the antecedent variables like ERP implementation and EHR adoption to the consequences like dynamic capabilities, servicing capability (competency) and the foremost outcomes i.e. operational and financial performance.

1.2 CONTEXT OF THE STUDY

This section describes the general type of hospitals, types of healthcare suppliers and their overall segregation in Indian Healthcare context. This section not only narrows down and highlights the focus area of the current research study, but also clarifies the in scope and out scope of the study.

Types of hospitals/healthcare-centers in India[14]

Classification of hospitals is done based on five main criteria, as follows:

- Based on ***ownership pattern*** hospitals are of two types: *Public* and *Private*.
- Based on ***stature and nature of operation***, hospitals are of three types:

    Primary Health Centre (PHC),

    Secondary or community healthcare centre (CHC) and

[14] https://www.indigomed.net/quality-and-safety/hospital-classification/

Tertiary healthcare centre (THC).

- Based on ***specialty*** hospitals are of two types:

  Multi-specialty (usually they have multiple specialties/departments aka general hospitals), and

  Single-specialty hospitals (includes *Super-specialty* hospitals as well).
- Based on ***teaching and research status*** hospitals are three types:

  Teaching cum research centers,

  Only teaching hospitals, and

  Only research centers.
- Based on ***business objective and profitability*** hospitals are of two types:

  Profit making/seeking and *Charitable/non-profit seeking.*

Details of public and private hospitals are discussed below:

- **Public hospitals**: Those hospitals which are owned managed and run by funding from government sources. Public sector hospitals are the Government hospitals which include healthcare centers, district hospitals and general hospitals.
- **Private hospitals**: Those hospitals which are run by either some trust, or individual or organization, but without any government share or responsibility. The Private hospital includes nursing homes, and mid-tier and top-tier private hospitals.

❖ **Types of hospital suppliers can be classified as** *(Callea et al., 2017; Kruetten et al., 2005)***:**

I) The ***supplier categories*** **based on product type** are:

- **Pharmaceutical suppliers** (supplying various oral and injection drugs, therapeutic and scheduled pharmaceutical compositions in the form of syrups, tablets and capsules, etc.)

- **Surgical suppliers** also known as “med-surg” suppliers (supplying all different kinds of surgical supplies including surgical instruments, utensils, bandages, sterilized cotton and operation-room mandatory kits, high grade syringes, sterilization instruments, etc.)
- **Device suppliers** who supplies equipments, implants and prosthetics also known as devices-prosthetics suppliers (supplying different implantable items starting from artificial lenses in eyes, artificial teeth, heart-valves and artery stents, pace-makers, artificial limbs, joints and bones to the extent of skin graft kits, breast implants, etc.)
- **General hospital suppliers** (supplying general day to day usage materials starting from linen, gloves, gauge and bandages to hospital disinfectants, different spirits, clinical and lab items like syringes, sterile sample containers, tube, catheters and what not including laboratory reagents and hospital day to day supplies).

II) Supplier categories based on their ***<u>nature of supplies</u>*** and their manufacturing and Supplying practices:

- **Suppliers who manufacture and supply** (i.e. the products are their own and they supply them),
- **Suppliers who procure and supply** (these types of suppliers are much like that of Indian

  Intermediary for foreign companies who don’t have direct operations in India)
- **Suppliers who modify and supply** (these are those suppliers who are involved in customized fabrication of products to suit the needs of their client hospitals and consequently modify the original product might be in terms of changing some feature for some niche use and often the prosthetics and implant suppliers fall in this category).

This study focuses on how the digitalized integration of supplier and hospitals’ by EHR and ERP upstream leads to increase in dynamic capabilities, servicing capability and further on operational performance and financial performance downstream.

Focus Study Area: Type of hospitals considered in this study

This study takes into account the Private sector hospitals in tertiary care centers (both Single specialty and Multispecialty) with profit objectives in the Indian context.

The reasons for targeting the Private Sector–Tertiary Care Hospitals with Profit seeking objectives are:

- Over 70% hospital beds are controlled by private sector with profit objectives. Operational profitability concerns are not a part of Non-profit hospitals and thus exempted from the purview of the study as they follow different models.

- In Private sector-profit making hospitals cost burden is passed to patients without affecting the hospital's profit margin. *(SOURCE: CII-McKinsey and Company Report, 2012, CII-PwC Report, 2013).*

- In the *Indian National Health Policy, 2017*[15], as private sectors emphasized to engage as the strategic partners so emphasis of the study needs to be given to private healthcare sector in India.

- The private sector has evolved a multi-pronged approach to increase accessibility and penetration and also new delivery models such as day-care centers, single specialty hospitals, end-of-life care centers, etc. are on the horizon to service larger sections of the population and address specific needs.

- The Public Sector is keen to continue to encourage private investment in the healthcare sector and is now developing Public – Private Partnerships i.e. PPP models to improve availability of healthcare services and provide healthcare financing. (CII-healthcare)[16]

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15 http://www.pmindia.gov.in/en/news_updates/cabinet-approves-national-health-policy-2017/?comment=disable

16 Healthcare - CII –Sectoral : http://www.cii.in/sectors.aspx?enc=prvePUj2bdMtgTmvPwvisYH+5EnGjyGXO9hLECvTuNu2yMtqEr4D408mSsgiIyM/

- In India, 70% of people in urban areas and 63% of people in rural areas access private healthcare services (WHO Report, 2012). Prominent factors responsible for skewed distribution are: proportion of private infrastructure, lower trust on public facilities, expectation of quality care, or non-penetration of public healthcare facilities.[17]

This study considers the Tertiary care centres. Tertiary care hospitals have distinct procurement divisions; distinct responsibilities of procurement and mostly tertiary care hospitals are the hospitals where the suppliers have direct procurement relationship and this work gets the scope to study different categories of suppliers in parallel. The rationale behind the choice of private tertiary care Indian hospitals is three-fold. First: the necessary scale of operation dealing with digitalization of the healthcare systems (both hospitals and suppliers) can be observed and studied only in case of tertiary care hospitals only. Second: 70% of Indian healthcare sector are in private ownership and hence studying private players becomes vital. Third: Lion's share of the private tertiary care centers are located in urban settings or around major state-capitals because the type of supplies, connectivity, patient-flow and infrastructure that is needed are only available in and around urban centers.

For any system to run coordination among its stakeholders are very important. Hospital sector is severely dependent on supplies (Sinha and Kohnke, 2009; Schneller and Smeltzer, 2006; McKone-Sweet et al., 2005). Hence the suppliers, their contracts, cost involved with ordering and extra inventory holding and overall management of supplies become crucial. Healthcare sector and the relationships in this sector and the solutions are simply not so easy and simple (McKone-Sweet et al., 2005). Even if alternative products are available and at cheaper cost or at higher certainty, often doctors have their own choices and preferences for certain key brands called physician preference items (PFIs) or sometimes group purchasing

[17] World Health Organization Report, 2012

organizations (GPOs) come in between and order after pooling demands from different hospitals for the items to be shipped, different lot sizes for the items, etc. all add to the confusion (Schneller and Smeltzer, 2006). Thus, this hospital-supplier relationship becomes a matter of prime importance.

1.3 OBJECTIVES OF THE THESIS

This research aims at analyzing the concepts of adoption of digital technologies which are Electronic Health Records (EHR) & Enterprise Resource Planning (ERP) in hospitals and their suppliers. The study aims at bridging the gap between healthcare digitalization visions and ground reality. It focuses towards developing a nuanced view and framework in implementation of EHR and ERP and their level-wise analysis towards process-level capabilities (Transparency & Interoperability) and their impact on major Dynamic capabilities (Quality, delivery-dependability, flexibility and responsiveness) with further consequences towards firm's competency like servicing-capability and finally the outcome variables like operational and financial performance in Indian healthcare sector (hospitals & hospital-suppliers). The study practically aims at conceptualizing a research framework based on theoretical underpinnings and exhaustive literature review and finally provides an empirical validation in the Indian-healthcare context (hospitals and their suppliers). The primary objective of this study lies in establishing the antecedent-consequence relationships between the aforementioned digital-technologies and final business outcomes i.e. intermediary steps (variables eliciting the different capability levels) between the digital resources enabling practices and the final outcome variables with empirical validations from the Indian healthcare sector. This thesis aims at conceptualizing and operationalizing an outcome based framework for the Indian hospital-side and Supplier-side scenarios with the healthcare concepts which makes its niche place in the healthcare fraternity.

1.4 STRUCTURE OF THE THESIS

This thesis comprises of 11 chapters with well-documented explanations. The chapters provide the readers all the details involved in the topic and research process. The flow of chapters provide a detailed understanding about background of study, its motivation, business problem, research problem, research gaps, research objectives, theoretical background, supporting literatures, hypotheses development, empirical investigation, analysis, conclusions and implications.

Chapter-1 provides introduction of the topic with opening details about healthcare, Indian healthcare scenario, aspects of digitalization and technology enablement, national healthcare digitalization visions/reports and introduces the context of study with details about types of hospitals and suppliers and further highlighting the objectives of thesis. Chapter-2 describes the motivation of study by highlighting the business problems identified from major industrial reports, literatures and key features of healthcare sector. It further addresses the research problems and research questions of healthcare digitalization; thereby highlighting the research gaps and research objectives of this study. Chapter-3 explains the theoretical background and supporting literatures to develop the conceptual research framework and further throws light on construct definitions. Chapter-4 provides a detailed literature review on the study constructs to posit and support the research conceptual framework. Chapter-5 establishes logical linkages of the constructs/discussions and develops the hypotheses for further study. Chapter-6 focuses on the research methodology applied in the study which summaries the research design, survey instrument details, methods of large scale survey process, sampling and analysis and highlights the tools and techniques involved in the study. Chapter-7 explains the data-analysis which provides details regarding empirical large-scale study. In this study the data analysis is done by EFA and CFA which are described in this chapter to highlight the results and findings. Chapter-8 provides the results of hypotheses testing done by SEM technique. Chapter-9 discusses about the findings from the large-scale survey and provides discussions regarding the findings. Chapter-10 deals with conclusion of the study and its contribution and managerial implications. Chapter-11 finally outlines the limitations and future scope of study. After this the references are provided. After chapter writing, the last section represents the appendices section, which provides the ancillary details like construct-items, survey-instruments like hospital and supplier-side questionnaire and other methodology related details. This marks the end of this thesis.

CHAPTER-II

2 MOTIVATION OF STUDY

Chapter-1 of this thesis described and discussed the background of healthcare sector in global as well as with reference to Indian context; highlighting on digitalization visions of healthcare domain with specific reference to digital technologies like EHR and ERP. The chapter further emphasized on technology-adoption inclination of healthcare sector from both hospitals and hospital-supplier perspectives. It also focused on the types of hospitals, their suppliers and emphasized on the objectives of this study. As an extension to chapter-1, this chapter (Chapter-2) throws light on the major issues and problem areas of major healthcare stakeholders (hospitals and hospital-suppliers). This chapter highlights and articulates the ***Business Problem*** of healthcare sector and emphasizes on aspects of digitalization of healthcare sector. Further this chapter digs deeper into related healthcare specific research literature linked to the business problem; translating to the ***Research Problem.*** This chapter further derives meaningful ***Research Questions*** reflecting the research problem; thereby identifying the ***Research Gaps*** with elaborations to present the ***Research Objectives*** of this study.

The below Figure-2.1 represents the flow of Research Process followed in this study.

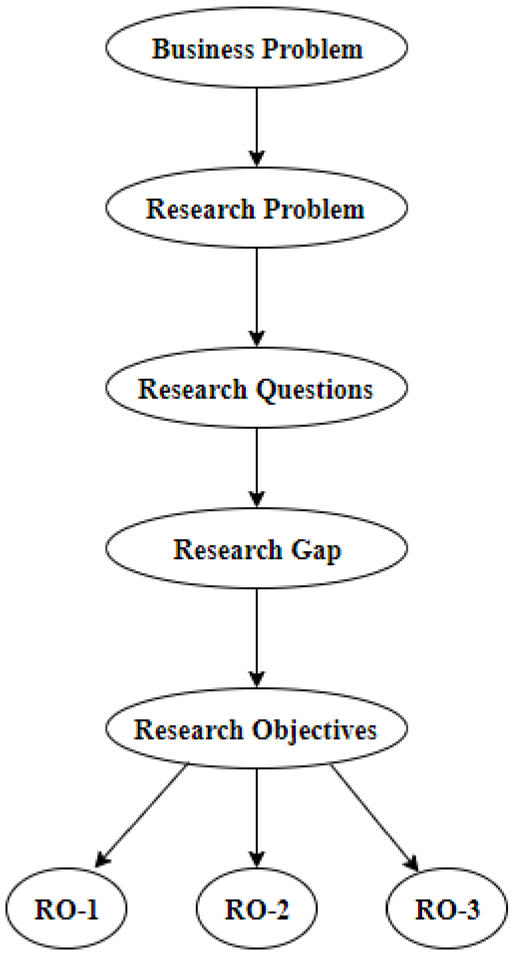


Figure 2.1: Research Process Flow Diagram

The below section-2.1 discusses the Business Problem in the digitalization aspects of healthcare sector.

2.1 BUSINESS PROBLEM

Digital technologies adoption is a great focus towards healthcare transformation and innovation with the visions of digital healthcare opportunities towards being faster, interoperable, connected, collaborative and integrated system for achieving better quality, efficiency and cost containment. Primary focus for healthcare firms is to be rapidly digitalized to compete in this dynamic world (Velthoven et al., 2019). But at ground level, with these digitalization aspects there have been a lot of issues regarding understanding of prominent digital technologies including electronic mode of handling patient-records; transforming from the traditional practices of using paper medical-records (Chakravorty et al., 2019). Another important aspect in healthcare sector is integration of stakeholders like hospitals and hospital-suppliers. Real-time information-sharing, proper coordination between distinct care-delivery silos and interoperability across multiple locations, calls for the need of integration across healthcare service delivery platforms and transformation in the process of storage and retrieval of data (Garg and Agarwal, 2014). Technologies like EHR and ERP have emerged as potential solutions largely needed for integrated patient reporting; however, extant sector-specific reports highlight lacunae and critical shortcomings in the context of understanding and relevant implementation of the aforementioned technologies across hospitals and hospital-suppliers in Indian healthcare sector.

The National Health Policy of India Report-2017 (NHPI-2017) emphasized the need for information technology (IT) implementation across components of healthcare system besides giving utmost priority to establishment of integrated IT architecture facilitating exchange of patient health information across platforms (Sarbadhikari, 2019). Critical success factors of technology adoptions in Indian healthcare context have been attributed to care-service-organization's (i.e. healthcare centres) openness towards technology adoption, managerial knowledge and awareness regarding technology implementation utility and most importantly physicians' interest and approach towards usage of technology (Bajwa et al., 2020).

In the backdrop of this scenario and the government policies and moves towards fostering an advanced digitalized patient-care delivery platform, this research gathers impetus and steam directed towards the need for a detailed understanding supported by an empirical validation regarding digital technologies adoption like EHR-adoption and ERP-implementation in Indian-healthcare context. So, the business problem highlighted is:

Low adoption of Electronic Health Records (EHR) i.e. digitalization and Electronic Resource Planning (ERP) i.e. e-integration is affecting servicing capability, operational and financial performance of the Indian healthcare sector (hospitals & hospital-suppliers).

Various contemporary sector-specific industry reports emphasize key aspects linked to Indian healthcare scenario and complexity status supported by key facts; thereby highlighting various challenging aspects and scopes of introspection. Selected key highlights are discussed below:

Several healthcare reports highlight the focus towards technology advancements, data interoperability, technologies to be the drivers of healthcare delivery, virtual-care technologies, increasing use of Data-as-a-platform and technology enabled healthcare model[18] (Deloitte Report, 2020; IBEF, 2019). But at the ground level the scenario of adoption of electronically managed patient records and digital technologies in hospitals are reported to be still at a nascent stage in Indian healthcare sector which is quite different from developed countries (Kaur et al., 2019). There are high dependencies on manual processes and paper-based patient records. These manual practices are often leading to repetitive, redundant and often erroneous process and record management; affecting efficiency, flexibility, responsiveness and servicing capability; posing barrier to vision of digitalized health, e-health, m-health, achieving mobility and interoperability (Bates and Samal, 2018; Accenture report, 2016; Deloitte report, 2016).

National Health Policy of India (2017) has focused on healthcare integration, universal access and digitalization of the patient records. 80% of healthcare data happens to be unstructured and not properly maintained electronically as documents, images, or notes (Priyanka and Kulennavar, 2014). There is a lack

[18] https://www2.deloitte.com/global/en/pages/life-sciences-and-healthcare/articles/global-health-care-sector-outlook.html

of supporting infrastructure for technology implementation in Indian healthcare scenario (Kaur et al., 2019). Predominantly, Indian healthcare system shows dearth of standardized platforms, coordination and integration as well as exhibits reluctance towards digital technology adoption for healthcare streamlining due to lack of understanding (Sarbadhikari, 2019). Similar to their global counterparts, Indian hospitals are also finding it difficult and struggling to achieve superior care-efficiency and performance in terms of cost, quality, bed-capacity, patient satisfaction, process-streamlining, digitalized reporting, etc. besides achieving required servicing capability as per the global benchmarked standards (Deloitte, 2020; Bain & Company report, 2015*)*.

In India, hospitals and suppliers' integration using ERP platform systems still remains at a nascent stage as only <1% of total hospitals were electronically integrated till 2016 and even after policy changes and digital technology trends only around 15-20% of multispecialty tertiary-care hospitals are at various stages of electronic integration, let alone only <5% of hospitals at advanced stage of complete integration as on 2019 (IBEF, 2019; IBEF, 2016). However, there is lacking in understanding regarding the visions of digital health and how digital-techs affects servicing capability and performance of hospitals and their suppliers (Mc-Kinsey Report, 2019). Impact of integration and digitalization using e-tech platforms on performance and service aspects of hospitals and their suppliers remains unclear; yet to be logically understood at large-scale (Kaur et al., 2019; Feldman et al., 2012).

In the context of the above mentioned issues related to healthcare sector, below section (section-2.2) elaborates the related 'Research Problems', focused towards healthcare digitalization.

2.2 RESEARCH PROBLEM

The above highlighted business problem has given a scope of deeper probing and introspection in order to throw light on the key problems of healthcare digitalization and the aspects which need further attention and focus for research. With extensive literature review on the above highlighted business problem, three major research-problems were identified. They are discussed below:

Research Problem-1:

Lack of empirical evidence linking EHR-Adoption and its impact on ERP and further their implications on servicing capability, operational and financial performance in Indian healthcare context (hospitals/ hospital-suppliers).

Current Scenario:

In India, the problem of re-investigation, non-acceptance of clinical investigations done at one clinic by another clinic, or prescribed by one doctor, or at specific lab has been very rampant. Moreover, patients are burdened to carry numerous reports which are several times investigated by hospitals. Because of manual arrangement of reports in the hospitals, dependency on staff and misplaced information, all the hospital stakeholders are also not completely aware of the requirements due to information asymmetry and availability (Kaur et al., 2019). This situation leads to many negative operational and financial burdens. With the increase in lead time, patient length of stay in hospitals increases, re-investigation cost spirals, hospitals bed-turnover ratio, return on per-patient days and servicing capability and ability to accommodate changes in patient care-delivery gets affected (Bhatt et al., 2019; Agrawal et al., 2013). Predominantly the root cause behind this problem, as highlighted across government reports (MHRD report, 2016, 2015), non-government white papers (Deloitte Report, 2020; IBEF, 2019) and practitioners literature highlights that a lack of well-established automated patient identification system is leading to lack of connectivity, transparency, interoperability and most importantly lack of standardization (Bajwa et al., 2020; Slotwiner et al., 2019). Due to these issues, the hospitals’ and their suppliers' servicing capability, quality of care, delivery, flexibility and responsiveness gets affected (Chakravorty et al., 2019).

Research Problem-2:

Lack of understanding on the business implications in terms of dynamic capabilities, servicing capability, operational and financial performance on the usage of ERP integrated systems in Indian hospitals and their suppliers.

Current Scenario:

Healthcare service sector in today's scenario is largely inclined towards patient-centric approach but at the same time needs to focus on business implications like quality, cost or time (Sangode and Metre, 2019). Indian healthcare sector happens to be a competitive market involving private players where handling of the operational and financial outcomes needs simultaneous emphasis, as the focus towards managing care-quality, cost-optimization, efficiency and performance go hand-in-hand (Rudrappa et al., 2019). Digital transformation of healthcare sector is at a nascent stage but studies acknowledge that rapid evolution of digital tools among stakeholders have the potential to improve access, care-quality, care-delivery and performance (Madanian et al., 2019). In case of hospitals / hospital chains or their suppliers, there is still a lack of connectivity, transparency, integration, well established invoicing, procurement system using electronic interface and automated back office functions (Kalpa, 2012). Integrated systems are necessary for healthcare systems to support the efficiency of patient care (Mucheleka and Halonen, 2015; Bose, 2003). ERP system happens to be the most powerful resource in integrating different silos into single platform and various sectors have reported the effectiveness and performance benefits obtained by ERP implementations (Jagoda and Samaranayake, 2017; Nandi and Kumar, 2016). In India, hospitals mostly in the Tier-1 cities have gradually been initiating or just implemented ERP packages (Garg and Agarwal, 2014), but still the benefits in terms of servicing capability and performance improvement in the Indian hospital systems and their suppliers remain unclear. There is a void of empirical evidences in the Indian hospitals and their suppliers in terms of ERP implementations and their level-wise outcomes (Chakravorty et al., 2019).

Research Problem-3:

Lack of well-established comprehensive framework highlighting antecedent-consequence relationship in the Indian healthcare context linking EHR-Adoption and ERP-Implementation with process level capabilities (transparency and interoperability) and dynamic capabilities (quality, delivery dependability, flexibility and responsiveness) with the competency like patient care servicing capability and outcome variables like operational and financial performance in hospital/hospital-suppliers' context.

Current Scenario:

Current state of healthcare in India is largely fragmented due to infrastructure gap, workforce scarcity and void of process-based knowledge (Accenture Report, 2019). Healthcare's focus towards technology is valuable but adoption is at a much slower rate as compared to other sectors. The private healthcare players are focused towards IT adoption but there is a lack of understanding among the staffs and stakeholders (Kaur et al., 2019). Digitalization in some of the major private tertiary care hospitals in the tier-1 cities have started the use of automated electronic systems and ERP integrated platforms but a detailed analysis of the level-wise impacts remains unexplored (Garg and Agarwal, 2014). Studies concerning implications of digital technology adoptions in Indian healthcare context remain largely un-addressed as large scale empirical studies validating aforesaid relationships are not prominent (Sarbadhikari, 2019).

2.3 RESEARCH QUESTIONS

The above highlighted research problems further compel the researcher to ponder upon the scenarios. With that backdrop, several *'Research Questions'* have risen from the key lacunae of research problems which needs to be addressed with further introspection. So, the overarching understanding of the research problems translates into key research questions which offer substantial scope of logical linkage based empirical validation.

This section highlights the prominent research questions given below as *RQ-1, RQ-2, RQ-3, RQ-4, and RQ-5.*

RQ-1

Keeping the point of view of digital technologies like EHR and ERP-Adoptions in hospitals and hospital-suppliers in mind, the primary thought that arises is their impact on firms' process-level capabilities. Based on that RQ-1 is:

RQ-1: What is the impact of EHR-Adoption and ERP-Implementation on the firms' process-level-capabilities i.e. transparency and interoperability in the Indian healthcare (hospitals and hospital-suppliers) context?

> RQ-1.1: How will EHR generate process-level capabilities like transparency and interoperability in Indian hospitals?
>
> RQ-1.2: How will ERP-Implementation impact process level capabilities like transparency and interoperability in Indian hospitals and hospital-suppliers?

RQ-2

There is also a need for consideration on the impact of EHR-Adoption in hospitals over the ERP-Implementation of the hospitals and hospital-suppliers. Based on that RQ-2 is:

RQ-2: How is EHR-Adoption in hospitals enabling ERP-Implementation in Indian hospitals and hospital-suppliers?

RQ-3

The research problems also indicate the need for analyzing the impact of integrative technologies on the business outcomes of healthcare sector in India. Thus, the RQ-3 is:

RQ-3: What is the impact of ERP-Implementation on Dynamic capabilities (quality, delivery dependability, flexibility and responsiveness) and further their impact on Servicing capability, Operational and Financial performance in Indian hospitals and hospital-suppliers?

The above RQ-3 can be further sub-divided as follows:

RQ-3.1): How will ERP-Implementation impact dynamic capabilities *(quality, delivery dependability, flexibility and responsiveness)*?

RQ-3.2): How will ERP-Implementation impact Servicing-Capability?

RQ-3.3): How will ERP-Implementation impact Operational-Performance?

RQ-3.4): How will ERP-Implementation impact Financial-Performance?

RQ-4

The focus of this study is dig deep into implementation of digital technologies and also to analyze their level-wise impacts on the healthcare firms. Based on that thought RQ-4 is:

RQ-4: How will the consequent process level capabilities *(transparency and interoperability)* impact key dynamic capabilities *(quality, delivery dependability, flexibility and responsiveness)* in Indian healthcare sector (hospitals and hospital-suppliers)?

RQ-5

Every research is incomplete without the analysis of resources on final outcomes i.e. performance measure. So, the question arises on how the aforementioned digital technology resources can not only impact dynamic capabilities but also trigger towards competencies and business level operational and financial performance. Based on that RQ-5 is:

RQ-5: How will the aforementioned key dynamic capabilities impact competency like servicing capability and in turn outcome variables like operational and financial performance in Indian healthcare sector (hospitals & hospital-suppliers)?

2.4 RESEARCH GAPS

The Research Problems and Research Questions discussed in the above sections clearly demarcate and indicate relevant scopes of detailed research which either lack theoretical support or literature driven conceptual linkages, let alone any empirical validations. So, these key focus research areas referred to as Research Gaps need to be highlighted, addressed and prioritized in a logical sequence leading to further conceptual linkage mappings. Thus, the key gaps are as follows:

Research Gap-1 (RG-1):

National health Policy of India (NHPI-2017) and Vision-2020 (Srinivasan, 2010) emphasizes on the digitalization of healthcare sector primarily emphasizing on electronic conversion or management of patient records and integration of the fragmented silos of Indian healthcare sector. Several industry reports have highlighted that priority is needed to electronically manage patients' medical records and provide easy access to all the stakeholders (Deloitte 2020 Global Healthcare Outlook Report, 2020; McKinsey Digital India Report, 2019). EHR-Adoption has shown a pathway for electronic management of health records and foster real time linkages of patients' medical data and ERP-Implementation in hospital and supplier firms forms the backbone of platform-level integration using software as a service; thereby fostering the healthcare information using interoperable and interconnected electronic reporting systems which has shown to improve care-quality and safety (Alanazi et al., 2020; Fiaz et al., 2018; Health data collaborative report, 2015).

However in Indian healthcare scenario, there has been reluctance in adoption of EHRs with the primary reason being lack of standardized infrastructure, lack of understanding of EHR-Adoption towards business implications or reluctance to change (Bajwa et al., 2020). EHR-Adoption is at a nascent stage in Indian healthcare scenario and most of the reviewed literatures are in Non-Indian context; highlighting a dearth of empirical validation in Indian context and those which are aligned to Indian healthcare context are predominantly conceptual.

Some of the linkages from research literature are indicative in terms of EHR-Adoption with process level capabilities like Transparency (Fontenot, 2013) and Interoperability (Bates and Samal, 2018; Zuckerman, 2017; Greenwood et al., 2017). Further linkages with Dynamic Capabilities (Lengnick-Hall et al., 2004) like Quality (Fontenot, 2013), Delivery Dependability (Koppar and Sridhar, 2009), Flexibility (Schobel et al., 2016), and Responsiveness (Schuler et al. 2016) can be found but no empirical evidence in Indian scenario are highlighted.

Thus, there is a need to empirically validate impact of electronic resources adoption (e-resources/platforms) like EHR on hospital-side processes in Indian healthcare context. Research is needed to investigate the process-level linkages between e-resource adoption with ERP implementation and process-capabilities like Transparency and Interoperability.

Research Gap-2 (RG-2):

India is among the top countries globally to adopt digital practices across all sectors including healthcare. Government schemes are largely enabling wider adoption of digital technologies to improve care (McKinsey Digital India Report, 2019). But for these schemes to work, India needs digitally integrated and standardized platform as an essential technology backbone. There is a prime need for seamless digitally enabled care platforms that can connect, automate and analyze the healthcare data (McKinsey Digital India Report, 2019; Accenture Report, 2019). The fragmented and decentralized departments in healthcare have often been discussed as the major issue for lack of proper, real-time and transparent information sharing (Nandi and Kumar, 2016). There has been a need for integrated, interoperable technology enabled systems for healthcare stakeholders and the sector needs to have an open understanding regarding the implications of digital technologies adoptions (Sarbadhikari, 2019). ERP systems in healthcare have evolved as a key platform for facilitating planning, functioning, visibility and real-time access of healthcare data; thereby fostering efficiency and performance parameters (Sangode and Metre, 2019).

However, extant literature review has highlighted that limited study exists in the context of integration in healthcare using ERP (Mucheleka and Halonen, 2015) and also studies in Indian context have highlighted that lack of proper knowledge, poor planning, top management unawareness and lack of standardized infrastructure have emerged as major barriers of ERP-Implementation in healthcare (Sangode and Metre, 2019; Mitra and Mishra, 2016). Some of the linkages has been observed in terms of ERP-Implementation with hospital level capabilities like Transparency (Mucheleka and Halonen, 2015; Poba-Nzaou et al., 2014) and Interoperability (Bates and Samal, 2018; Zdravkovic et al., 2017). Some extant literatures highlights ERP linkages with Dynamic Capabilities (Fiaz et al., 2018; Lengnick-Hall et al., 2004) like Quality (Chaniotakis and Lymperopoulos, 2009), Delivery Dependability (Wahlgrenand Persson, 2011), Flexibility (Schobel et al., 2016), and Responsiveness (Kritchanchai 2012). Majority of the studies are not in

Indian healthcare context and very few studies which exist in Indian context are non-empirical and conceptual.

Thus, there is a need to investigate and empirically validate the impact of e-integration platform resource like ERP on various levels of capabilities: Process Capabilities (like Transparency and Interoperability), Dynamic Capabilities (like Quality, Delivery Dependability, Flexibility, and Responsiveness) and Patient servicing capability and its subsequent impact on business performance (Operational and Financial) in Indian hospitals and hospital-suppliers scenario.

Research Gap-3 (RG-3):

While doing the literature review it was observed that although some studies in various contexts had discussed the impacts of EHR and ERP in various phases but a holistic analysis of the technologies adoption across all the phases of hospitals and hospital-suppliers were lacking. There has been a dearth of comprehensive antecedent-consequence linkages between the application of the Key resources- ERP and EHR to the process level capabilities, key dynamic capabilities and outcome variables like servicing capability, operational and financial performance (Dobrzykowski et al., 2016; HassabElnaby et al., 2012) in the Indian healthcare context.

There is a need for proper handy framework for managers of hospitals and hospital-suppliers in analyzing the impact of EHR and ERP adoption/implementation on the firms' process-level capabilities, dynamic capabilities of hospitals/hospital-suppliers, their servicing capabilities and finally holistic impact on the operational and financial performance. Due to this lack of guiding framework, the hospital superintendents, supplier managers, healthcare stakeholders and even the top managements in Indian healthcare sector tend to be hesitant in their practical applications and thus EHR and ERP are not yet universally applicable in all types of hospitals (Sarbadhikari, 2019). There is a grave need from the research point of view to provide insight to healthcare managers who are the prospective decision–makers for making decisions concerning EHR-Adoption and ERP-

Implementation in hospitals or supplier-firms and work towards the visions of digitalization of Indian healthcare sector.

With is backdrop, it is eminent that there is a need to study and establish the comprehensive antecedent-consequence linkages through the intermediary variables between EHR adoption and ERP implementation and their subsequent impact on the business outcomes (namely capabilities, competencies and performance) in Indian healthcare (hospitals and hospital-suppliers) context.

2.5 RESEARCH OBJECTIVES

However, the Research Questions and Research Gaps discussed above need probing and further require to be operationalized into suitable Research Objectives in order to conceptualize the antecedent-consequence linkages between the variables. From the business point of view, there is also a need to propose an operational framework for healthcare managers in order to provide a detailed understanding on this area of research.

RO-1: To examine the impact of EHR-Adoption on ERP-Implementation, transparency and interoperability in Indian healthcare context.

RO-2: To study the impact of ERP-Implementation on Dynamic Capabilities, Servicing Capabilities, Operational and Financial performance in Indian healthcare context.

RO-3: To establish antecedent-consequence relationships linking EHR-Adoption and ERP-Implementation with business outcomes (namely capabilities, competencies and performance) in Indian healthcare context.

2.6 Chapter Summary

The summary of this chapter is as follows:

This chapter provides the highlighted issues of healthcare sector referred to as ‘Business Problem’; further section refers to research literatures and discusses the ‘Research Problem’ from which meaningful ‘Research Questions’ and ‘Research Gaps’ have been emphasized. Based on these gaps the ‘Research Objectives’ of this study has been finalized for further research.

The next chapter i.e. Chapter-3 further throws light on the theoretical research literatures and highlights the theories which have been finalized for conceptualization of the research framework.

CHAPTER-III

3 THEORETICAL BACKGROUND

The previous chapter i.e. chapter-2 has highlighted the *'Business Problem', 'Research Problem', 'Research Questions', 'Research Gaps' and 'Research Objectives'* of this research work. This chapter i.e. Chapter-3 titled as 'Theoretical Background' further digs deep into the fundamental literatures of supply chain and digital technology adoptions providing the details of theoretical underpinnings which are logically linked and forms the base of the conceptual framework which is finalized for further large-scale research. The chapter also discusses about various literatures linked to the described theories which throws light on the identified gaps in this study; thereby focusing towards analysis of the research objectives finalized in chapter-2 and contributing towards healthcare supply chain academic and practitioners' body of knowledge.

Theoretical backdrop is very vital for conceptualizing and proposing research models. The current study is well-grounded and draws logical support and linkages from two base theories (I, II) and two ancillary (III, IV) theoretical supports. The theories are:

i. **Core competence theory *(Base Theory-1)*:**

Core competence theory by Javidan (1998) suggested the competency hierarchy which explained that at the bottom of the hierarchy is resources. This theory conceptualized the hierarchical structure of core competence which starts from resources then forms capabilities, which further forms competencies, and finally leads to core competencies. Resources form the building blocks of capabilities which further form the competencies of the firm and further impacts performance or core-competencies. Resources are the inputs into the organization's value chain. Every firm has a bundle of resources, but cannot put its resources into best use. The backbone of the study framework is derived from Javidan's theory of core competence hierarchy framework. This research framework is aligned to the concepts of capability, competency, performance and organizational resources based view described by Mansour Javidan.

Kogut and Zander (1992) stated that combined resources allow the synthesis of capabilities. Bi et al. (2017) tested the theory to empirically validate e-business capability and value in the fast growth of enterprises. Zhang et al. (2016) applied the core competency theory by Javidan (1998) and showed that capabilities lead to core competencies which remain often embedded in functional areas which are further boosted by internal interactions between functional divisions; thereby highlighting that the solution-capabilities lead to value creation and strategic coordination.

Some of the recent literatures in various sectors also referred this theory as a potential theory to build competence on various resources and capabilities. de Vasconcellos et al. (2019) applied this theory in the context of small and medium enterprises (SMEs) and aligned competence to be built on resources and capabilities, to highlight the roles of organizational creativity (as resources) to be building blocks for developing firms' international business competence with entrepreneurial capability as the mediating concept. Chiu et al. (2019) draws its backdrop from this theory in a case-based research in automotive company to demonstrate business model which integrates products, services and supportive infrastructures which adopted the hierarchical structure of Javidan (1998) to assess collectiveness, uniqueness and strategic-flexibility capacity as key aspects for identifying its core competence. Mahdi et al. (2019) conducted an empirical study in private universities and linked knowledge management processes as key resource for sustainable competitive advantage by linking this theory as coordination and cross-functional capabilities incorporation.

Most of the cited literatures regarding this theory are in the non-healthcare context and thus, understanding of this theory and its linkages in healthcare sector remains unexplored. Thus this study contributes to a more focused understanding of this theory and its appropriate linkages in healthcare digitalization and supply chain context.

ii. Resource based view (RBV) theory *(Base Theory-2)*:

The RBV theory claims that firms compete based on bundle of resources that are valuable, rare, difficult to imitate, and non-substitutable (VRIN) by competitors (Barney, 1991). These unique resources enable firms to achieve competitive advantage and superior long-term performance. Barney (1991) suggested that organizational resources and capabilities are key factors for competitive advantage and its sustainability. This theory was further evolved in the relational resource based view (RRBV) by (Dyer and Singh, 1998) who suggested that partners generate relational rents through relationship-specific assets, knowledge-sharing routines, complementary resources and capabilities, and effective governance. Dyer and Singh (1998) highlighted that such rents cannot be generated by either firm in isolation and only created through joint partner contributions. In this study, EHR and ERP are taken as the unique resources to the firms, internal capabilities developed through them are transparency and interoperability, the dynamic capabilities developed by these resources are quality, delivery-dependability, flexibility and responsiveness and servicing capability as the competitive advantage. RBV emphasizes that along with firm’s resources these capabilities are also highly important for competitive advantage.

Bi et al. (2015) draws upon RBV theory, to develop and test a theoretical model exploring the interrelationships between IT resources (IT expertise, IT infrastructure), IT capability (IT integration), IT-enabled inter-firm processes (activity integration, coordination, partnership enhancement), and organizational performance in the fast growth SME context. Vargas and Lloria (2017) explored the links between RBV, intellectual capital and knowledge creation theory to explore the linkages between resources, enabling capabilities, competitive advantage and organizational performance with empirical validations from Spanish biotechnology firms.

According to RBV, resources can be tangible or non-tangible, resource inputs like data and information sharing among the supply chain participants adds value to the systems (Seppala et al., 2019). Sharma et al. (2019) applied RBV in the context of Indian economy and addressed the linkages between corporate sustainable performance and firm performance. Cruz et al. (2019) conducted an empirical study on medical service providers' context based on RBV theory to analyze the impact of maintenance providers in service firms' resources and their capabilities on maintenance performance as quantified by turnaround-time of medical devices. Sehgal and Gupta (2019) applied the RBV theory in Indian healthcare context to highlight the effects of improved services by effective resource utilization and integrated customer co-production process which fosters care-quality. A study in Chinese hospitals context also applied RBV theory and considered electronic medical records as key resources which triggered IT-enabled information synergy between departments and knowledge assets of hospitals (Li et al., 2019). A recent study in healthcare by (Ramakrishnan et al., 2020) applied RBV to analyze Business Intelligence and analytics as key resources to generate capability which was classified in three categories like infrastructure capability, process capability and integration capability which could further improve quality of services.

Based on the above literatures cited it was evident that RBV theory can be potentially linked with this study and this research framework can further be explored with its alignment to RBV.

iii. Cybernetic control theory *(Ancillary Theory-1)*:

Cybernetic control theory (CCT) explains how cyber or digital technology resources (EHR and ERP systems as described in the current study context) offer a means by which managers can effectively develop their business strategy and organization capabilities (Vancouver, 1996). This theory also emphasizes on the concepts of receiving timely feedback, analyzing deviations from expectations and taking necessary decisions to correct deviations. Cybernetic control theory highlights that organization needs to analyse the key performance indicators, take appropriate action and observe system responses (Vancouver, 1996). Consistent with this theory, ERP and EHR systems provide the means by which organizations can capture, process, and deliver a wide array of key performance indicators in real-time.

HassabElnaby et al. (2012) applied CCT to explain how ERP systems are effective for developing business strategy and organizational capabilities; RBV theory and dynamic capabilities theory to discuss assets as important factor in improving performance (Barney, 1991; Teece et al., 1997), and agency theory to describe how performance measures motivate managers to emphasize on key financial and non-financial performance indicators (Feltham and Xie, 1994). CCT focuses on real time information sharing and digital technologies appropriately trigger the timeliness and accuracy of information processing. Bhatt et al. (2019) applied CCT in a case-based Indian healthcare study to analyze the impact of IT and care-analytics on operational performance and highlighted the aspects of how IT resources can trigger care-analytics and operational performance.

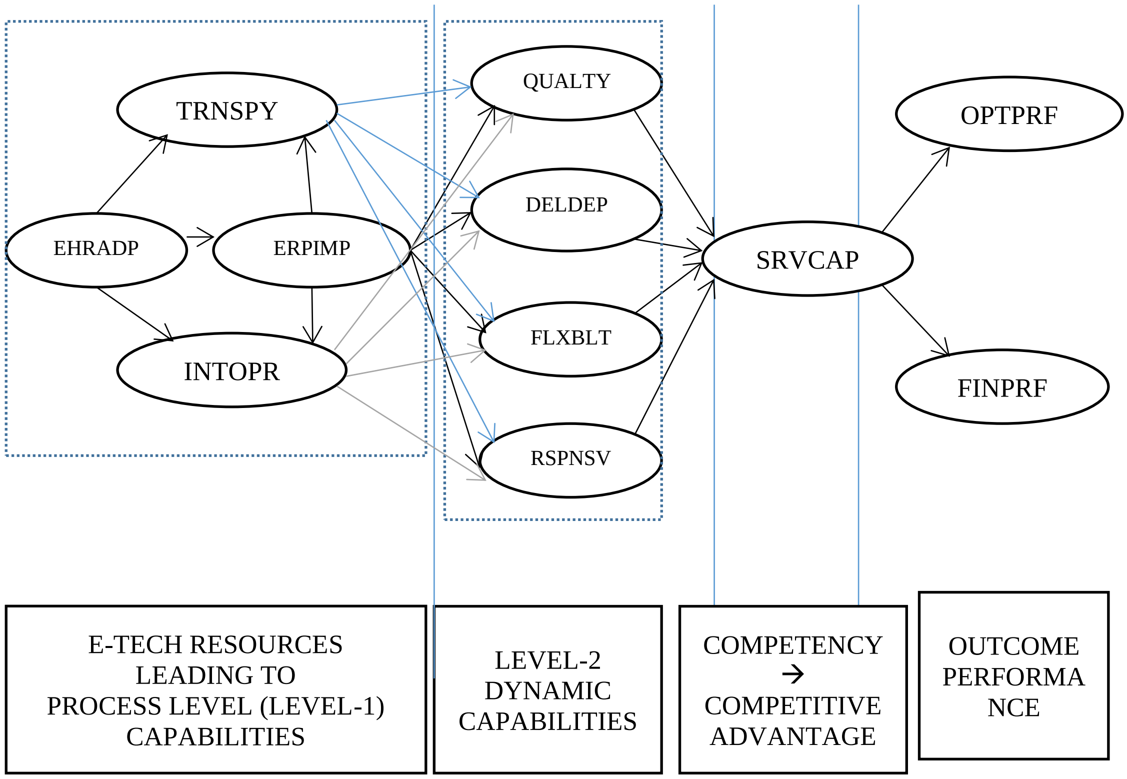
Another view of CCT given by Carver and Scheier (1998) emphasized on the self-regulation behavioral aspects of resources. It specifies on the characteristics of cyber-resources focusing on continual monitoring of processes and attaining ways to reduce the discrepancies of actual state from what is to be expected. Various technology resources like EHR, ERP, Internet of Things (IoT) medical devices or wearables have been aligned to CCT backdrop as these technologies are self-regulatory and CCT provides understanding regarding building firms' strategies and capabilities (Chakraborty et al., 2019; Chakravorty et al., 2019). Based on the above literatures it is evident that CCT is applicable in this study context.

iv. **Dynamic capabilities theory *(Ancillary Theory-2)*:**

Dynamic capabilities (DC) theory by (Teece et al., 1997) suggests that capabilities contribute to performance outcomes because they embody dynamic routines that can be manipulated into unique configurations to drive product and service differences. Teece and Pisano (1994) developed the area proposing dynamic capabilities theory as the "subset of the competences/capabilities which allow the firm to create new products and processes and respond to changing market circumstances". DC is aligned to organizations' abilities to respond to dynamically changing environment. Competitive advantage rests on distinctive processes, shaped by the firm's asset positions and the evolutionary paths followed. DC theory emphasizes management capabilities and inimitable combinations of resources that cut across all functions, including R&D, product and process development, manufacturing, human resources and organizational learning.

Studies highlighted DC as the ability of firms to work towards differentiating from their competitors and fostering competency or competitive advantage i.e. the firm's behavioral orientation towards competitive advantage and forms embedded processes to construct firms' core capabilities (Helfat and Peteraf, 2003; Winter, 2003). DC is referred to as the firms' ability towards differentiating from their competitors thereby gaining competitive advantage (Braganza et al., 2017; Cepeda and Vera, 2007; Zahra et al., 2006). A recent study by Fainshmidt et al. (2019) highlighted that organizational environment and resources are not the only factors leading to competitive advantage but rather strategic fit and process-level capabilities of organizations are also needed for triggering competitive advantage. Jiang et al. (2019) analyzed dynamic capabilities view in tourism sector to highlight how resources and processes can alter the existing operational practices and transform into new ones which are enabled by dynamic capabilities and slack resources. Bhatt et al. (2019) applied DC theory to highlight the positive impact of IT adoption on care-analytics and performance of healthcare firms. Based on the above literatures it is evident that DC theory is applicable in this study context for analysis of the antecedent-consequence linkage of resources with capabilities, competencies and performance.

Therefore, based on the above discussion the below Figure-3.1 represents the 'Conceptual Research Framework' of this research work.



Construct KEY

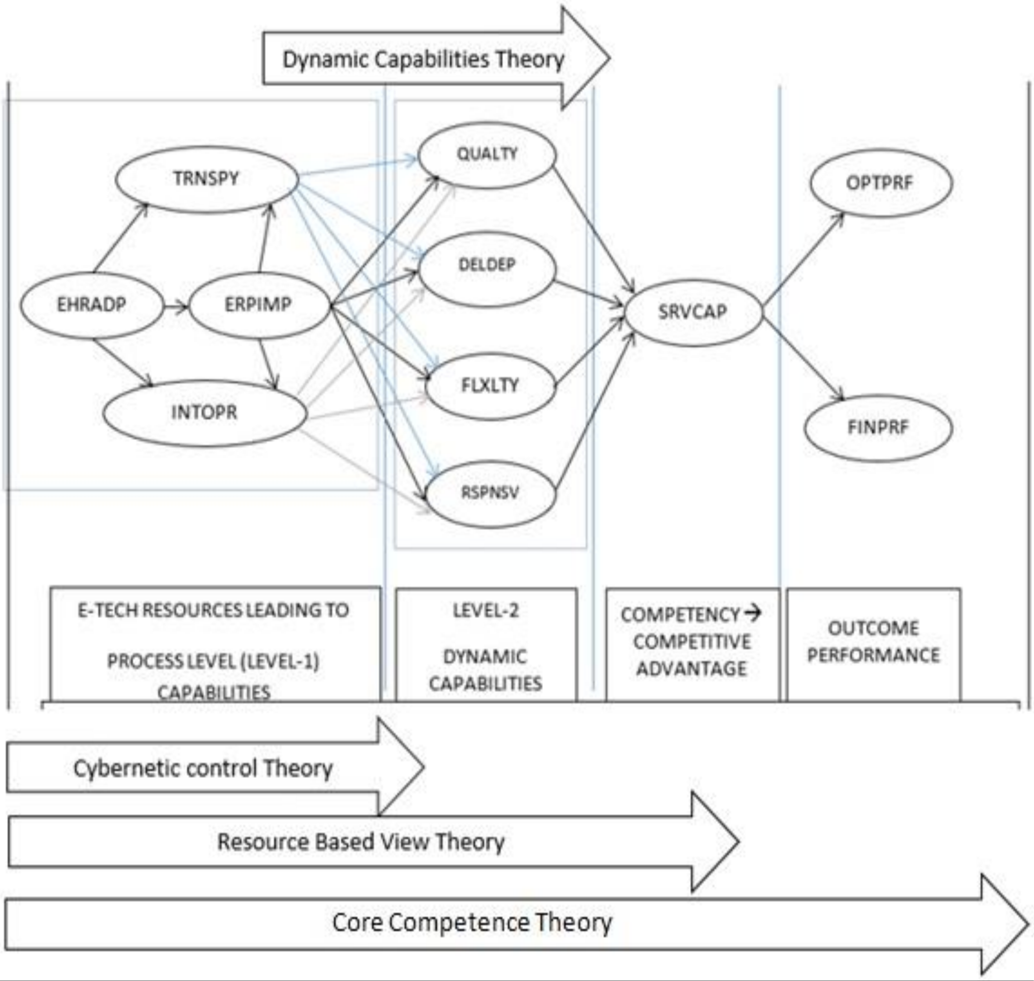
ERPIMP= ERP Implementation
EHRADP= EHR Adoption
TRNSPY= Transparency
INTOPR= Interoperability
QUALTY=Quality
DELDEP=Delivery Dependability
FLXBLT= Flexibility
RSPNSV= Responsiveness
SRVCAP= Servicing Capability
OPTPRF= Operational Performance
FINPRF= Financial Performance

Figure 3.1: Conceptual Research Framework

Therefore, from the theoretical perspective, in a nutshell, the first base theory *'Capability-vs-competency' theory (Javidan, 1998)* is used to propose the flow of the framework. The second base theory *'Resource based view (RBV) theory'* (Barney, 1991) highlights that how resources create Valuable, Rare, Inimitable and Non-Substitutable (VRIN) attributes. This theory finds importance in service sector literature and finds relevant application in Indian healthcare sector which happens to be one of the foremost critical service sectors. Drawing linkages from two ancillary theories [‘Cybernetic control theory’ by Vancouver (1996) and ‘Dynamic capabilities theory’ (Teece et al., 1997)], the complete antecedent-consequence relationships have been proposed in this study. *‘Cybernetic control theory’* states how cyber resources like EHR, ERP or other IT platforms help in better strategy, capability and performance and can be used to support digitalization of healthcare sector. The *‘Dynamic capabilities theory’* highlights how dynamic capabilities hold importance in generating competencies. DC theory analyses the firm’s abilities to be aligned to internal and external changes and further trigger competencies and performance. This study thus highlights the impacts of resources on the dynamic capabilities of the firms. The dynamic capabilities considered in this study are quality, delivery dependability, flexibility and responsiveness.

However, the study is keen at examining the intermediary stages as suggested or indicated in the extant literature. The study conceptualizes transparency and interoperability as the firm’s process- level internal capabilities as direct consequences of EHR and ERP implementation; Quality, delivery-dependability, flexibility and responsiveness have been conceptualized as the firm’s dynamic capabilities further downstream to process-level capabilities (transparency and interoperability); thereafter, servicing capability is considered at the next consequent level as competency and then finally the performance variables i.e. operational and financial performances have been placed as ultimate outcome consequences for firms (hospitals and hospital-suppliers).

Below Figure-3.2 illustrates the phase-wise linkage of the two Base-theories and two Ancillary-theories applied in this research framework:



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OPTPRF= Operational Performance
FINPRF= Financial Performance

Figure 3.2: Theoretical Linkage with the Research Framework

3.2 CONSTRUCT DEFINITIONS

This section provides the definitions of all the constructs which are considered in this study framework for further research.

Table 3.1 : Construct Definitions

Construct	Construct Definitions	References
EHR Adoption (EHRADP)	EHR Adoption is the extent to which the firms (hospital) have adopted electronic technologies to save access and handle patient related data to facilitate diagnosis and clinical decision making.	Dobrzykowski and Tarafdar, 2015, 2017 ; Jha et al., 2009 ; Kim et al., 2017
ERP Implementation (ERPIMP)	ERP Implementation is the extent to which the firms (hospitals/suppliers) have implemented the relevant ERP system modules, properly aligned to its business processes.	Markus and Robey, 1998 ;HassabElnaby et al., 2012; Miller and Sim, 2004; Kelle and Akbulut, 2005
Transparency (TRNSPY)	Transparency is defined as the extent to which the firm (hospital-depts./supplier) can portray/reveal their true motivations, goals, and agenda through regular exchanges and updates of relevant information regarding vital business aspects involving policies, practices, expectations, etc.	Eggert and Helm, 2003 ; Schneller and Smeltzer, 2006; Handfield and Bechtel, 2002; Lamming et al. 2004
Interoperability	Interoperability is the extent to which the firm (hospital-depts./supplier) is	Ide and Pustejovsky, 2010

(INTOPR)	capable of sharing information between the systems and applications in meaningful ways, make the information operable from multiple locations and make informed decisions.	; Chen et al., 2008 ; Tolk and Muguira, 2003 ; Zdravkovic et al., 2017
Quality (QUALTY)	Quality is the extent to which the firm (hospital-dept./supplier) can provide superior, distinguished and efficient service according to the benchmarked standards.	Chaudhry et al., 2006 ; Mosadeghrad, 2013
Delivery Dependability (DELDEP)	Delivery dependability is the extent to which the firm (hospital-dept./supplier) provides dependable, on time, accurate and appropriate/effective service to its specific customer (patient/hospital-dept.).	Dabholkar et al., 1996; Li et al., 2005
Flexibility (FLXBLT)	Flexibility is the extent to which the firm (hospital /supplier) can adapt to the dynamic process environment, recognize process loopholes and address variable customer (patient/hospital) complaints/requirements, concerning delivery of care/order.	vanGool et al.,2017; Matanock et al., 2014; Li et al., 2005;Wekre et al., 2011;Rotar et al., 2016
Responsiveness (RSPNSV)	Responsiveness is defined as the extent to which the firm (hospital/supplier) provides/delivers appropriate response/services quickly within the stipulated time horizon, on-demand ubiquitously.	Selvakumar, 2016;Sachdev and Verma, 2004;Raposo et al., 2009;Leen et al., 2004; Li et al., 2005;Irfan et al.,

		2012;Saghier and Nathan, 2013; Munhurrun et al., 2010
Servicing capability (SRVCAP)	Servicing capability is the extent to which the firm (hospital/supplier) exhibits ability to deliver unique, innovative, cost-effective and customized value-added service propositions.	Zhang and Chen, 2008; Kumar et al., 2017
Operational Performance (OPTPRF)	Operational performance is defined as the extent to which the firm (hospital/supplier) fulfills its operational goals/targets compared to its operational outcome levels prior to technology implementation.	Nyaga et al., 2010; Uhrin et al., 2017
Financial Performance (FINPRF)	Financial performance is defined as the extent to which the firm (hospital/supplier) fulfills its financial goals compared to its financial outcome levels prior to technology implementation.	Cao and Zhang, 2011; Dobrzykowski et al., 2012

GENERALIZABILITY OF DIGITAL INDICATORS (EHR & ERP)

The digital technologies considered in this study are EHR and ERP. Although EHR or ERP are the generalized name of these digital technologies but in case on actual practices the names or indicators of these technologies have various names. While considering the indicators in large-scale study of hospitals and hospital-suppliers all the generalized digital indicators were considered. Therefore, this section explains all the related probable indicators of these two technologies.

The ***construct term (EHR)*** used predominantly in this study, referred to as *electronic health record* is described in a generic sense as an indicator of any and every form of digitalized medical data storage in any form that may be image, scanned medical prescription records, patients' diagnostic reports, manual entry automatic reading for ease of retrieval, analysis and generation of medical records or usage in any automated patient identification systems.

The ***construct term (ERP)*** used predominantly in this study is also a placeholder in this context, referred to as *enterprise resource planning*. In a generic manner it actually means any and every form of integrated or connected network platform or software within or across department/ silos/ partners which brings ease of connectivity, clarity and enhanced real time information sharing by integrating the systems.

3.3 Chapter Summary

The summary of this chapter is as follows:

This chapter provides the details of the theoretical underpinnings of this research work. The first section of this chapter explains the two base theories which are - 'Capability-vs-competency' theory (Javidan, 1998) and 'Resource based view (RBV) theory' (Barney, 1991) which are used to finalize the flow of the research framework and impact of resources; and two ancillary theories which are - 'Cybernetic control theory' (Vancouver, 1996) and 'Dynamic capabilities theory' (Teece et al., 1997) which are used to highlight the cyber/digital technology resources and consequences with dynamic capabilities, competencies and performance. The section also highlights the prominent research literatures aligned to these theories. The chapter further provides the conceptual research framework of this study and further the second section provides the construct definitions of this research work. Further the next section describes the generalizability of the digital technology indicators i.e. EHR and ERP used in this study.

The next chapter i.e. Chapter-4 further reviews extant literature of the constructs finalized for this study and highlight the research linkages based on literatures in order to provide detailed understanding of the concepts.

CHAPTER-IV

4 LITERATURE REVIEW

The previous chapter i.e. Chapter-3 discusses the theoretical supporting/backdrop of this study with relevant literatures aligned to the theories and finalizes the conceptual research framework. It further defines all the constructs adapted from relevant literatures and their generalizability. This chapter i.e. Chapter-4 reviews the existing academic and practitioner literature and attempts at establishing logical linkages between the constructs. The literature and logical linkages are overtly in line with the research objectives mentioned in Chapter-2.

The literature review section is broken into *five sections*. ***First*** section (4.1) introduces the ***key digital indicators or resources*** - EHR and ERP and its relevance in healthcare context; ***second*** section (4.2) discusses and indicates the linkages between ***process-level capabilities*** i.e. the level-1 capabilities as indicated in the framework, namely Transparency and Interoperability; ***third*** section (4.3) defines and discusses the ***dynamic capabilities*** i.e. the level-2 capabilities as indicated in the framework, namely Quality, Delivery Dependability, Flexibility and Responsiveness and also logically elaborates their literature-based linkages with their antecedents; ***fourth*** section (4.4) unfolds the antecedent to consequence relationships of the above dynamic capabilities to ***hospital competency*** i.e. Servicing Capability and finally the ***fifth*** section (4.5) provides literature evidences supporting the impact of the antecedent hospital-level servicing capability on the ***final outcome-level*** variables, namely Operational and Financial Performances. The following literature-based evidences strengthen the objective towards the empirical study on Indian healthcare scenario.

4.1 DIGITAL RESOURCES- INTRODUCTION

This section introduces the key enabling digital technology practices/ resources- Electronic Health Records (EHR) and Enterprise Resource Planning (ERP) and describes a detailed literature review of concepts.

4.1.1) Electronic Health Records (EHR)

EHR is a digital version or electronic record of patient health information and medical history maintained over time comprising of the longitudinal data (Farhadi et al., 2019; Dobrzykowski and Tarafdar, 2015; Jha et al., 2009). EHR is emphasized as a platform for electronic storage of patient medical records and helps in achieving information standardization, proper storage and access improving coordination among healthcare delivery providers (Bates and Samal, 2018; Berndt and Fischer, 2018; Angst et al., 2011). Many hospitals setup IoT-devices near the medical beds (especially in ICUs and ITUs) for recoding information which is often stored in decentralized systems and eventually stored as the electronic medical records for patient care. Studies highlighted that EHR adoption in many countries have improved the healthcare-quality, convenient access to patient health records and past medical histories, better patient follow-ups which triggers the medical decision-making process by physicians and also ensuring confidentiality and integrity of the records as the records are protected and secured (Chakravorty et al., 2020; Farhadi et al., 2019).

In the healthcare context EHR and EMR are often interchangeably used. EHR information includes demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, radiology reports, etc. EHR provides real time access to patient information across clinicians' workflow (Plantier et al., 2017). EHR is also under specific contexts referred to as 'Automated Patient Identification System', which maintains the entire set of patient records including diagnostic test results, physician prescriptions, medical contradictions, pathological outcomes, complications, past treatment details, patient history, appointment details, etc. are all maintained and are linked in the hospital databases electronically and can be accessed through unique patient IDs accessible through barcodes, loyalty cards or tags (Mollart et al., 2020; Nayak et al., 2008). EHR incorporation in hospitals facilitate better communication and cohesion among the staffs and nurses to contribute to cognitive work-environment to enhance quality, quantity and efficient optimization (Williams et al., 2020).

EHR is gaining a lot of importance across the world; the American Reinvestment and Recovery Act (ARRA) signed a law in 2009, supporting the federal government's commitment to the improvement of health care quality, safety, and efficiency through requirements to implement EHR by hospitals and eligible providers potentially realizing penalties or reduced reimbursement rates. In addition to ARRA, EHR or digitized patient records is largely envisioned in the Indian National Health Policy, 2017 and private sector players have been planned and engaged as strategic partners in the digitization processes. The Central Government Rules, 2012 has also highlighted the importance of EHR and made it mandatory to convert and store the health data in electronic format (Kaur et al., 2017). Dobrzykowski and Tarafdar (2017) highlighted that EHR adoption show positive outcomes when implemented with information sharing among the healthcare professionals to enhance social shared values, physicians' involvement and employment fully mediate the relationship and yields positive effects on physicians' performance. Successful EHR adoption needs good IT communication, connection and managerial expertise (Williams et al., 2020; Narattharaksa et al., 2016). 'Institute of Medicine' has viewed EHRs as essential component of healthcare systems which promotes innovation, quality, safety and efficiency.[19]

19http://www.igi-global.com/article/content/67366

Fontenot (2013) highlighted that increasing the access to digitized records decreases cost, duplication of data, claim-processing time involving multiple providers, facilitates data-mining to detect fraudulent billing practices and advances per capita comparisons between communities with similar patients but disparate utilization rates. Dobrzykowski and Tarafdar (2015) indicated that healthcare process is complex and requires lot of information exchange, interaction and coordination among the physicians and hospital staffs; thereby necessitating efficient EHR adoption. They emphasized that physician involvement and social interaction amplifies the impact of EHR system; thereby aiding in vertical integration among the healthcare supply chain stakeholders to enhance operational performance.

Collum et al. (2016) emphasized that comprehensive adoption of EHR shows improvement in financial performance with prolonged usage. They conducted a longitudinal study, showing a significant improvement in the total profit margin after comprehensive EHR adoption, relative to the Non-EHR enabled hospitals. However, they found the direct impact of EHR on financial performance but the intervening stages are missing. There is a need to find out the mechanism involved in the process of how EHR affects the subsequent variables which in turn affects financial performance.

4.1.2) Enterprise Resource Planning (ERP)

ERP is a key digital resource which provides the firm's ability to adapt, configure, and integrate information flows and business processes (HassabElnaby et al., 2012; Hong et al, 2010). Generic ERP software integrates all facets of an operation — including product planning, development, manufacturing, sales and marketing — in a single database, application and user interface. ERP systems first came into existence in the 1990s and now tried out in large scale, medium scale as well as small scale industries (Kelle and Akbulut, 2005). ERP systems are the packaged information software systems which provide integrated framework and connectivity across business processes including verticals like supply chain and logistics (Klaus et al., 2000). ERP merges firms' data and allows real time information sharing and connectivity across the business silos of supply chain (Kelle and Akbulut, 2005). By ERP implementation firms seek to provide real-time, accurate and integrated information for improved decision making (Fiaz et al., 2018; HassabElnaby et al., 2012; Trott and Hoecht, 2004) and thereby achieving stakeholder integration both internally and externally across the supply chain (Kelle and Akbulut,2005). Various sectors have earned benefits from the implementation of ERP platforms and systems.

Relevance of ERP in Healthcare context

ERP usage in healthcare have largely benefitted in terms of connectivity and real-time synchronized information interchange from ERP implementation (Miller and Sim, 2004). ERP can potentially enable regional networking and foster not only real-time data sharing but also resources sharing and collaboration among all the stakeholders of a system (Fiaz et al., 2018). ERP implementation in healthcare sector has a significant impact and vital for information sharing, real time tracking, supplier-hospitals integrated interaction (Garefalakis et al., 2016; Mozafari et al., 2012).
Akkermans et al. (2003) defined ERP as an umbrella system facilitating the integration of business software systems that power a corporate information structure, which controls a broad range of activities right from the procurement of supplies to shop floor control and financial accounting. It amalgamates management functions across geographic sites and complex heterogeneous networks. It is highlighted that successful ERP implementation requires behavioral intention in the form of users' usefulness perception, ease of use and the users' level of intrinsic involvement (Gyampah, 2007).

Abukhader (2015) conducted an empirical study on (ERP) implementation in private hospitals of Saudi Arabia in terms of performance outcomes and highlighted that ERP improves interactions with suppliers and customers thereby simplifying and standardizing the system. The study obtained responses on the performance outcomes on ERP implementation listed as decreased financial close cycle, improved order management/order cycle, quickened information response time, increased interaction across the enterprise (with suppliers and customers), improved cash management, lowered inventory levels, reduced direct operating costs and improved on-time delivery.

Miller and Sim (2004) highlighted that healthcare delivery stakeholders including the clinicians, hospital managers, physicians, nurses, etc. are often in real-time and urgent need of using high-end medical technology and associated device platforms, aimed at improving the quality of patient care service delivery. Dobrzykowski and Tarafdar (2015) emphasized that information exchange between the healthcare stakeholders (namely hospital staffs, physicians and patients) has been instrumental for successful healthcare delivery and its synchronous continuity. In another contemporary paper, Boonstra and Govers (2009) studied ERP implementation in a hospital of Netherlands as a case based approach and reported that in healthcare sector responsibility of services is shared between many autonomous stakeholders and stakeholders' participation is essential. Almajali et al. (2016) observed in an empirical study involving small and medium-sized enterprises, that successful ERP system is complex and needs training, supportive leadership and ease of use as antecedents in order to bring user satisfaction and ERP implementation success.

Healthcare information systems and the associated enterprise platforms are information intensive and often deal with large volumes of high frequency patient data (Dobrzykowski and Tarafdar, 2015). Extant literature establishes the importance and relevance of ERP implementation in healthcare sector as an important enabler of integration between the different patient care service verticals. The prospect ERP systems implementation and its success in ensuring superior patient servicing capability and quality of service have been highlighted in extant literature (Mucheleka and Halonen, 2015).

High variability and uncertainty makes ERP implementation in healthcare context complex and dicey (Garefalakis et al., 2016). The criticality of the healthcare sector with human life at stake makes ERP implementation and its utility more important in healthcare context; unlike other sectors where the cost of asymmetry of information is relative not as high (Miller and Sim, 2004). Though there is dearth of extensive empirical validation on the ERP implementation in Indian healthcare context. however anecdotal studies and case-based literature evidences highlight that ERP adoption increases the productivity significantly by enhancing the agility and reliability of transmitted information across the verticals of the service delivery network; thereby ensuring minimization of lead time delays, lessening ambiguity and enhancing real-time transparent connectivity between supplier-side and hospital side dispatch and procurement division respectively; minimizing waiting times and avoidable delays on one hand, while overstocking or stock-outs of essentials on the other hand (Garefalakis et. al, 2016; Teittinen et al., 2013).

However, ERP implementation has shown advantages in the healthcare context but exact intermediary stages leading to better performance is kept in dark. The proposed study elicits the stage-wise impacts of ERP on the capabilities, competency and performance outcomes.

4.2 TRANSPARENCY AND INTEROPERABILITY: PROCESS LEVEL CAPABILTIES

Based on extant academic and practitioners' literature, EHR and ERP can be envisioned as antecedents facilitating capabilities in the healthcare supply chain. Various studies have indicated that ERP implementation and EHR or automated patient data management systems adoption have achieved various aspects of capabilities. The capabilities covered in this study have been segregated into two process level capabilities: 'Transparency' and 'Interoperability'. The following section provides a detailed literature based on above capability constructs with the two key resource variables (ERP implementation and EHR adoption).

4.2.1) Transparency

Transparency is described as openness, empowerment, auditability, availability, accountability and verifiability in the system (Spagnuelo and Lenzini, 2017). Transparency forms an important aspect in the supply chain network. Extant academic research publications stress the importance of supply chain transparency in sharing data and information among the partners and stakeholders (Akkermans et al., 2004) for developing better supply chain wide capabilities. Using a case-based approach, Akkermans et al. (2004) in their study highlighted that computer-supported collaborative supply chain planning and IT improvements positively impacted free flow of information among the supply chain networks and supported open sharing of all relevant information and better business outcomes i.e. increasing transparency improved business performance. In another empirical research, Bartlett et al. (2007) suggested that varying degree of transparency can be achieved by sharing of information between partners in a supply chain and they highlighted that IT process adoption fostered seamless information sharing, characterized by higher connectivity, collaboration and real-time tracking; thereby facilitating transparency in the system. Liebovitz (2013) in their empirical study in the context of healthcare showed that enhanced transparency in the healthcare sector facilitated streamlining of patient information with enhanced accuracy and efficiency; thus fostering effective patient care delivery. Wulfovich and Meyers (2020) emphasized real-time knowledge sharing and transparency in healthcare organizations to be the driving forces for handling multi-disciplinary teams for sharing information and handling complex issues. Bringing transparency in healthcare system effectively bridges the gap between healthcare stakeholders and the adoption of digital technologies alters the boundaries of working process of healthcare stakeholders and professionals (Freye et al., 2020; Petersson, 2020).

4.2.2) Interoperability

Interoperability is the extent to which the firm (hospital-departments/supplier) is capable of sharing information between the systems and applications in meaningful ways, make the information usable and operable from multiple locations and make informed decisions (Bates and Samal, 2018; Zdravkovic et al., 2017; Ide and Pustejovsky, 2010). The word ‘‘inter-operate’’ generally means that one system performs an operation for another system (Chen et al., 2008). Tolk and Muguira (2003) explained that information systems and digital facilities help in bringing interoperability and proposed a hierarchical classification of information systems based on level of interoperability. They explained that such systems can range from ‘Isolated Systems’ (i.e. systems where no physical connection exist) on one hand to those of ‘Connected Systems’ (i.e. those systems where homogeneous product exchanges are possible) on the other hand. Further classifications include those of ‘Distributed Systems’ (where heterogeneous product exchanges are possible), ‘Integrated Systems’ (where shared applications and shared data are the norm) and ‘Universal Systems’ (those systems where enterprise wide sharing are enabled). With the increase in aged population and commitment to health success, there is a high demand for interoperability in healthcare sector (Schneller and Smeltzer, 2006). There is a shift towards value-based care, aimed at providing a competitive edge in quality care, population health, and analytics initiatives for value generation (Dobrzykowski and Chakraborty, 2014; Prahalad and Ramaswamy, 2004; Day, 1995). Studies suggest an increasing importance towards interoperability for providers, patients, and other appropriate stakeholders; to enable reliable and consistent exchange of healthcare information (Blackman, 2017). However, healthcare interoperability is still a long way to go and data standardization has been largely missing, attributable to heterogeneous systems suffering interoperability (Blackman, 2017). Heterogeneity of medical data is due to lack of standardized documenting systems, improper terminologies and support systems which is leading to lack of interoperability in the system and coordination among the providers, stakeholders and patients (Satti et al., 2020).

Interoperability between electronic medical platform systems and patient engagement solutions happens to be the driving forces for improving outcomes and patient-centric care-delivery (Pohlmann et al., 2020). Increased interoperability helps the stakeholders to streamline the process, increase efficiency and improving clinical outcomes across the continuum of care-delivery. Data in its electronic format and digitalized medical information provide an effective way for data interoperability which has a vital role for achieving interoperability in the healthcare systems (Satti et al., 2020). Therefore, interoperability among the processes of care-delivery providers in healthcare system forms a major breakthrough towards highly effective and value based care-delivery (Remondino, 2020).

4.3: DYNAMIC CAPABILITIES- INTRODUCTION & LINKAGES

Each and every firm, especially in service sector has strong focus towards developing capabilities. Successes of the organizations are largely due to their dynamic capabilities which can help them to have an edge in the market (Javidan, 1998). Based on resource based view theory (Barney, 1991) and capability-versus-competency theory (Javidan, 1998), this research focuses on the impact of healthcare digitalization on dynamic capability aspects of hospitals and their suppliers. In the previous section the process-level capabilities have been described. This section further unfolds the dynamic capabilities to be reviewed from extant literature predominantly focusing on healthcare supply chain context. The Level-2 capabilities (dynamic capabilities) considered in this study include Quality, Delivery Dependability, Flexibility and Responsiveness.

Dynamic Capabilities

Dynamic Capabilities are referred in studies as the ability of firms to work towards differentiating from their competitors and fostering competency or competitive advantage i.e. the firm's behavioral orientation towards competitive advantage and forms embedded processes to construct firms' core capabilities (Helfat and Peteraf, 2003; Cepeda and Vera, 2007; Zahra et al., 2006). Dynamic Capabilities were first put forward by Teece et al., 1997 which explains how capabilities of resources can bring in competitive advantage (Helfat et al. (2007). Dynamic capabilities are the dimensional framework defining a firm's behavioural orientation towards competitive advantage and forms embedded processes to construct firms' core capabilities (Braganza et al., 2017; Winter, 2003; Teece et al., 1997). Dynamic Capabilities are referred to as 'how you change your operational routines' i.e. how the firms work towards differentiating from their competitors thereby gaining competitive advantage (Cepeda and Vera, 2007; Winter, 2003). Braganza et al. (2017) referred to dynamic capabilities in case of technology aspects as the firms' ability to exploit data and technology resources to reconfigure their process to make the process sustainable and achieve beneficial results. In today's scenario of dynamically changing technology, the dynamic capability theory addresses on how digital transformations, new-IT technologies and cyber systems cope up with firms' strategic process and change (Konlechner et al., 2018). Focusing on dynamic capabilities of healthcare firms, digital technology resources are highlighted as primary aspects towards healthcare infrastructure-capability, process-capability and integration-capability which help in informed decision making and better performance (Ramakrishnan et al., 2020).

Based on the aforementioned discussions, the dynamic capabilities considered and adapted as appropriate in the healthcare sector context are: *Quality; Flexibility; Delivery-dependability and Responsiveness.* Below section reviews the dynamic capabilities in detail.

4.3.1) Quality

In today's world, customer has gained the prime focus. For success and survival across all service sectors, let alone healthcare sector which is considered as a critical service sector, delivering quality service has become not only a necessity but has started being an essential strategy in today's globally competitive environment (Braganza et al., 2017; Reichheld and Sasser, 1990; Zeithaml et al., 1990; Parasuraman et al., 1985). Extant healthcare literature is clearly bifurcated into two zones: 'hospital service quality' and 'quality care'. In the current research context, the latter aspect of care, i.e. 'quality care' is the one which is being referred to and positioned as the variable called "quality". Quality is referred in extant literature as the extent to which a firm can provide superior and distinguished service (Sagier and Nathan, 2013; Naidu, 2007). Adapting the same in the context of healthcare, quality care is the ability of the healthcare stakeholders to consistently delighting the patient by providing efficacious, effective and efficient healthcare services according to the expected clinical standards, which can meet the patient's needs and satisfies the providers (Mosadeghrad, 2013). To clarify in details, by quality care Chaudhry et al. (2006) referred to certain key aspects, namely: reduced medication errors, accurate treatment and adherence to standards, risk reduction and providing valuable care. Though the concept of quality finds relevance and importance across both public and private sector healthcare establishments, however for private healthcare establishments, the primary focus is most importantly given towards patient-centered healthcare system and healthcare quality; acting as a differentiator in terms of firm performance (Gemmel, 2017).

Studies on quality of care are very less and empirical investigations are even few. Some of the recent studies that highlight the concepts of Quality in healthcare and its importance with hospitals, providers and patients and further linkages with digital technologies are provided as follows. Cribb et al. (2020) emphasized on healthcare quality as a measureable and evaluative judgment factor for healthcare improvement. The new age healthcare system of 21st century is primarily focused on value based quality care. The Institute of

Medicine highlighted six dimensions of healthcare quality which are-effectiveness, timeliness, safety, efficiency, patient-centeredness and equity (Cribb et al., 2020; Baker, 2001). Braithwaite et al. (2020) studied the care quality aspects in Australian hospitals scenario and suggested that effectiveness of measurement, evaluation of progress over time, selection of better quality methods and showing continual improvement over time and usage of all proficiency and tools available are core parameters of quality improvement. Sofaer and Firminger (2005) in a conceptual study discussed about healthcare quality and studied definition of quality. They highlighted that Quality is described as the ability of products or services to meet the customers' expectations and bring satisfaction and delight. In healthcare, the customers are the patients so hospital services focus on achieving or exceeding patient satisfaction. In the healthcare system quality care improvement and access to quality-care has always been a challenge and it is largely evident that quality-care has a great influence on patient satisfaction (Andaleeb, 2001). Andaleeb (2001) suggested that dimensions like quality, responsiveness, assurance, communication and discipline have strong association with patient satisfaction. In the healthcare industry, hospitals provide the same types of service but they are differentiated based on the quality of care, efficiency and innovation they provide (Chaniotakis and Lymperopoulos, 2009). Interactions at an interpersonal level between care-providers and patients and creating patient centered treatment approach have emerged as a trigger of improving the healthcare quality (Saha et al., 2008). Healthcare delivery scenario is transforming gradually as there is a large need for care-quality improvement. Digital technologies implementation or new IT technologies are regarded as prominent solutions towards treatment quality improvement (Lapao, 2019).

4.3.2) Delivery Dependability

Delivery Dependability is referred to as the extent to which the hospital is keeping delivery of care and promises on time (Li et al., 2005). 'Delivery dependability' has several attributes in common with quality. It is a "conformance" measure, but conformance to time rather than specification. It is also an attribute which influences customer satisfaction over the longer term rather than one which necessarily insures an immediate sale (Dabholkar et al., 1996). Effective utilization and delivery of healthcare services largely depends on the dependability of the healthcare centers (Rai and Nathawat, 2017). Supporting ongoing delivery, reliable care, on-time delivery and consistency in delivery are important aspects of healthcare which indicate the care delivery to be dependable (Gemmel, 2017). In case of healthcare, the primary and crucial aim of hospital is to deliver safer care, improve quality and satisfaction and further provide dependable experience to patients (Greer et al., 2020). Delivering compassionate care by nurses and hospital-staff are also attributed as the key feature for improving patient experience and outcomes; thereby enhancing the dependability of patients towards healthcare centers (Landers et al., 2020; Mollart et al., 2020). Denham (2020) conducted a case study at two rural maternity units and highlighted the aspects of dependable care-delivery to be vital and explained that dependability is related to trustworthiness towards the care-givers. Healthcare systems need to be competitive in terms of performance therefore they need to be dependable and deliver sustainable care (Boano et al., 2016). Martin et al. (2006) in a case based work highlighted that dependable healthcare systems to be deployed by healthcare stakeholders is an important aspect of healthcare system and suggested that configuration, integration and testing are the primary antecedents to delivery dependability. Healthcare system involves patient monitoring by capturing of data, transmission of information and proper monitoring in order to ensure that the care delivery is dependable, reliable and safe (Chakraborty et al., 2020a; Agirre et al., 2016). Digital technology platforms have a major role in patient surveillance and medical disease monitoring as well as control thereby facilitating automated care-delivery process (Chakraborty et al., 2020b).

Wan and Alagar (2017) analyzed healthcare big data systems and highlighted on the digitalization aspects of healthcare network and suggested that enhancing patient care delivery experience along with sustainable and dependable care is the primary goal of healthcare centers. Patients can depend upon a healthcare center only if they get timely, trustworthy and committed treatment from the hospitals. Dependable care is the primary aspect of patient satisfaction and willingness of patients to repeat the center or re-admission and further recommend others for treatment; which can therefore potentially impact the performance outcomes of hospitals. Similarly, the suppliers' delivery dependability also needs to be an important capability for their customers to have an intention to repeat their purchase (Ruswanti et al., 2020).

4.3.3) Flexibility

Flexibility is referred to as the extent to which the firms are flexible in adapting to the dynamic environment, capacity to recognize new capabilities and offering customized services to patients (vanGool et al., 2017). Being flexible in providing services is often indicated as the firms' abilities to accommodate changes and respond to the dynamic situations (Chakraborty et al., 2019). It is an essential component of patient-centered care and mentioned as an important concept of dynamic capabilities by Teece et al. (1997). In today's digitally enabled scenario, the primary focus of suppliers and firms are towards a flexible and responsive response to customer demands (Chakraborty and Mandal, 2011). Flexibility in daily work and task scheduling promotes both resident and staff autonomy, which in turn allows for higher staffing levels, lower staff turnover, and more typical life experiences for residents (Cohen-Mansfield and Bester, 2006). Flexibility in care-delivery services is largely needed towards its readiness to provide agile and patient-centric care as major emphasis is towards personalized care-delivery (van de Bovenkamp et al., 2020). Healthcare being a highly critical sector, the care-givers need to meet the needs of the patients in a much more flexible manner (Chakraborty et al., 2019). Use of IT enabled practices in healthcare system, facilitates and enables flexibility of the system (vanGool et al., 2017; Schobel et al., 2016). Usak et al. (2020) in a conceptual study has analyzed the technology adoption aspects in healthcare system and highlighted that the primary factors that are essential for healthcare are flexibility, quality, timeliness, accuracy, efficiency and satisfaction. Matanock et al. (2014) in an African healthcare context highlighted that frequent interactions with patients form the key aspects of achieving flexibility in healthcare. However in current dynamic environment, where patient wants and needs are endless and often where the ability of the hospital to adapt to patient demands and choice act as deciding factor behind choice of hospital, flexibility in care delivery process keeps the hospital in a better position to serve (Matanock et al., 2014). Rotar et al. (2016) in an empirical study in OECD countries suggested that there is a higher emphasis in value based patient-centered care and providing response in flexible operating hours has become vital for ensuring enhanced patient flow. They emphasized that with the evolving healthcare vision, flexible workforce, receptive to research and innovation, anticipation of changing healthcare needs and flexibility in skill development have turned out to be the key aspects of achieving system flexibility, improved servicing capability and better performance[20].

4.3.4) Responsiveness

Responsiveness is often attributed as a potential factor for capability and competitive advantage of firms (Thatte, 2007). Responsiveness is defined as the interests shown in providing prompt service to customers when required (Zeithaml et al., 1990; Thatte, 2007). RamseookMunhurrun et al. (2010) suggested that responsiveness is the willingness of firms to help customers and provide timely and prompt service; thus, it is an important aspect of achieving an effecting servicing capability. Saghier and Nathan (2013) conducted an empirical study in Egyptian firms for service dimensions and heighted responsiveness to be one of the primary aspects of firms' services. Further, it is researched that willingness or readiness of employees to provide the required customer service without any inconvenience at any time will strongly influence the level of customer satisfaction (Parasuraman et al., 1988). Singh (2015) in a systematic literature review highlighted the success factors of responsiveness in supply chain of the firms. The study highlighted that

[20]Quality, D. H., & Effective, C. C. (2013). Developing the Right People with the Right Skills and the Right Values. *A Mandate from the Government to the Health Education England: NHS April*.

changing demands, shorter lead times and complexities are the key factors for responsive market requirements and this responsive behavior is the key aspect of better service and performance. In healthcare sector also need for responsive care forms an effective capability. Healthcare responsiveness indicates the care-givers' or hospital's speed of treatment delivery to patients (Chakraborty et al., 2020). Coulter and Jenkinson (2005) conducted an empirical survey in the European patients' views on responsiveness of healthcare systems and healthcare providers and indicated that responsiveness to patients is the key characteristic of effective health systems as highlighted by younger patients and 74% indicated the desire for the providers to be actively involved and to be responsive to patient care. Delays in treatment can be fatal in healthcare and thus a lot of emphasis is given to reduction of information gap among the healthcare providers (Naidu, 2009). Responsiveness of the healthcare providers by regular surveys of the views and experiences of patients are nowadays seen to be an indispensable addition to the panoply of performance indicators used for monitoring the effectiveness of health policy (Coulter and Jenkinson, 2005). Responsiveness is highlighted as the key factor for achieving higher servicing capabilities as (Donabedian, 1986) categorized provider responsiveness, friendliness and attentiveness as a critical component of healthcare service (Chakravorty et al., 2020).

4.4 COMPETENCY: SERVICING CAPABILITY- INTRODUCTION & LINKAGES

Servicing capability in general is referred to as the ability of a servicing firm to deliver unique and value added services to their customers (Zhang and Chen, 2008). In the current study context of hospitals, servicing capability in terms of patient care is referred to as the ability of hospitals to provide care and value added services in a unique way of patient service experience (Coulter and Jenkinson, 2005; Donabedian, 1986). With the rapid changing world, patient satisfaction and care has a major strategic influence and has significant pressures on hospitals (Andaleeb, 1998). In the private hospitals, primary importance is given to the patient centric care; patient service and patient satisfaction have gained a lot of importance recently (Majeed et al., 2011). Enhanced usage of IT leads to value creation, increased efficiency, improved quality care and accuracy of care service delivery (Shih et al., 2009). In case of competitive healthcare sector, where the need for quality care also joins with cost optimization, the treatment services can enhance capability only when the services provided are cost-effective and customized according to patient needs (Chakraborty and Kalepu, 2019). In this study, servicing capability aspects is analyzed in terms of hospitals' care delivery and services provided by the hospital-suppliers. In order to achieve better servicing capabilities, the care and services delivered to the respective customers need to be customer or patient focused; thereby improving the competitive advantage (Chakraborty and Kalepu, 2019). Digitalization of healthcare data and application of analytics have shown potential improvement in servicing capability as they have the capabilities to analyze data patterns, care-processes, unstructured and structured health data sequencing, traceability, predictive, prescriptive and forecasting capabilities and effectively enhance the strategic decision making abilities (Wang et al., 2018). Ramakrishnan et al. (2020) emphasized that in terms of healthcare digitalization the major aspects of healthcare service capabilities based on business intelligence and analytics of healthcare are infrastructure capabilities, process capabilities, and integration capabilities. Studies have highlighted that enhanced quality-care, improved business outcomes, flexibility in care delivery process, improved accuracy and timeliness of information handling and value-based patient oriented care, forms a key tool towards better servicing capabilities and competencies (Landers et al., 2020; Chakraborty and Kalepu, 2019; Wang et al., 2018; Majeed et al., 2011; Lo et al., 2011).

4.5 OUTCOME PARAMETERS: PERFORMANCE- INTRODUCTION & LINKAGES

Healthcare organizations are largely operating in dynamic environment and the primary needs for these firms are to manage their performance and to improve in terms of competitive outcomes (Furnival et al., 2019). In case of healthcare services, parameters of performance are the most vital aspects for service delivery. Prakash and Srivastava (2019) conducted a cross-sectional study in Indian healthcare system and highlighted that coordinated care, internal quality of service and integrated supply chain performance act as the antecedents to value-dense environment and patient-centric care delivery. Ferry and Scarparo (2015) in their critical review of healthcare systems highlighted that the post-2010 happens to be the era conformed to performance. Management literature broadly considers two major performance aspects: *operational* and *financial performance*. In the current research context, as well, these two performance aspects have been considered in the study with respect to hospitals and hospital-suppliers in Indian healthcare context that play a pivotal role for hospital/supplier managers to make decisions on implementation of any vital technology or process related decisions.

4.5.1) Operational Performance

Operational performance is explained as the extent to which the firms' or organizations are able to manage their operational goals in terms of goods, delivery or services (Nyaga et al. 2010). A performance-based approach for medical services has been highlighted as a new-age aspect of healthcare sector. The major pay-for-performance measures include access to care, patient waiting times, responsiveness of hospitals, number of served patients and treatment delivery efficiency (Jiang et al., 2012). Healthcare sector is much more challenging as compared to other sectors because of the operational cohesion and high dependencies in terms of operational processes, supply chain efficiencies and dependencies (Chakravorty et al., 2019; Meijboom et al., 2011). Extant literature has demonstrated that the major parameters of operational performance are cycle time, turn-around-time, process streamlining, timeliness of delivery, lead time, etc. which has been indicated as key triggers to enhanced efficiency, effectiveness, cost-optimization, and resource-utilization (Chakravorty et al., 2019; Prajogo et al., 2012; Nyaga et al. 2010; Li et al., 2006). Prajogo et al. (2012) analyzed supplier-management and operational-performance relationships and highlighted that quality, delivery, flexibility and cost-optimization are the major measures related to supplier integration, assessment and strategies. In case of healthcare services, the focus on operational performance aspects become even more crucial especially in private sector tertiary care context where hospitals strive constantly for the betterment of operational outcomes and gain extra portion of profit pie along with achieving greater patient satisfaction and loyalty (Stefanini et al., 2020; Majeed et al., 2011). In healthcare-context, the aspects of operational services are majorly focused towards patient-care and the primary aspects of operational performance which are largely focused and analyzed are: *service/process cycle-time reduction*; *service/process accuracy improvement*; *on-time service delivery* and *service/process forecasting accuracy* (Chakravorty et al., 2019; Prajogo et al., 2012; Nyaga et al. 2010). Proper operational performance management happens to be the primary goal for organizations to provide risk free services (Gil et al., 2008). In healthcare sector, the suppliers and hospitals largely operate independently from one another with very little communication and demand signaling in most context. Therefore, ensuring proper hospital-supplier coordination and integration in the operational front becomes essential for the success of healthcare processes (Lee et al., 2011). Ko et al. (2019) studied that various aspects of operational performance that largely influence patient-satisfaction and highlighted that long waiting-time, operational-inefficiency, lack of coordination among departments or underperforming staff are some of the major aspects leading to patient-dissatisfaction; thereby indicating the importance of operational performance aspects in healthcare delivery.

4.5.2) Financial Performance

Financial performance is referred to as the extent to which the focal firm (hospital/ hospital-suppliers in the current study context) fulfills its financial goals compared to its primary competitors (Cao and Zhang, 2011; Dobrzykowski et al. 2012). Healthcare supply chain is continuously burdened by the pressure of managing cost along with quality, delivery and customer experience; thus managing financial coordination and performance in healthcare delivery is largely needed to reduce the fees of hospital and medical supplies so as to ease the financial obligations of patients during treatment process (Dobrzykowski, 2019). In every organizations, it is always crucial for firms for manage their performance measures in terms of financial aspects and top management can largely make a difference by utilizing and distinctively managing their competencies (Vainieri et al., 2019). Vainieri et al. (2019) explained the performance aspects of healthcare and suggested that better financial performance is not merely about more financial capacity rather the aspects of managing the input resources efficiently and effectively, proper planning, integrating/ coordinating, and controlling the managerial activities, staff and physicians' engagement are the highlighted aspects of financial performance. Some of the well reported attributes that characterize financial performance are: return on asset (ROA), return on investment (ROI), net revenue per discharge (NRPD) and market share (Bojja and Liu, 2020; Cao and Zhang, 2011). In case of healthcare digitalization process the primary focus of implementation of technology involves the cost and budget of the IT investment and its analysis with return on investment (ROI) and hospital performance (Bojja and Liu, 2020). ROI is an essential measure of profitability and financial performance. Every private healthcare organization needs to evaluate the aspects of ROI with performance. Bojja and Liu (2020) highlighted the impact of IT investment and IT budget on return on investment aspect of hospital performance with a longitudinal study comprising of a panel of US hospitals over four-year time span and explained that clinical information systems positively impacts ROI and performance. Epane et al.

(2019) emphasized on the impact of hospitalists, physicians and staffs on financial performance aspects of hospitals and discussed that with proper management increased the revenues obtained from patients and operating profitability and further reduce the operating costs by reducing patient days or length of stay. Studies have shown that organizational processes and innovation play a pivotal role for financial performance aspects like total assets, equity ratio, total revenues and profit which can lead to long term success at large (Jaskyte, 2020; Bojja and Liu, 2020; Cao and Zhang, 2011).

4.6 Chapter Summary

The summary of this chapter is as follows:

This chapter discusses an extensive literature survey explaining each constructs: EHR, ERP, transparency, interoperability, quality, delivery-dependability, flexibility, responsiveness, servicing capability, operational and financial performance in healthcare context. The section-wise detailed literature review also emphasizes on the level-wise linkages of the constructs in order to elicit the understanding of the research framework.

The next Chapter i.e. Chapter-5 further develops the hypotheses based on the detailed literature reviewed in this chapter. Hypotheses development section also discusses the linkages of constructs which needs to be further empirically validated in the large-scale survey from hospitals and hospital-suppliers in Indian private tertiary-care hospital context.

CHAPTER-V

5 HYPOTHESES DEVELOPMENT

The previous chapter i.e. Chapter-4 of this thesis has covered a plethora of relevant literatures in the context of this study and explained in details about the constructs and their linkages indicating their level-wise connections. This chapter i.e. Chapter-5 titled as 'Hypotheses development' put forth relevant arguments to elicit the linkages among the constructs which lays the foundation for development of hypotheses of this research work which has been further tested empirically in the context of hospitals and hospital-suppliers. The chapter also displays the research framework of supplier-side which has been conceptualized for large-scale survey from hospital-suppliers' end. The supplier-side hypotheses are also provided in this chapter. This chapter reviews extant literature in detail to present the linkages of the constructs conceptualized in the research framework.

The below section-5.1 presents the linkages of EHR, ERP, Transparency and Interoperability in order to depict the first level hypotheses

5.1 LINKING EHR, ERP, TRANSPARENCY & INTEROPERABILITY

Linking EHR with ERP

In the study context, ERP and EHR are the two key technology resources which have been considered as driving forces changing the face of healthcare delivery platform worldwide. These two resources have emerged as instrumental technology platforms affecting the service oriented capabilities and performance (Mucheleka and Halonen, 2015; Priyanka and Kulennavar, 2014). Contemporary literature-based arguments attempt at linking EHR and ERP and shows that EHR adoption in the hospital-side facilitates ERP implementation across the business silos. Kohli and Tan (2016) emphasized that information systems linked with EHR improves patient care and also stated EHR adoption facilitates integration. EHRs play a significant role in documentation and health information exchange across the hospitals and foster integrative usage of records forming an effective future system for healthcare learning, teaching and clinical reasoning (Williams et al., 2020; Berndt and Fischer, 2018). Dobrzykowski (2012) highlighted that EHR usage and the progression toward advanced EHR applications have been facing concerns of heterogeneity and thus needed to focus towards integration in the healthcare delivery. Thus, there happens to be an important scope to link EHR data systems with ERP platforms, facilitating connectivity with different stakeholders using ERP. ERP systems have been known to form an integrated software environment which in the hospital context can be comprehended to comprise of healthcare-data with patients and healthcare providers and also the key suppliers linked with the hospitals; thereby forming a seamless platform (Chakravorty et al., 2019; Fiaz et al., 2018).

EHR platforms and applications are utilized by health-care delivery providers' for viewing clinical results such as those from lab and radiology and sharing information seamlessly across platforms (Jha et al., 2009). EHR adoptions have been turning out to be largely useful and apt for healthcare providers, especially when integrated with ERP systems, because in the process of getting integrated with the ERP platform, it fosters connectivity and effective information sharing among the stakeholders and largely facilitates quick and informed decision making (Zdravkovic et al., 2017; Dhas et al, 2017); thereby proving to be instrumental for better performance of the system (HassabElnaby et al., 2012). With the patient's clinical and healthcare related records readily available over EHR platforms and ERP systems linking across vital functional departments, the hospitals including their procurement divisions and key suppliers liked to the system, remains in a state of preparedness which in turn facilitates faster decision making and also provides detailed insights about medical history and contradictions of the patient (Haux et al., 2016). Walsh et al. (2013) conducted a systematic literature review and highlighted that EHR forms an effective tool for communication, integration and improves patient-physician coordination. Thus, combined usage of EHR and ERP can help in the improved order management/order cycle, quickened information response time, increased interaction across the enterprise (with suppliers and customers); thereby helping in managing inventories, supplies, equipments without delays, avoiding stock-outs, minimizing shortages (Garefalkis et al., 2016), improving cash management, lowering inventory levels, reducing direct operating costs and most vitally improving on-time delivery (Abukhader, 2015). Integrated EHR with several digital technologies foster connectivity, online access to patient records, and visibility across location thereby increasing transparency and empowering all patients and patient-parties to have a better involvement and support (Freye et al., 2020; Petersson, 2020).

Linking EHR with Transparency

The potential of enhancing transparency in healthcare, through EHR adoption has created a seismic transformation from paper-charts to digital electronic records. With EMRs and digital technologies, the care-delivery units have potentially evolved into much advanced form as they work in a more efficient way, optimize the treatment process by reducing time to access patient records, personalize the care-delivery process and increase transparency of the process thereby fostering better care outcomes (Wulfovich and Meyers, 2020). EHR adoption provides a common platform for sharing information and brings openness in the system making the system transparent (Speier et al., 2011). Managing patient records and detailed needs through EHRs, facilitates transparency as they bring openness, empowerment, auditability, availability, accountability and verifiability (Spagnuelo and Lenzini, 2017). Fong et al. (2015), in their case-based study in the context of healthcare in Hongkong, promoted adoption of EHR systems. They indicated that electronic systems enhanced availability and transparency of information through sharing of patient records between healthcare providers (across both the public and private sectors), reduced frequency of consultations, improved the accuracy of diagnosis and patient management, avoided duplication of investigations, highly reduced errors associated with paper records, besides enabling better disease surveillance. With fully integrated EHR, the healthcare providers can achieve transparency across the healthcare system involving patients and suppliers together. EHR has thus been providing a standard framework for storing, retrieving and understanding patient information; thereby bringing enhanced level of transparency among the healthcare stakeholders. Patients too in such EHR enabled systems have access to their own health records which provides opportunity for patients to get much more involved (Koopman, 2012). In case of large-sized tertiary care hospitals, there are large amount of medical data to be handled, therefore organizations need to digitalize their medical records for enhancing efficiency of process and facilitate self-reporting of errors that can increase transparency of the system (Amantea et al., 2020). Thus, EHR is seen to foster transparency in and across the healthcare system.

Linking ERP with Transparency

ERP brings improved visibility, real time data access, fast interdepartmental communications, etc. Connectivity through digital enterprise-wide technology platforms enhance real-time coordination and communication which fosters full transparency in the organizations that effectively triggers care-activities across teams, departments and venues by eliminating redundant and repetitive tasks and minimizing manual error (Wulfovich and Meyers, 2020). Some issues which can come up with ERP implementation can be related to misalignment and security aspects (Bhati and Trivedi, 2016). ERP systems have the potential to enhance transparency across the supply chain networks by eliminating information distortions and increase information velocity by reducing information delays. This provides reason to believe that ERP adoption could be associated with significant gains in supply chain effectiveness (Akkermans et al., 2003). Su et al. (2011) in a case-based study highlighted that transparency of information and reduced information gap between partners improves the performance. The implementation of technologies in healthcare sector largely increases access to data or information across the globe which influences the healthcare professionals and patients towards better care-participation (Freye et al., 2020; Petersson, 2020). Thus increased visibility and transparency in the system by using technologies like ERP and EHR can foster the supply chain capabilities.

Linking EHR with Interoperability

EHR provides a shift from paper records to electronic records which provides shift in thinking to a much more connected and portable health data and the time value of information avoiding information overload (Kohli and Tan, 2016). EHRs form the backbone for e-health services as they foster access to medical data from multiple locations and provide a transparent access for hospital staffs (Kaur et al., 2019). Retention of data, metadata connections and data linked with hospitals, patient practice or ancillary service are the key needs of healthcare data management which are fulfilled by EHR adoptions (Zuckerman, 2017). Studies have highlighted that EHR digitizes the patient records, helps in sharing information, and makes them operable from various location (Dobrzykowski and Tarafdar, 2015; Jha et al., 2009). EHR provides a driving force in fulfilling long awaited gap of interoperability and EHR usage in optimal fashion provides portability of data in tools (Zuckerman, 2017).

A2iA Corporation[21] has reported that interoperability depends on the successful exchange of relevant electronic health information among the partners from one organization and one system to another. The study reported

[21]http://vertassets.blob.core.windows.net/download/9112e652/9112e652-6e4a-4337-9da2-49143145f11e/a2ia_intelligently_transforming_traditional_workflows_infographic.pdf

that EHR adoption improved visibility, business agility, increased the speed of access of data, increased productivity, decreased operating cost thereby increasing revenue by 36%, reducing costs by 30% and reducing error and risks by 23%. However, the study happens to be in non-Indian context. Thus, there remains a need to study the relationships between the above mentioned relationships in Indian context as EHR is slowly creeping up in India due to major emphasis on digitalization of healthcare as per *National Health Policy, 2017*.

In a recent study, Blackman (2017) has highlighted that in order to bring interoperability in healthcare sector, recorded and stored patient data should be easily accessible and fully available to all the participants or stakeholders (obviously with necessary privacy), aimed at improving ease and speed of care delivery and thus the necessity to adopt and implement EHR sets in. Kohli and Tan (2016) highlighted that proper EHR development brings interoperability among the various stakeholders of healthcare like patients, physicians, and purveyors (vendors, suppliers). They highlighted that with integrated EHR systems the providers can see the patient data even outside their clinics and provide the diagnosis from several sources. With EHR adoption, over the last few years, at a very fast pace the healthcare systems across the world have developed and provided the much-awaited flexibility to the end users and healthcare providers; providing them with the ability to synchronize and ubiquitously access patient records and clinical data (laboratory reports, medical contradictions, etc.) across platforms without any location constraints (Koopman, 2012). Adoption of EHR has also been shown to greatly enhance physician's mobility and interoperability (Greenwood et al., 2017). However empirical studies involving validation of linkages between EHR adoption and Interoperability in Indian healthcare context remains largely missing; eliciting the necessity to study the aforementioned relationship.

Linking ERP with Interoperability

Concept of interoperability has gathered much steam recently and different recent studies have focused on interoperability concept (Satti et al., 2020;

Zdravkovic et al., 2017; Jagoda and Samaranayake, 2017; Wang and Hajli, 2016). Interoperability is a representation of process, policies, guidelines and procedures which potentially bridges the gap between various silos, systems and services (Satti et al., 2020). Zdravkovic et al. (2017) referred to the concept of interoperability to be complex; however they indicated it as an inherent need of present day systems. Interoperability has been highlighted as the ability to provide integration in data and support collaboration (Wang and Hajli, 2016; Sadeghi et al., 2012). IoT technologies and integrated electronic platforms effectively triggers the process of healthcare data interoperability which primarily triggers exchange and consumptions of electronic data across locations

Healthcare informatics related ERP modules play pivotal role in managing the complexities of interoperability. ERP platform and modules on being implemented, help in integrating and collaborating with the hospital transaction partners (namely suppliers) and brings them onto a single platform, enabling real-time information sharing, which makes the system well-coordinated (Jagoda and Samaranayake, 2017).

Despite the need for interoperability, extant literature highlights different issues associated with the very concept in healthcare. Berler et al. (2006) highlighted that the major issues are lack of vision and leadership of the health care managers, user acceptability, usability of proposed information systems, technological gap between healthcare professionals and information science experts and confidentiality of patient data. Berler et al. (2006) through empirical and case based investigation in the context of e-health and interoperability established that well integrated information systems like ERP are the major pathways for sustainable interoperability. Adoption of enterprise packages (ERP) and service oriented architecture (SOA) in healthcare has the potential of great progress in interoperability by achieving medical information sharing, tele-consultation and hospital efficiency enhancement in developing countries (Gambo et al., 2011). Interoperability of healthcare by IT systems foster access to extensive medical data that are stored and handled electronically thereby providing easier support for different care delivery pathways (Remondino, 2020). Though form the literature it is evident that there should be surely a linkage between EHR, ERP and Interoperability but empirical evidences in the Indian healthcare sector remains largely missing, opening up a research gap and scope for future research. The current study aims at empirical investigation of the step by step unfolding of the stages of EHR adoption and ERP implementation in the Indian private tertiary-care hospital and hospital-suppliers' context.

Below section-5.2 further presents the linkages of ERP, Transparency and Interoperability with dynamic capabilities representing the second level hypotheses

5.2 LINKING ERP, TRANSPARENCY& INTEROPERABILITY WITH DYNAMIC CAPABILITIES

This section unfolds the further impacts of antecedents on the dynamic capabilities considered in this study.

Linking ERP, Transparency, Interoperability with Quality:

The use of information technology (IT) in managing the service sector has drawn increasing attention in the corporate world. In the healthcare sector Quality is a major differentiator among the hospitals. (Yang et al. 2015) in a Singaporean healthcare context highlighted that the usage of technologies like ERP in the healthcare sector potentially obtains improvements in healthcare quality by integrating and automating the healthcare functionalities. ERP provides the opportunity of integrating every procedure of business into a single platform and improving the quality of several areas simultaneously (Williams et al., 2020; Fiaz et al., 2018; Chaudhry et al., 2006). ERP system can potentially enhance the healthcare service quality, productivity, service cost reduction and efficiency (Fiaz et al., 2018). Treatment and care quality in health care services can be achieved by accurate and timely information, and information at right place and to the right person. IT systems have largely contributed in real-time information sharing, eventually making the healthcare sector transparent and integrated (Ramakrishnan et al., 2020).

Yeh et al. (2007) in an empirical study from Taiwan emphasized that implementing ERP brings in quality both downstream (customers/patients in healthcare sector) and upstream (manufactures/ hospitals and suppliers) leading to improved service quality by eliminating quality gaps. There is a need to study the linkage in the Indian healthcare sector where technologies are slowly creeping up and gaining emphasis in the healthcare scenario. In the Indian healthcare context, research studies concerning ERP implementation and its consequences are still quite nascent and empirical investigations on the said context and relationships remain largely missing. Thus, research is essential for bringing clarity on how ERP adoption in the hospitals and their suppliers impacts the quality of care they provide. Stewart et al. (2000) showed that when healthcare administrators, managements, providers, patients and families work as integrated units in partnership then the quality of care and eventually the patient satisfaction increases. Chaudhry et al. (2006) emphasized that technologies like ERP and EHRs are major tools for digitalization of the healthcare system and brings out increased information sharing; thereby fostering transparency to improve quality by increasing adherence to guidelines, enhancing disease surveillance, reducing medication errors and adhering to standards.

Jarvis et al. (2013) assessed the impacts of technologies like ERP as the enabler for hospital quality in the US hospitals context and concluded that improved quality care can be achieved with ERP implementation in healthcare. In healthcare operations context, Gittel et al. (2000) conducted an empirical study and suggested that coordination should be embodied in frequent, timely and accurate communication among healthcare providers (e.g. physicians, nurses, staff), and is associated with improved quality of care and more efficient clinical outcomes. Middleton et al. (2013) highlighted that health information technologies supported by ERP platform acts as facilitators for standardization and interoperability; which in turn can enhance patient safety and quality of care. Walker et al. (2010) also highlighted in an empirical study in the US healthcare context and technology usage and electronic data flows between providers of healthcare has positive implications on interoperability and showed an improved patient safety, quality care and financial benefits. Interoperability approaches by technology adoptions in healthcare sector can potentially enhance the care quality and manage performance by reducing the overall costs by eliminating redundant processes and operations (Satti et al., 2020). Technology implementation in healthcare and e-health processes like ERP platforms can effectively increase the availability and accessibility of medical-data and information by care-providers and patients; thereby improving the quality of healthcare services (Lapao, 2019). Proper integration of healthcare services with interoperable mobile devices and technologies are evolving as a major breakthrough for better quality care delivery (Cobelli and Chiarini, 2020; Lapao, 2019).

Thus, the ERP implementation fostering transparency and interoperability due to frequent information sharing and accessing across platforms can be logically linked to accelerated quality care.

Linking ERP, Transparency, Interoperability with Delivery Dependability:

Technologies like ERP and EHR can transform the healthcare delivery process (Siau, 2003). ERP integration helps in improving the efficiency by decreasing the lead-time of delivery. Digitization of healthcare system helps in decreasing the time to deliver treatment using computerized tracking (Koppar and Sridhar, 2009). ERP implementation provides synchronization between verticals and ensures reduced information asymmetry; thereby helping the hospitals to make seamless decisions. Thus, ERP prompts higher dependability in the care delivery system by bringing all the silos onto a single platform (Wahlgren and Persson, 2011). Traditional healthcare system largely depends on manual redundant processes whereas digitalized systems offer tools for raising the level of care delivery dependability and offer cost-effective solution (Boano et al., 2016). Curry (2007) in a conceptual study highlighted that e-health supports ubiquitous health facility, integration in the systems, real-time and on-time sharing of information and across platforms healthcare delivery; thus, indicating towards provisions of transparency and interoperability in the system and thereby improving the delivery dependability. Proper integration, coordination and interoperability aspects managed in within healthcare systems potentially foster dependability in terms of care-delivery and rise the patient's satisfaction level, fulfillment and faith for patients to be dependent on those hospitals and increase readmission; similarly such attributes for suppliers also increase trust and repurchase aspects for customers which is essential for further business outcomes (Ruswanti et al., 2020). As compared to traditional healthcare systems, the digitalized management of healthcare networks manages the information completely without manual error which can effectively improve patient experience along with sustainable and dependable care which is financially much more viable (Wan and Alagar, 2017). Implementation of enterprise-wide digital technologies and mobile wearables in healthcare system can effectively connect the silos and integrate with business applications and customer support that eventually not only strengthens the system control and robustness but also enhances the confirmation and delivery-dependability of the care-delivery system (Bajaj et al., 2021; Usak et al., 2020). Based on aforementioned extant literature evidences, ERP, transparency and interoperability appears as logical antecedents to delivery-dependability in the system (for both hospitals and also the hospital-suppliers).

Linking ERP, Transparency, Interoperability with Flexibility:

Extant literature highlights that IT applications can enhance the flexibility, reduce cycle time, achieve higher efficiency, and increase doctor productivity (Garefalkis et al., 2016). Determining how IT infrastructure as a resource, can create a sustained competitive advantage for a firm, remains to be an unresolved issue (Barney et al., 2001). Schobel et al. (2016) highlighted that mobile devices and technology integrated platforms like ERP improves integration and user navigation; thereby providing a positive impact on flexibility. Sherry et al. (2016) also constructed a conceptual framework and proposed that collaboration and coordinated care, across silos of healthcare, facilitate the flexible value delivery and share a strong vision of commitment towards delivery of patient-centered service. Flexibility has become pivotal across all service sectors, especially to manage the ever spiraling whims and fancies of customers and critical service sector like healthcare is no exception (van de Bovenkamp et al., 2020). Flexibility in terms of care design-time, care deployment-time and actual care run-time are the major focus areas in flexible healthcare context and can be helped by IT involvement and electronic data exchange (Schobel et al., 2016). IT enabled healthcare system support e-health, m-health or cloud-based services to the healthcare stakeholders and make the system interoperable, secure and flexible (Usak et al., 2020). Greaves and McCafferty (2017) in a study in England's public healthcare context highlighted that digitization of healthcare is primarily leading to accountability, enhanced transparency and providing flexible healthcare propositions. In a very recent study, Ford et al. (2017) highlighted the impacts of information disruption in healthcare system and their study had further drawn on the insights of key opinion leaders across industry, consulting and clinical practices, as to how digitization can impact on key aspects of the healthcare value chain, including stakeholder relationships, service activities, resource requirements and healthcare economic models. Real-time information flow, standardized connectivity and communication platform across all departments, transparency in the system and interoperable access from multiple locations have been highlighted as key aspects of generating healthcare value (Ford et al. 2017). Platform connectivity technologies like ERP fosters seamless information flow across hospital departments and hospital transaction partners (i.e. suppliers) and thus helps in reducing the gaps among the stakeholders; thereby bringing in transparency and also flexibility in the system (Piper, 2012). ERP helps systems to access information from multiple locations and thus making it interoperable across systems (Chakravorty et al., 2019; Chen et al., 2008). Integrated healthcare systems with digital technologies can significantly increase flexibility due to its increased data communication abilities and real-time information access (Chakravorty et al., 2019). Well managed healthcare integration can improve the healthcare operations and monitoring of patients (Chakraborty et al., 2019; Chakravorty et al., 2019). Based on extant literature evidences, ERP, transparency and interoperability appears as logical antecedents to flexibility in the system (for both hospitals and also the hospital-suppliers).

Linking ERP, Transparency, Interoperability with Responsiveness:

ERP leads to real time information sharing and connectivity between the stand-alone business-vertical (silos) (Kritchanchai, 2012). Level of ERP implementation in terms of putting in place all the relevant available ERP modules should enhance the business connectivity not only between the relevant departments linked to the hospital procurement team, but also the external supplier-facing procurement module should better interconnect with the hospital procurement system with the supplier-side order processing, invoicing and dispatch modules; thereby facilitating quicker order processing and superior instantaneous procurement and demand collating processes across departments and order placing system (Christiansen et al., 2012; Trimmer et al., 2002). Christiansen et al. (2012) suggested that being responsive means that the system is integrated and people are communicating. They also highlighted that ERP seek to bring the organizations under strategic control by creating a unified infrastructure for collecting and analyzing data from virtually all fields of organizational operations to enable planning and monitoring of activities (Kallinikos, 2006). This should enhance faster response in terms of order dispatch and reduce response delays and backlogs. Thus, intra-departmental and supplier-focused ERP implementation should favor responsiveness of the hospital procurement team and the supplier side order-fulfillment process team and the entire system at large (Garefalkis et al., 2016). Transparency is a vital aspect for inter-firm, inter-department and inter-stakeholder interaction. Transparency in terms of overall firm goals/agenda and transparency enhancing processes which favor real-time sharing of information between the transacting partners, reduces scope of ambiguity and apprehension regarding uncertainty of the forthcoming processes; thereby fostering a state of readiness and ability to quickly respond and react (Eggert and Helm, 2003). This ability to respond in shorter period of reaction-time provides better servicing capability to the concerned transaction partner in the firm relationship (Schneller and Smeltzer, 2006). In the current study context of healthcare: the transparency finds relevance and can be envisioned between the hospital procurement department and hospital-suppliers (Spagnuelo and Lenzini, 2017). When the requisite level of transparency is maintained between the relationship partners i.e. the hospital and its suppliers then on both the sides, the partners should be in a better prepared state to exhibit readiness to meet the forthcoming process needs; which in turn should streamline process flow and shorten the ability to quickly respond to the business/process stimulus, which can be referred to as a state of enhanced responsiveness (Teittinen et al., 2013; Naidu, 2007; Coulter and Jenkinson, 2005). Interoperability provides ubiquitous service guarantee i.e. uninterrupted connectivity and service linkage across locations and platform which necessarily keeps the information flow linkages in sync (Berler et al., 2006). This should enhance the preparedness of the system, and interacting partners in a better state of business readiness and around the clock in a state of 360-degree connectivity whereby reducing scope of introduction of unintended variability in the system flow and processes (Gambo et al., 2011). In the current study context, in case a better system showcasing superior interoperability level remains in place (Blackman, 2017), the hospital procurement and materials ordering departments placing requisite procurement orders and the hospital-suppliers should be in a state of sync and surprises related to procurement decisions should be minimal/reduced; thereby increasing the pace, readiness and ability to respond to the requirement needs with quicker reaction (Zdravkovic et al, 2017). A recent study in the Indian healthcare sector analyzed the influence of digital technologies like electronic medical records (EMR), ERP and internet of things (IoT) enabled medical wearables on hospitals and highlighted their impact on process integration and dynamic capabilities like quality, agility and responsiveness (Chakravorty et al., 2020). Based on extant literature evidences, ERP systems, transparency and interoperability appears as logical antecedents to responsiveness between the hospital and the hospital-suppliers i.e. the transacting partners.

Below section-5.3 further presents the linkages of antecedents, dynamic capabilities and servicing-capabilities to represent the third level hypotheses

5.3 LINKING THE ANTECEDENTS, DYNAMIC CAPABILITIES & SERVICING CAPABILITY

Linking Quality, Delivery-dependability, Flexibility and Responsiveness with Servicing Capability:

Strong measures are needed in the private hospitals for delivering high-quality services. Australian commission research on healthcare safety and quality, demonstrates that patient-centered care and service improves patient care experience in Australian healthcare context (Luxford et al., 2015). Aliman and Mohamad (2016) conducted an empirical study in the private healthcare sector in Malaysia and highlighted that quality has strong positive influence on the patient care and servicing capability. Thus, superior quality should be a critical factor for competitive advantage in healthcare services.

Gemmel (2017) in a recent study indicated that supporting ongoing delivery, reliable care delivery, on-time delivery and consistency in delivery act as boosters for servicing capability and performance. Delivery of dependable care service largely influences patient psychology, as they don't suffer from apprehension of erroneous and delayed care delivery and in turn does not unnecessarily hamper the hospital's process flow; thereby maintaining streamlined operations which allows the hospital to develop, accommodate and finally offer newer and more adaptive care service propositions (Majeed et al., 2011). Thus dependable care delivery fosters a reinforcing belief among the patient and also the hospital staff, department and management that if they can provide adaptive and dependable i.e. reliable care delivery routine, patients will cooperate and accommodate changes in the care delivery processes enabling the hospital to offer better service value propositions and thus enabling them to offer more customized, innovative and adaptive services to the patients with varied care needs. Thus dependable care delivery in a technology enabled transparent hospital ecosystem should be a logical antecedent to improved servicing capability (Chang, 2010; Martin et al., 2006).

Customer service and patient-centered care are given high priority in today's healthcare ecosystem. Though majority of the healthcare service providers' offer pretty standardized care services, however the tertiary care specialty and super-specialty hospitals compete and distinguish themselves from one another in terms superior flexible service delivery propositions and attempt at gaining niche positions in terms of creating patient centric approach and value system. Similarly, the hospital suppliers also compete with each other and in the process differentiate and position themselves as critical and prime to the hospitals in terms of offering niche flexible services. IT practices forms a high significance towards enhancing the efficiency, flexibility and effectiveness of the service capability of the healthcare system (Chakraborty and Kalepu, 2019). Koc et al. (2016) highlighted that flexible service is a fundamental requirement for capability-driven service in digital enterprise. A healthcare research conducted in Belgium by Agrali et al. (2017), explained that flexible availability of staffs to serve flexible demands in hospitals has a lot of importance and it is very crucial for hospitals to be flexible enough to generate high value of patient centered care and increase the patient servicing capability. Flexibility in terms of timing, care customization, adaptive accommodation, niche care procedure formulation, etc. adds immense value to the service capability front (Chakravorty et al., 2019). Digitization of healthcare service sector is proving to be valuable to patients and focus on patient centered care and patient centered service capability (Chakraborty et al., 2020; Ford et al., 2017). Thus, it becomes imperative to examine the linkage and study the impact of flexibility on servicing capability in Healthcare system (hospital as well as hospital-supplier contexts).

Amidst intensified competition in the healthcare arena, agility to respond and quickly adapt to the patient care needs, provide the hospitals with the much-needed competitive edge (Chakraborty et al., 2020). Thus, becoming responsive has become the key pivotal objective for healthcare providers; therefore, patient care and service capability eventually forming the basis for healthcare centers. Responsiveness and timeliness of care is an important process aspect of healthcare service capability and an effective driving force for performance (Cowing et al., 2009). Responsiveness is highlighted as the key factor for achieving higher servicing capabilities (Chakraborty et al., 2020; Donabedian, 1986). Provider responsiveness, friendliness and attentiveness have emerged as critical components of healthcare service as it helps the healthcare provider to differentiate itself and curve out a niche position (Saghier and Nathan, 2013; Kritchanchai, 2012). The hospitals and hospital suppliers both parties strive to prove themselves responsive in terms of providing customized adaptive care and supply propositions respectively. Thus, responsiveness forms an important parameter for servicing capability. It should be a logical extension to link responsiveness as an antecedent to gaining superior servicing capability.

Therefore, based on extant literature evidences and the linkages, dynamic capabilities like quality, delivery-dependability, flexibility and responsiveness appears as logical antecedents to servicing capability i.e. the primary competency of hospital and hospital-suppliers.

The next section-5.4 finally discusses the linkages of servicing-capabilities with performance parameters finally representing the outcomes.

5.4: LINKAGES OF SERVICING CAPABILITY AND PERFORMANCE PARAMETERS:

Linking Servicing Capability and Operational Performance:

Servicing capability of hospitals potentially reduces patient service time and facilitates handling of more patients, accuracy of processing should reduce errors and ambiguity in terms of diagnosis through better screening processes (Ko et al., 2019). Healthcare servicing capability involves on-time care-delivery by reducing delays and waiting or layover between patient care processes and precise estimation or forecasting accuracy that should help in better capability to know unavoidable layovers and plan accordingly (Ko et al., 2019; Angst et al., 2011; Bartlett et al., 2007). The managerial relevance of servicing capability enhancements lies in its impact on the firm performance. Proper process based approaches such as plans or policies, specific or time-bound measures are needed for effective operational performance indicators (Vosoughi et al., 2020). Development of enhanced capabilities provides competitive advantage to the firm (Teece et al. 1997; Teece, 1998; Devaraj et al. 2007) and enhances firm's operational performance (Zhang and Chen, 2008; Yeung et al., 2008). Plantier et al. (2017) further conducted an empirical study on France acute care hospitals and showed a significant difference on operational performance by the usage of electronic data systems as compared to non-digital hospitals; thereby leading to higher bed occupancy rate and operating room utilization. Information systems and digital technologies improve the decision making process and increases access to care delivery process (Kunjan et al., 2019). Properly planned technology enabled healthcare processes potentially improves the operational performance of hospitals and their suppliers as they improve efficiency, quality of care, mortality-rate which potentially foster patient satisfaction (Bojja and Liu, 2020). Hospital-systems typically involves treatment processes reflecting patient-flow, safety of patients or staff, and care-quality as well as the satisfaction of all involved stakeholders like patients, physicians, nurses, staff, and administration (Ryan et al., 2020; Williams et al., 2020). Readily accessible, real-time and integrated information and patient-data available in electronic formats can potentially manage patient operational complexities or patient needs and reduces patient's waiting time; further data-driven algorithmic healthcare processes involving big data technologies that can create and manage patients, physicians, staff, or operating room schedules with better operational performance (Keskinocak and Savva, 2020). Thus, linking superior servicing capabilities as an enabler of better care-delivery, removing redundancies, managing processes and reducing delays appears as a logical extension and linkage to operational performance.

Linking Servicing Capability and Financial Performance:

Enhanced servicing capability of the hospital should provide the hospital better means of extending care delivery to the patients through cost-effective and satisfying ways which in turn should put the hospital in superior position to meet patient demands with better precision, ensuring satisfaction. Enhanced patient satisfaction helps in spreading positive word of mouth and thereby brings in more and more new as well as repeat patients. Satisfied patients thus should contribute to enhanced revenue growth and better return on asset and investment and boost market share of the hospital. Servicing capability enhancement should reduce unnecessary delays for care-delivery and wastages of excess inventory; thereby enhancing the financial figures (ROA, ROI and cost optimization) (Dobrzykowski et al., 2012; Cao and Zhang, 2011). Walker et al. (2005) also highlighted in an empirical study in the US healthcare context and technology usage and electronic data flows between providers of healthcare has improved quality care, servicing capability, service quality and financial benefits. In case of various types of hospitals, the experience of treatment provided to patients, capabilities of care and services provided, quality of care and processes have shown a positive effects on financial performance at large (Dishman, 2020). Dynamic capabilities and operational or service capabilities can be enhanced by information systems and digital technologies which improve performance of firms where the aspects of technological, human related, financial, tangible as well as intangible resources play a crucial role to achieve competitive performance (Mikalef et al., 2020; Walker et al., 2005). Financial aspects of healthcare play a crucial role in today's competitive scenario as the hospital need to apply cost optimization techniques so as to attain a sustainable capabilities and competitive performance which foster patient care and services (Luan et al., 2020; Mikalef et al., 2020). In case of financial performance measures, although the outcomes are mostly calculated along the lines of cost or profit measures but focusing on process related aspects like efficiency, effectiveness, integration, transparency, dynamic and organizational capabilities are largely needed to achieve competitive performance and services (Amos et al., 2020; Mikalef et al., 2020). Thus, based on the aforementioned extant literature, healthcare servicing capability can be a logical antecedent to financial performance.

However, existing literatures have elicited the linkages of the aforementioned constructs conceptualized in this study, but there is a dearth of empirical validation in the Indian hospital context and two-way study regarding hospitals and hospital-suppliers remains missing. Therefore, the empirical validation of this study finds its unique place in healthcare supply chain literature.

Based on the above literature support, arguments and linkages established, the following sets of hypotheses have been proposed in the context of hospitals:

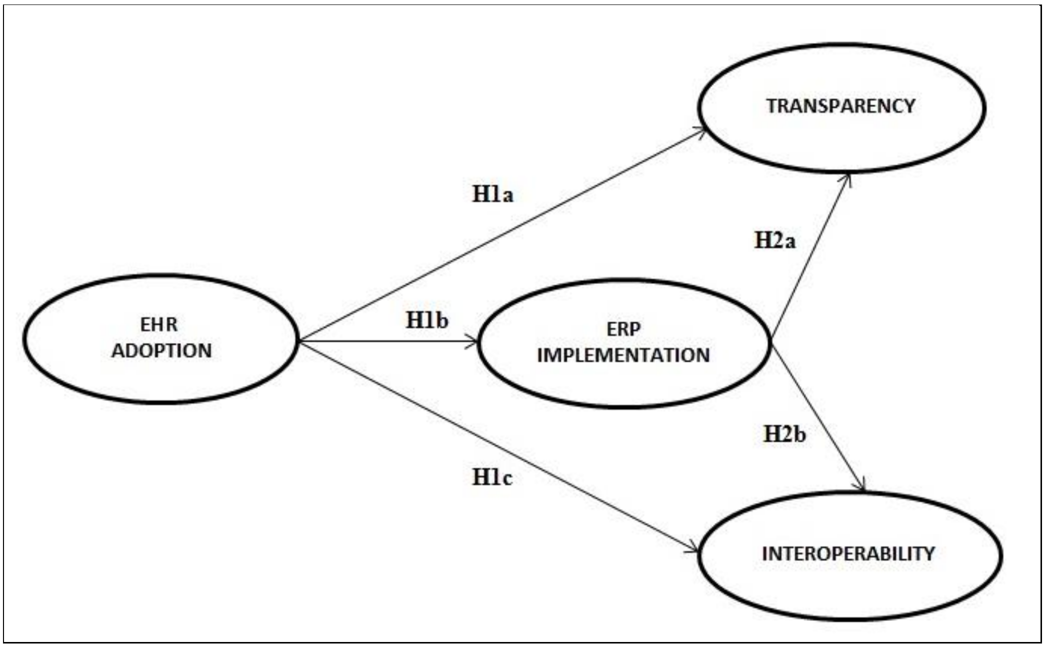


Figure 5.1: Hypotheses: Linking Digital Technologies with Process Level Capabilities

Linking Key Resources with Process Level Capabilities:

H1a: Level of EHR-Adoption is positively related with the level of transparency in hospitals.

H1b: Level of EHR-Adoption is positively related with the level of ERP Implementation in hospitals.

H1c: Level of EHR-Adoption is positively related with the level of Interoperability in hospitals.

H2a: Level of ERP-Implementation is positively related with the level of transparency in hospitals.

H2b: Level of ERP-Implementation is positively related with the level of Interoperability in hospitals.

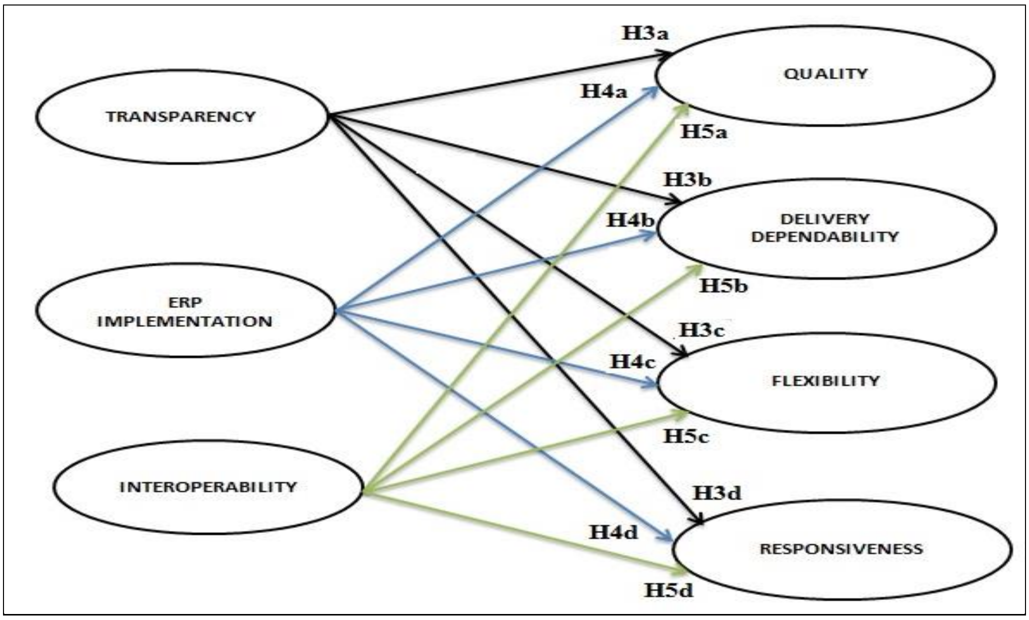


Figure 5.2: Hypotheses linking the antecedents with Dynamic Capabilities

Linking the Antecedents with Dynamic Capabilities:

H3a: Level of Transparency is positively related with the level of Quality in hospitals.

H3b: Level of Transparency is positively related with the level of Delivery-dependability in hospitals.

H3c: Level of Transparency is positively related with the level of Flexibility in hospitals.

H3d: Level of Transparency is positively related with the level of Responsiveness in hospitals.

H4a: Level of ERP-Implementation is positively related with the level of Quality in hospitals.

H4b: Level of ERP-Implementation is positively related with the level of Delivery dependability in hospitals.

H4c: Level of ERP-Implementation is positively related with the level of Flexibility in hospitals.

H4d: Level of ERP-Implementation is positively related with the level of Responsiveness in hospitals.

H5a: Level of Interoperability is positively related with the level of Quality in hospitals.

H5b: Level of Interoperability is positively related with the level of Delivery-dependability in hospitals.

H5c: Level of Interoperability is positively related with the level of Flexibility in hospitals.

H5d: Level of Interoperability is positively related with the level of Responsiveness in hospitals.

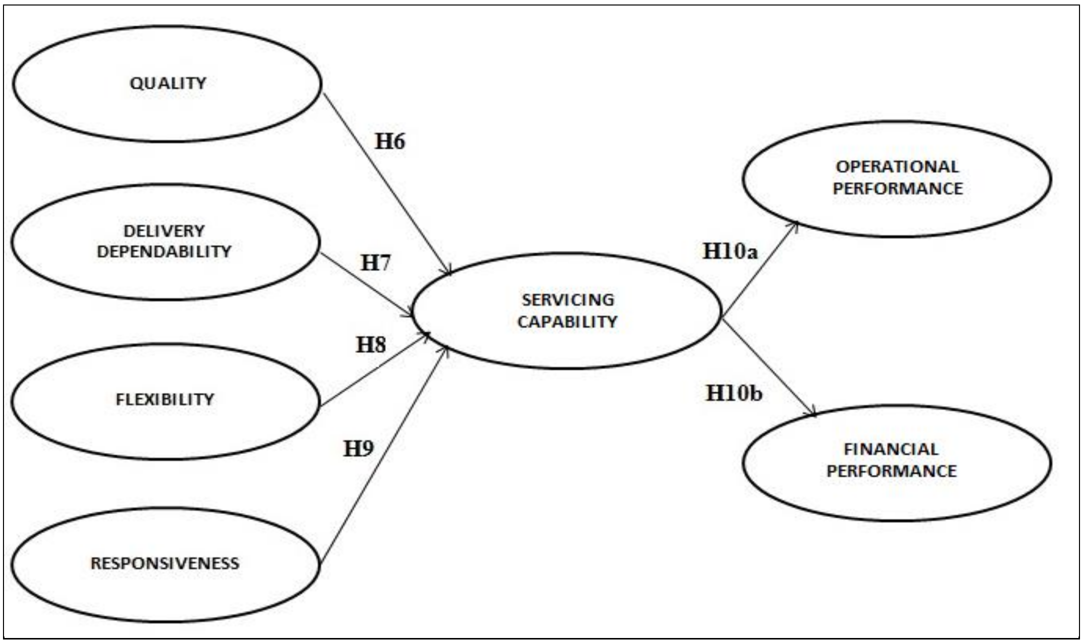


Figure 5.3: Hypotheses linking the Antecedents with Competencies and Outcome performance

<u>**Linking the Antecedents with Competencies and Outcome performance:**</u>

H6: Level of Quality is positively related with the level of Servicing Capability of hospitals.

H7: Level of Delivery-dependability in the system is positively related with the level of Servicing Capability of hospitals.

H8: Level of Flexibility is positively related with the level of Servicing Capability of hospitals.

H9: Level of Responsiveness is positively related with the level of Servicing Capability of hospitals.

H10a: Level of Servicing Capability is positively related to the level of Operational Performance of hospitals.

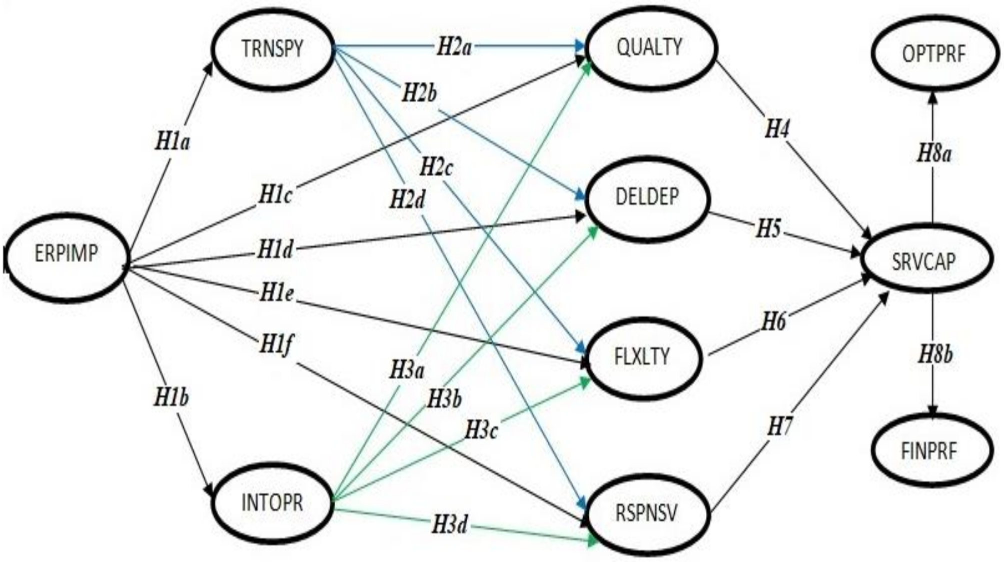
H10b: Level of Servicing Capability is positively related to the level of Financial Performance of hospitals.

Below section-5.5 presents the Supplier-side research framework and hypotheses for hospital-suppliers large scale study.

5.5 SUPPLIER-SIDE RESEARCH FRAMEWORK & HYPOTHESES

This study not only considers the framework from the Hospital-side but also focuses on the supplier-side perspective. As, discussed in the previous section the hospital-side framework comprises of all the 11 constructs highlighted in this study i.e. focusing on the analysis of impact of digital technologies both EHR and ERP implications on capabilities, competencies and performance. However, supplier-side study framework focuses only on the impact of ERP-Implementation on the process-level capabilities (transparency, interoperability), dynamic capabilities (quality, delivery-dependability, flexibility, and responsiveness), servicing-capability and performance parameters (operational performance, financial performance). The supplier-side focuses on ERP-implementation because the aspects of supplier-integration is a close study aspects in extant literature (Schneller and Smeltzer, 2006; Boyer and Pronovost, 2010). However, EHRs are only concerned with the electronically managed patient-records that are channeled for hospitals, and customer/patient facing areas and do not have its usage in the supplier-side aspects (Wurzer, 2012).Therefore, ‘EHR’ construct is not considered in the supplier-side framework.

Below Figure 5.4 illustrates the supplier-side framework of this study and Table 5.1 provides the supplier-side hypotheses summary.



Constructs KEY

ERPIMP= ERP Implementation	DELDEP=Delivery Dependability
TRNSPY= Transparency	FLXLTY= Flexibility
INTOPR= Interoperability	RSPNSV= Responsiveness
QUALTY= Quality	OPTPRF= Operational Performance
SRVCAP= Servicing Capability	FINPRF= Financial Performance

Figure 5.4: Conceptual Framework: Supplier-Side

Table 5.2 : Supplier-Side Hypotheses

S No.	Constructs Linked	Hypotheses
H1a	***ERP-Implementation →Transparency***	***Level of ERP-Implementation is positively related with the level of Transparency of the hospital-suppliers.***
H1b	***ERP-Implementation→ Interoperability***	***Level of ERP-Implementation is positively related with the level of Interoperability of the hospital-suppliers.***
H2a	***Transparency→Quality***	***Level of Transparency is positively related with the level of***

		Quality of the hospital-suppliers.
H2b	***Transparency→ Delivery-dependability***	***Level of Transparency is positively related with the level of Delivery-dependability of the hospital-suppliers.***
H2c	***Transparency→Flexibility***	***Level of Transparency is positively related with the level of Flexibility of the hospital-suppliers.***
H2d	***Transparency→Responsiveness***	***Level of Transparency is positively related with the level of Responsiveness of the hospital-suppliers.***
H1c	***ERP-Implementation →Quality***	***Level of ERP-Implementation is positively related with the level of Quality of the hospital-suppliers.***
H1d	***ERP-Implementation→ Delivery-dependability***	***Level of ERP-Implementation is positively related with the level of Delivery dependability of the hospital-suppliers.***
H1e	***ERP-Implementation →Flexibility***	***Level of ERP-Implementation is positively related with the level of Flexibility of the hospital-suppliers.***
H1f	***ERP-Implementation →Responsiveness***	***Level of ERP-Implementation is positively related with the level of Responsiveness of the hospital-suppliers.***
H3a	***Interoperability→Quality***	***Level of Interoperability is positively related with the level of***

		Quality of the hospital-suppliers.
H3b	***Interoperability → Delivery-dependability***	***Level of Interoperability is positively related with the level of Delivery-dependability of the hospital-suppliers.***
H3c	***Interoperability →Flexibility***	***Level of Interoperability is positively related with the level of Flexibility of the hospital-suppliers.***
H3d	***Interoperability →Responsiveness***	***Level of Interoperability is positively related with the level of Responsiveness of the hospital-suppliers.***
H4	***Quality →Servicing Capability***	***Level of Quality is positively related with the level of Servicing Capability of the hospital-suppliers.***
H5	***Delivery-dependability → Servicing Capability***	***Level of Delivery-dependability in the system is positively related with the level of Servicing Capability of the hospital-suppliers.***
H6	***Flexibility → Servicing Capability***	***Level of Flexibility is positively related with the level of Servicing Capability of the hospital-suppliers.***
H7	***Responsiveness → Servicing Capability***	***Level of Responsiveness is positively related with the level of Servicing Capability of the hospital-suppliers.***

H8a	***Servicing Capability→ Operational Performance***	***Level of Servicing Capability is positively related to the level of Operational Performance of the hospital-suppliers.***
H8b	***Servicing Capability→Financial Performance***	***Level of Servicing Capability is positively related to the level of Financial Performance of the hospital-suppliers.***

5.6 Chapter Summary

The summary of this chapter is as follows:

This chapter establishes the hypotheses developed for this research. The literature and arguments explains the linkages among the constructs to finalize the hypotheses. The section-5.1 provides the linkages of EHR, ERP, Transparency and Interoperability; section-5.2 further links ERP, Transparency & Interoperability with the Dynamic Capabilities (Quality, delivery-dependability, flexibility, and responsiveness); section-5.3 further links the antecedents & dynamic capabilities with servicing-capability; and finally section 5.4 links servicing-capability with operational and financial performance. The chapter further discusses the supplier-side research framework and also establishes the supplier-side hypotheses.

The next chapter i.e. Chapter-6 further explains the research methodology of this study. It throws light on the detailed aspects of Research Design, Survey Instrument, Large Scale survey and Methods of Analysis.

CHAPTER-VI

6 RESEARCH METHODOLOGY

The Previous chapter i.e. Chapter-5 has presented the hypotheses of the conceptual research framework for both hospital-side constructs and also provided the supplier-side research framework with supplier-side hypotheses. This chapter i.e. Chapter-6 titled as 'Research Methodology' provides the details of entire research methods and process followed in this empirical research work. Research methodology forms the backbone for any social science research work. The chapter discusses the details of Research Design which includes survey-based research technique, survey instrument or questionnaire development, survey instrument validation process, details of Q-sort (pilot study), sampling process followed in this study. This chapter also covers the discussion on methods of data analysis which are exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and structural equation modelling (SEM) used in this study.

RESEARCH METHODOLOGY FLOW DIAGRAM:

The below flow diagram provides a snapshot of the Research design and methodology which has been used in this study.

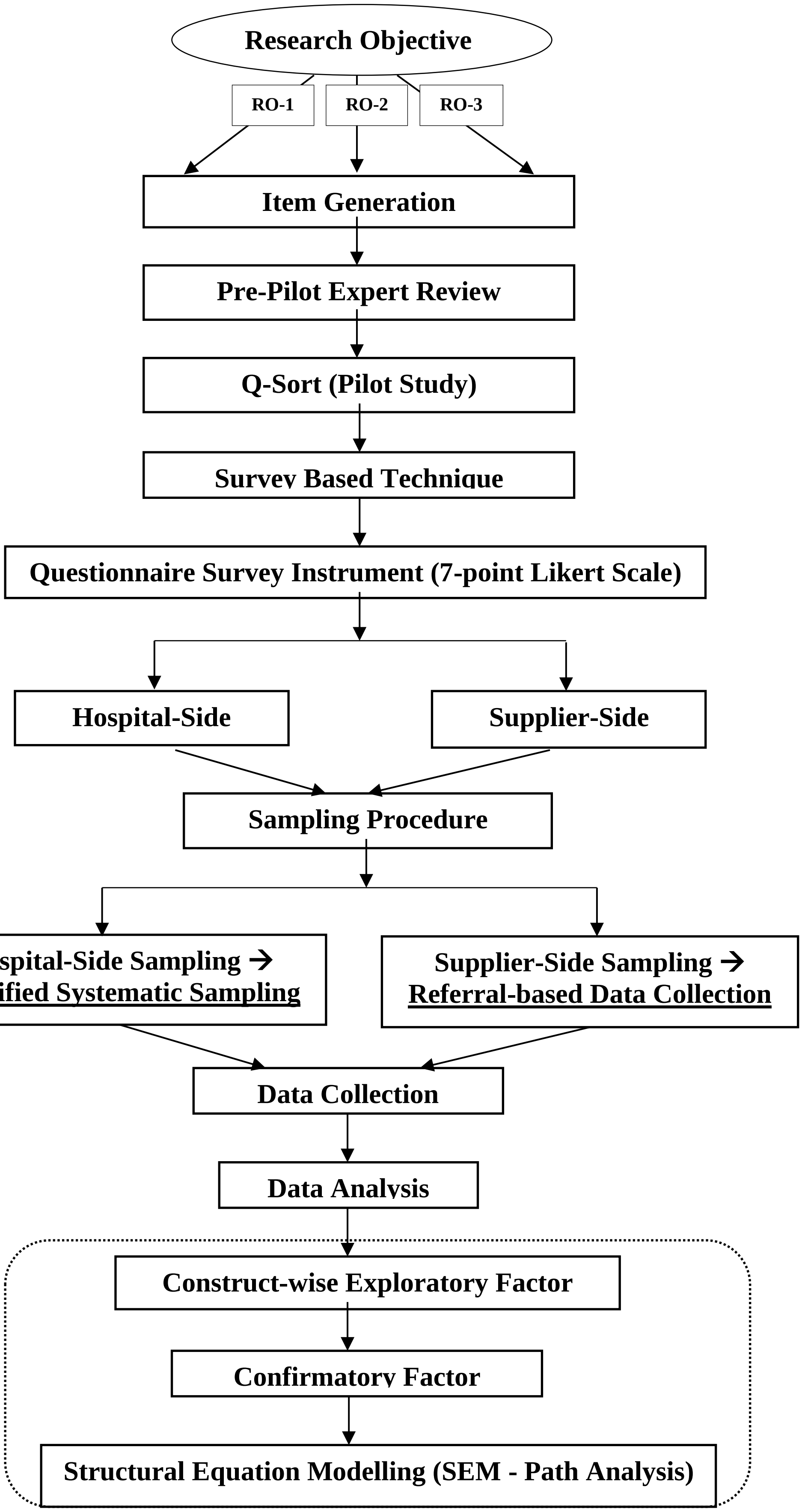


Figure 6.1: Research Methodology Flow Diagram

This section unfolds all the research methods being used for fulfillment of the research objectives i.e. RO-1, RO-2 & RO-3 of this study. The first part of this research methodology chapter discusses objective-wise research design, highlights on the instrument development process (questionnaire development), discusses about the sample frame, sampling technique used, the data collection process, research techniques followed in the study followed by detailed techniques to be used as part of research methodology along with objective specific statistical tools and techniques.

6.1 RESEARCH DESIGN

This 'Research Design' section unfolds the complete detail of this study which is taken up as the guiding principles of the research objectives providing the details of research decisions undertaken in due course of this study including data collection methods, data analysis process and methodology followed. In social-science research, the Research Design applied is broadly classified as two approaches (Frankfort-Nachmias and Nachmias, 1992). First approach is known as 'quantitative paradigm' in which the theoretical backdrop and research model or framework is constructed first and then the testable hypotheses are empirically validated. Second approach is known as 'qualitative paradigm' in which deduction of theory and construct research model is based on the investigation findings.

In this study, 'quantitative paradigm 'methodology is used as the main aim of this study is to empirically validate the strengths of the proposed test-hypotheses and analyze the level-wise impact of the constructs taken up to propose the comprehensive framework derived from previous extant literature review and theoretical backdrop; thereby validating the complete framework which is oriented towards the goals of bridging the research gaps, enriching the academic frontier and providing the findings which can be applicable to managerial perspective in healthcare fraternity. In the subsequent section, after hypotheses-development, survey-based data collection is performed through questionnaire-based instrument.

6.1.1 Survey Based Research Technique:

Survey research is a well-known technique used for capturing information, perception or attitudes of a sample or population of interest in research to describe and explore the characteristics of the data target pool taken in a study (Pinsonneault and Kraemer, 1993; Kothari, 2004). Survey research is primarily a quantitative method which requires a target sample for the subjects being studied which might be individuals, groups, organizations, etc. (Pinsonneault and Kraemer, 1993)

This survey-based research data collection technique has been highlighted in extant literature as an effective approach for perception-based empirical studies (Pinsonneault and Kraemer, 1993; Chakraborty, 2015; Dobrzykowski and Tarafdar, 2015; Kim et al., 2017). This technique holds well in the current study context. It fulfills the needs of both research objectives (RO)-1 & 2 i.e. to examine the impacts of digital technologies (EHR & ERP) towards transparency and interoperability; thereby further examining their impact on 'Dynamic Capabilities, Servicing Capabilities, Operational and Financial Performance'. The data collected from the survey helps the researcher to find out the strength of hypotheses linkages, required to fulfill the needs of RO-3 to validate the conceptual framework in the current study scenario.

Survey research technique has been classified to be Analytic survey and Descriptive survey (Oppenheirn, 1992). Analytic survey explores the associations and linkages between research variables and Descriptive survey focuses on drawing inferences from the study sample for the representation of the population (Kothari, 2004). This study uses both these survey techniques as the linkages of the construct variables taken in this study are based on analytic survey method and the demographic information taken from the statistical sample and then generalization of the results towards managerial and academic implication is based on descriptive survey method. This study uses the standardized procedure of survey-based research techniques: i.e. 'Survey instrument development/construction', Sample selection/sampling' & 'Data collection' (Kothari, 2004; De Vaus, 2013).

6.1.2 Survey Instrument:

There are various instruments used for gathering information in survey-techniques. The major survey instruments highlighted in extant literature being Questionnaire, Structured and general interviews, In-depth interview, Observation and Content analysis (De Vaus, 2013). The survey instrument used in this study is '*Questionnaire'*. Questionnaires are the most widely used survey instruments in research. Questionnaires are question-based instruments which combine single or multiple questions of the research constructs or items and information is collected from each person by giving them the questionnaire as documented and further collected by copying them into data grid (Kothari, 2004; De Vaus, 2013; Kim et al., 2017). Development and construction of a holistic survey instrument is the most important aspect for understanding the perception in social-science studies (Hinkin, 1998). Various methods of questionnaire administration include web-based questionnaires, email questionnaires, computer-assisted personal interviews, disk by mail questionnaires and other forms of electronic and manual data collection (De Vaus, 2013).

This is a research study in which the data is collected from two stakeholders of the healthcare supply chain *(hospitals and their suppliers)*. For performing this survey, two set of questionnaires are developed; first is the hospital-side questionnaire aimed at collecting the responses of the hospital-side respondents and second is the hospital-supplier-side questionnaire for collecting the responses of the hospital-suppliers. Both these questionnaires are circulated for data collection over both online and offline modes.

<<Questionnaires prepared are provided in the Appendix Section C & D>>.

The hospital-side questionnaire is circulated to the tertiary-care hospitals (*primarily hospital managers, physicians and or healthcare executives)* which have been using some form of digital technologies like EHR or ERP either in segment-wise or complete holistically. While the supplier-side questionnaire is circulated to the principal-suppliers of the hospitals whose details are taken from the hospitals that are filling the hospital-side questionnaire.

6.1.3 Questionnaire/Instrument Structure:

- **Hospital-Side Questionnaire:** The hospital-side questionnaire starts with the survey cover letter describing a brief summary of the study context and highlighting the constructs on which the survey is intended. Next is the PART-A of the questionnaire which takes up the details of the hospital profiles like name, city, specialty, bed-size, hospital-respondent profile, and work-experience. PART-B of the questionnaire contains the construct-wise measurement items intended for capturing the perceptions of the respondents. The constructs for hospital-side survey are EHR-Adoption, ERP-Implementation, Transparency, Interoperability, Quality, Delivery Dependability, Flexibility, Responsiveness, Servicing-Capability, Operational and Financial performance.

- **Supplier-Side Questionnaire:** The supplier-side questionnaire also starts with the survey cover letter describing the brief study-context and highlighting the constructs on which the survey is intended. The supplier selection is done on the basis of the details obtained from the hospitals. Similar to hospital-side questionnaire, PART-A of this questionnaire also takes up the details of the suppliers'-profiles like name, city, supplier-type and integration technology implementation details. EHR Adoption is not applicable in the supplier-side, so data taken for technology adoption is only ERP. PART-B of this questionnaire further contains the construct-wise measurement items for capturing the perceptions of the hospital-suppliers. The constructs for supplier-side survey are ERP-Implementation, Transparency, Interoperability, Quality, Delivery Dependability, Flexibility, Responsiveness, Servicing-Capability, Operational and Financial performance.

6.1.4 Questionnaire/Instrument Development:

This research is focused on the hospitals and their suppliers and aimed at linking the constructs by capturing the perceptions of the healthcare stakeholders. In case of social science research where perception-based measurements are needed for capturing the attitudes of respondents various extant literatures implement the questionnaire-based approach (Pinsonneault and Kraemer, 1993; Chakraborty, 2015; Dobrzykowski and Tarafdar, 2015; Kim et al., 2017). The questionnaire instrument is used to empirically validate the hypotheses which are proposed from the literature review and constructs defined in this study (Dobrzykowski and Tarafdar, 2015; Chandratre et al., 2018; Fiaz et al., 2018). In this survey-based study, validity and reliability of the questionnaire instrument is also tested; thereby ensuring that the adapted/developed questionnaire instrument is validated for the constructs taken in this study.

Validity of the questionnaire for measuring the constructs is the ability of a scale or instrument developed to measure what it is supposed to measure (Fernández-Berrocal et al., 2004; Hair et al., 2006). Whereas, Reliability of the questionnaire for measuring the constructs is the accuracy or precision of the scale while needs to be ensured once instrument validity condition is fulfilled (Hair et al., 2006; Gliem and Gliem, 2003; Kerlinger, 1986).

The constructs taken in this study have got their presence in the form of construct meanings, scales, definitions and item in the extant literature of various sectors. But this study is conducted in healthcare (hospital and hospital-suppliers) context which is a very critical and complex study area, so the constructs definitions, scales and items adapted from different sectors to healthcare and further applied to Indian healthcare sector requires sequential step-by-step instrument development process (Churchill, 1979; Hinkin, 1998).

The aforementioned process of development/revalidation of valid and reliable instruments is described as instrument development process (Dobrzykowski and Tarafdar, 2015; Chandratre et al., 2018; Fiaz et al., 2018). This is in accordance with the scale development process of established psychometric principles of survey research (Hinkin, 1998).

This instrument or scale development process comprises of four stages: first-Item generation; second-Pre testing; third-Q-sort pilot study testing & fourth-final large-scale data collection, analysis and instrument validation (Hinkin, 1998; Jin, 2008).

Step-1: Item Generation:

The instrument development process starts with creation of items. Item generation is a process of developing questions to develop items for assessing the constructs taken in study (Hinkin, 1998; De Vaus, 2013). In the process of item generation questions corresponding to each item developed from thorough literature review and backed by theoretical underpinnings from the study domain (Churchill, 1979). The primary goal of item generation is to confirm the validity of the construct taken for study. There are two major techniques for item generation –Deductive and Inductive. Deductive item generation process derives its information and initial items from extant literature review and theoretical definitions in order to finalize and validate the constructs (Fiaz et al., 2018). While the Inductive Item Generation process involves exploratory research, which develops items by interpretations of the responses obtained. It is essential to provide clear linkages of the items with the constructs to be studied and accordingly the construct definitions must be defined as per the study context (Alsmadi and Alnawas, 2019). Current study uses deductive item generation process as the constructs and definitions are obtained from literature and backed by theoretical supporting and further designed for empirical validation as highlighted by researches like (Fiaz et al., 2018; Chakraborty, 2015; Ironson et al., 1989) The construct items taken in this study are adapted from literature review and modified according to this study context. For some items, existing scales are adapted for usage while for some items new scales are developed. *<<Details of items and their references are given in the Appendix A, B>>*

Number of items in constructs: Literatures have highlighted that optimal number of items per construct scale are 4-6 for testing intra-construct homogeneity (Hair et al., 2006; Harvey et al., 1985). Some studies also stated that intra-construct reliabilities can also be obtained with 3 items (Hair et al., 2006; Kothari et al., 2004); but adding items more than required can progressively reduce the impact on reliability (Hair et al., 2006; Carmines & Zeller, 1979). This study also targets to finally keep 3-4 items per construct for achieving the required results.

Below Table 6.1 provides the initial number of items considered from the literature review process and sent for Q-sort process.

Table 6.1: List of Constructs & Number of items

S.No	Constructs	No. of Items
1	EHR Adoption*	6
2	ERP Implementation	5
3	Transparency	5
4	Interoperability	4
5	Quality	5
6	Delivery Dependability	4
7	Flexibility	5
8	Responsiveness	7
9	Servicing Capability	4
10	Operational Performance	5
11	Financial Performance	4
		Total-54

**EHR Adoption:-Only in Hospital-side framework, not applicable for supplier-side.*

Scale Development: Scale is the instrument used for the measurement of constructs to generate a quantitative value (Kothari, 2004). A researcher attempting to quantify the constructs which cannot be directly measured predominantly uses multiple-item scales and summated ratings (Kothari, 2004). It largely seen, that for perception-based study where the people's attitude is to be measured and further analyzed quantitatively most widely used scale is Likert Scale (Kerlinger, 1986; Gliem and Gliem, 2003). The Likert scale was invented by Rensis Likert (1931), for quantitatively assessing the attitudes and opinions of respondents as per a degree of agreement or disagreement (from strongly agree to strongly disagree). Disagreement will have the lowest score and Agreement will have the highest score, with equal intervals and middle point being neutral (Hinkin, 1998; Norman, 2010). Widely accepted Likert Scales are 5-point, 7-point and 9-point Likert scales.

Likert Scale Usage: Justification

Likert scale is an ordinal scale but is generally treated as interval scales as it allows the researchers to calculate averages and standard deviation. Moreover, it also enables to apply further more advanced statistical techniques like hypothesis testing (Carifio and Perla, 2008). This study also being a perception-based study which is capturing the motives of users towards implementation of digital technologies (EHR & ERP) and trying to analyze the impacts of these towards the process level capabilities (Transparency, Interoperability), Dynamic Capabilities (Quality, Delivery-dependability, Flexibility, Responsiveness), Servicing Capability & Operational and Financial Performance. So, the current study uses 7-point Likert scale to have the data collection survey. Using Likert Scale, the items generated are tested for favorable and unfavorable perceptions of the respondents where corresponding numbers are assigned in which 1-stands for strongly disagree, 7-stands for strongly agree and the midpoint 4-is neutral (Hinkin, 1998; Gliem and Gliem, 2003; Norman, 2010). Respondents with most favorable perceptions have highest scores and most unfavorable have the lowest scores (Kerlinger, 1986; Gliem and Gliem 2003).

Step-2: Pre-Pilot testing:

Pre-testing is an ***expert review phase*** of the scale development as guided by Churchill (1979) in which domain experts or management researchers are consulted for the verification of the items selected for factor loadings in the research study (De Bruin et al., 2005; Swink and Song, 2007). In this study, four experts were chosen (2 industry experts and 2 academicians). The industry experts were 12 years & 10 years experienced whereas the academicians were approximately 15 years of academic teaching and research experience with exposure in healthcare supply chain's procurement area. The entire conceptual framework and construct definition had two rounds of discussions with the experts; further their applications in healthcare sector adoption was analyzed and conformed. After this expert review stage, the draft questionnaire which was formed from existing academic literature was narrowed down and agreed upon measurement of items by data collection and analysis. Thus, this pre-pilot expert review phase boosts the content validity of the instrument.

Step-3: Q-Sort (Pilot Study):

Q-Sorting is a technique in further instrument which is used for finalizing the items which are taken from the item generation process and done with expert review pre-testing for adapting in the current study context in a better manner (Moore and Benbasat, 1991). For adapting the items in the current context of Indian healthcare sector focused on tertiary-care hospitals and their suppliers, the technique of Q-sorting is applied as a pilot testing technique (Moore and Benbasat, 1991). Q-Sort technique was introduced by Stephenson (1953) and further used by various researchers like (Deogaonkar et al., 2016; Ladan et al., 2018; Yang, 2018; Van Damme and Courtois, 2018; Iofrida et al., 2018) which comprises of Q-sort judges or the experts who are involved in the items validation process where the items are analysed, added, modified or deleted according to the constructs of study for further being adapted in this study context (Deogaonkar et al., 2016; Ladan et al., 2018; Yang, 2018). It is a pilot study technique where experts are involved to capture their viewpoints for ranking or sorting the construct items; thereby giving information about the similarities and differences typically used for sorting the items into construct groups before subjecting them to actual data sample to be further taken in the study (Yang, 2018). Q-sort not only helps the researcher to adapt already existing scales to the current study context but also enables the researcher to develop new scales of the constructs from existing literature review (Moore and Benbasat, 1991; Yang, 2018).

In this study total 11 constructs were finalized from literature review to build to conceptual framework in the hospital-side. In this study among the constructs taken, the item scales of EHR, ERP, interoperability & delivery-dependability have been developed according to the conceptual review of literature and theoretical understandings whereas the items for rest of the constructs are adapted from existing literature. Thus, Q-sort happens to be essential in this study for the sake of better applicability of these construct-items into a very niche sector i.e. Indian healthcare context. Total eight experts, four from hospital side and four more experts from the supplier-side domains were finalized for carrying out this Q-sort process *(known as Q-sort judges)* who analyzed the construct items by ranking them, adding new items, modifying or deleting the existing items (Churchill, 1979). Two rounds of Q-sort were done to finalize the questionnaires.

Q-Sort Judges Profiles: For the hospital-side, one expert-professional was a senior service-line executive operational manager from a reputed tertiary-care hospital; one expert judge was a senior physician who had established her own tertiary-care hospital; two more expert professionals were senior superintendents of tertiary-care hospitals. For the supplier-side, two experts were from the medical supplier companies involved in supply and distributions and dealings with tertiary-care hospitals; and two academicians who were supply chain professors in a business school. This mix of judges having huge experience in the healthcare service delivery sector in India coming from hospitals, medical-suppliers and academicians were taken in this study to get a clear insight on the Indian-healthcare sector considered in this study. The Q-Sort conducted separately for hospital-side and supplier-side in this study were in two rounds where the four judges were taken in teams of two in each round to consult them with the set of items being finalized by the researcher.

Q-Sort Process:

For the ***hospital-side***, all the 11 constructs were taken for the process where all 54 items of all the constructs were mixed and handed over to Q-sort judges in Round-1. The judges were provided with the constructs definitions and separate random items list and were asked to organise the items into 11+1 groups i.e. 11 constructs and one separate category was kept for the 'Not applicable' item which was used when judges found any item to be not applicable for the constructs provided. This process was conducted in presence of the researcher for giving clarity of any constructs related doubts or items reference to ensure that the results were accurate. In each round the Q-sort was done separately by two judges and the results were computed based on comparison and the results were discussed thoroughly. This entire process of Q-Sorting technique was conducted to ensure 'construct validity' and item's authenticity to bring more clarity before subjecting to further testing by factor analysis (Churchill, 1979).

For the *supplier-side*, *'EHR-Adoption'* construct was not applicable as per the literature and also suggested by experts. Thus, in the supplier-side all other 10 constructs were included in the supplier-side framework. The supplier-side Q-sort judges were asked to organize the items in 10+1 groups (one as not-applicable) and same process was followed as explained in the hospital-side Q-sort process.

Below Table-6.2 contains a list of number of items entering first round of Q-sort and the items entering the Q-sort is given in Appendix A, B. Feedback on the study was taken from the Q-sort judges that helped at further finalization of the data collection process.

Table 6.2: Construct-wise No. of items entering the Q-sort process

S.No	Construct Names	Construct #	No. of Items taken initially
1	EHR Adoption (EHRADP)*	1	6
2	ERP Implementation (ERPIMP)	2	5
3	Transparency (TRNSPY)	3	5
4	Interoperability (INTOPR)	4	4
5	Quality (QUALTY)	5	5
6	Delivery Dependability (DELDEP)	6	4
7	Flexibility (FLXLTY)	7	5
8	Responsiveness (RSPNSV)	8	7
9	Servicing Capability (SRVCAP)	9	4
10	Operational Performance (OPTPRF)	10	5
11	Financial Performance (FINPRF)	11	4
			Total-54

**EHRADP only considered for hospital-side framework and not for supplier-side.*

- **Assessment of Q-Sort Results**:

The Q-sort technique is used to assess the convergent and discriminant validity of the constructs which focuses on three methods of inter-rater reliability which are: inter-judge raw agreement score, placement ratio, and Cohen‘s Kappa (Moore and Benbasat, 1991).

The first measure ***inter-judge raw agreement score*** calculation is obtained by sum-total of the no. of items that the judges agree upon into one category divided by total no. of items (Moore and Benbasat, 1991).

The second measure ***placement ratio (Hit ratio)*** measures the agreement of category classifications between the Q-sort judges and theoretical associations. This calculation is done by summing-up the total no. of items suitably placed into intended category by the participating Q-sort judges divided by twice the total number of items. The higher the percentage of correct placements better is its construct validity and reliability (target of placement percentage is ~80% for a good study)

The third and the most robust measure is ***Cohen's Kappa***as it is measured by the percentage agreement observed minus the percentage agreement expected by chance alone, whole divide by 100 minus percentage agreement expected by chance alone (Gordis, 2009; Hsu and Field, 1989). Thus, Kappa calculation gives clarity on how much the observed agreement by judges is exceeding that to be done due to chance alone.

Below is the formula for Kappa (K) calculation (Gordis, 2009):

$$K = \frac{\text{\% agreement observed} - \text{\% agreement expected by chance alone}}{100\% - \text{\% agreement expected by chance alone}}$$

i.e. the workable formula is:

K= [(Total Item Placed * Matched Agreements) – (Sum of Row Totals * Column Totals)] / [(Total Item Placed)^2 - (Sum of Row Totals * Column Totals)]

These three measures of Q-sort are highly indicative of superior convergent/discriminant validity and reliability of the constructs as used in various extant literatures like Swink and Song (2007). Research works like Landis and Koch, 1977; Todd and Benbasat, 1989; Moore and Benbasat, 1991; Yang, 2018 have explained standard values of these measures.

Landis and Koch (1977) provided insight on the interpretation of Cohen‘s Kappa values. The ideally acceptable and desirable Cohen's Kappa value was indicated as 0.75 and higher to be a substantial agreement between the Q-sort judges. Some studies also accepted Kappa score of 0.65 to be fine but preferably above 0.9 is an excellent value of agreement (Todd and Benbasat, 1989; Moore and Benbasat, 1991).

Below Table 6.3 provides the interpretation of various Cohen's Kappa (K) values as adopted from Landis and Koch (1977).

Table 6.3 Cohen's Kappa values

Cohen's Kappa values (K)	Interpretation
<0	No agreement
0-0.19	Poor agreement
0.20-0.39	Fair agreement
0.40-0.59	Moderate agreement
0.60-0.79	Substantial agreement
0.80-1.00	Almost perfect agreement

- **Q-Sort Pilot Study Results**:

In this study, two rounds of Q-sort process was conducted by four judges in sets of two in the hospital-side and four judges in sets of two in the supplier-side to analyze the items for achieving convergent and discriminant validity of the constructs so as to validate the items. These items were subjected to modifications in every round as per suggestions of the Q-sort judges which further helped in finalizing the hospital-side and supplier-side questionnaires. In each Q-sort rounds all the 11 constructs were analyzed for the hospital-side and for the supplier-side *'EHR-Adoption'* construct was not applicable as per the literature and also suggested by experts. Thus, in the supplier-side all other 10 constructs were included in the supplier-side framework. Once they were in agreement after first round, the results of the items were subjected to second Q-sort round. After the two rounds were done both the questionnaires (hospital-side & supplier-side) were included in the final research survey.

Table-3 above shows the list of constructs with the variable codes which entered the Q-sort. Two separate set of items list was placed for Q-sort process.

Round-1: Q-Sort Process:

In Round-1 of Q-sort, the number of items for hospital-side was 54 and that for supplier-side was 48. After first Q-sort round, the hospital-side measures were: inter-judge raw agreement score was 0.833 (45/54), the item placement (hit) ratio was 0.833/83.3% (90/108), and the Cohen's Kappa score was 0.816; while the supplier-side measures were: inter-judge raw agreement score was 0.875 (42/48), the item placement (hit) ratio was 0.875 / 87.5% (84/96), and the Cohen's Kappa score was 0.86. The findings measures of Q-sort Round-1 (Raw Agreement score, item placement ratio and Cohen's Kappa) are provided in tables- 6.4, 6.5 (hospital-side) and tables- 6.6, 6.7 (supplier-side). The three measure indices were quite within the acceptable ranges for the research and the items which did not fall on the diagonal of the matrix were removed and kept as not applicable and wherever required the item wordings were modified for making them more appropriate in this study. Actually, after round-1 of Q-sort, 9 items were deleted and another 3 items were revised in the hospital-side while 6 items were deleted and 2 items were revised in the supplier-side. The feedbacks given by Round-1 judges were incorporated and all these construct items were subjected to Round-2 Q-sorting process.

Table 6.4: Q-sort (Round 1) Hospital-Side: Inter-Judge Raw Agreement Score

Round-1:							**JUDGE 1**						
	Constructs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**NA**
	1	**5**											**1**
	2		**4**										**1**
	3			**4**									**1**
J	**4**				**4**								**0**
U	**5**					**4**							**1**
D	**6**						**4**						**0**
G	**7**							**4**					**1**
E	**8**								**4**				**3**
	9									**4**			**0**
2	**10**										**4**		**1**
	11											**4**	**0**
	NA	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**3**	**0**	**1**	**0**	
Total Items placed: 54			**No. of Matched Agreement: 45**						**Agreement Ratio: 0.833 (45/54) (Raw Agreement score)**				

Cohen's Kappa (K) = [(54*45) – {(6*6)+(5*5)+(5*5)+(4*4)+ (5*5)+(4*4)+ (5*5)+(7*7)+(4*4)+ (5*5)+(4*4)}] / [(54*54)-{(6*6)+(5*5)+(5*5)+(4*4)+ (5*5)+(4*4)+ (5*5)+(7*7)+(4*4)+ (5*5)+(4*4)}]

= 0.816

Table 6.5: Q-sort (Round 1) Hospital-Side - Item Placement Ratio

Round-1:		Actual Categories													
	Constructs	1	2	3	4	5	6	7	8	9	10	11	NA	Total	%
	1	10											2	12	83.3
	2		8										2	10	80
	3			8									2	10	80
	4				8								0	8	100
	5					8							2	10	80
Theoretical Categories	6						8						0	8	100
	7							8					2	10	80
	8								8				6	14	57.1
	9									8			0	8	100
	10										8		2	10	80
	11											8	0	8	100
	NA	2	2	2	0	0	2	0	2	6	0	2			
Total Items placed: 108			No. of Hits: 90					Overall Hit Ratio: 0.833 / 83.3% (90/108)							

Table 6.6: Q-sort (Round 1) Supplier-Side - Inter-Judge Raw Agreement Score

Round-1:							**JUDGE 1**					
	Constructs*	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**NA**
	2	**4**										**1**
	3		**4**									**1**
J	**4**			**4**								**0**
U	**5**				**4**							**1**
D	**6**					**4**						**0**
G	**7**						**4**					**1**
E	**8**							**5**				**2**
	9								**4**			**0**
2	**10**									**5**		**0**
	11										**4**	**0**
	NA	**1**	**1**	**0**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	
Total Items placed: 48				**No. of Matched Agreements:42**					**Raw Agreement Score:0.875**			

Cohen's Kappa, K= [(48*42) – {(5*5)+(5*5)+(4*4)+(5*5)+(4*4)+ (5*5)+(7*7)+(4*4)+ (5*5)+(4*4)}] / [(48*48)-{(5*5)+(5*5)+(4*4)+ (5*5)+(4*4)+ (5*5)+(7*7)+(4*4)+ (5*5)+(4*4)}]

= 0.86

Construct#- 1:-EHRADP is not applicable for Supplier-side framework. So, numbers are marked from 2 to 11

Table 6.7: Q-sort (Round 1) Supplier-Side - Item Placement Ratio

Round-1:	Actual Categories													
	Constructs	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**NA**	**Total**	**%**
	2	**8**										**2**	**10**	**80**
	3		**8**									**2**	**10**	**80**
	4			**8**								**0**	**8**	**100**
	5				**8**							**2**	**10**	**80**
	6					**8**						**0**	**8**	**100**
Theoretical Categories	**7**						**8**					**2**	**10**	**80**
	8							**10**				**4**	**14**	**71.4**
	9								**8**			**0**	**8**	**100**
	10									**10**		**0**	**10**	**100**
	11										**8**	**0**	**8**	**100**
	NA	**2**	**2**	**0**	**2**	**0**	**2**	**4**	**0**	**0**	**0**			
Total Items Placed: 96				**No. of Hits: 84**						**Overall Hit Ratio:0.875 / 87.5%**				

Construct#- 1:-EHRADP is not applicable for Supplier-side framework. So, numbers are marked from 2 to 11

Round-2: Q-Sort Process:

In Round-2 of Q-sort, the number of items for hospital-side was 45 and that for supplier-side was 42. After Round-2, the hospital-side measure came up as: inter-judge raw agreement score was 0.933 (42/45), the placement (hit) ratio was 0.933 / 93.3 % (84/90) and the Cohen's Kappa score was 0.927 i.e. 92.7%; while the supplier-side measures were: inter-judge raw agreement score as 0.905 (38/42), the placement (hit) ratio as 0.905 / 90.5 % (76/84) and the Cohen's Kappa score as 0.894 i.e. 89.4%. Thus, it was evident that all the measure showed significantly perfect agreement as per indices figure described by Landis and Koch (1977). The findings measures of Q-sort Round-2 (Raw Agreement score, item placement ratio and Cohen's Kappa) are provided in tables- 6.8, 6.9 (hospital-side) and tables- 6.10, 6.11 (supplier-side).

Thus, after Round-2, the measures came as significantly perfect, so the items were finalized for questionnaire survey during the further large scale data collection process.

Table 6.8: Q-sort (Round 2) Hospital-Side - Inter-Judge Raw Agreement Score

Round-1:						**JUDGE 1**							
	Constructs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**NA**
	1	**4**											**1**
	2		**4**										**0**
	3			**4**									**0**
J	**4**				**4**								**0**
U	**5**					**4**							**0**
D	**6**						**3**						**1**
G	**7**							**4**					**0**
E	**8**								**3**				**1**
	9									**4**			**0**
2	**10**										**4**		**0**
	11											**4**	**0**
	NA	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	
Total Items placed: 45			**No. of Matched Agreement: 42**					**Agreement Ratio: 0.933 (Raw agreement score)**					

Cohen's Kappa (K) = [(45*42) – {(5*5)+(4*4)+(4*4)+(4*4)+ (4*4)+(4*4)+ (4*4)+ (4*4)+(4*4)+ (4*4)+(4*4)}] / [(45*45)- {(5*5)+(4*4)+(4*4)+(4*4)+ (4*4)+(4*4)+ (4*4)+ (4*4)+(4*4)+ (4*4)+(4*4)}]

= 0.927

Table 6.9: Q-sort (Round 2) Hospital-Side - Item Placement Ratio

Round-1:								Actual Categories							
	Constructs	1	2	3	4	5	6	7	8	9	10	11	NA	Total	%
	1	8											2	10	80
	2		8										0	8	100
	3			8									0	8	100
	4				8								0	8	100
	5					8							0	8	100
Theoretical Categories	6						6						2	8	75
	7							8					0	8	100
	8								6				2	8	75
	9									8			0	8	100
	10										8		0	8	100
	11											8	0	8	100
	NA	2	0	0	0	0	2	0	2	0	0	0			
Total Items placed: 90			No. of Hits: 84						Overall Hit Ratio: 0.933 / 93.3 % (84/90)						

Table 6.10: Q-sort (Round 2) Supplier-Side - Inter-Judge Raw Agreement Score

Round-1:					JUDGE 1							
	Constructs*	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**NA**
	2	**4**										**0**
	3		**4**									**0**
J	**4**			**4**								**0**
U	**5**				**4**							**0**
D	**6**					**3**						**1**
G	**7**						**4**					**0**
E	**8**							**3**				**2**
	9								**4**			**0**
2	**10**									**4**		**1**
	11										**4**	**0**
	NA	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**1**	**0**	
Total Items placed: 42				**No. of Matched Agreements:38**					**Raw Agreement Score:0.905**			

Cohen's Kappa, K= [(42*38) – {(4*4)+ (4*4)+(4*4)+ (4*4)+(4*4)+ (4*4)+(5*5)+(4*4)+ (5*5)+(4*4)}] / [(42*42)- {(4*4)+ (4*4)+(4*4)+ (4*4)+(4*4)+ (4*4)+(5*5)+(4*4)+ (5*5)+(4*4)}]

= 0.894

Construct#- 1:-EHRADP is not applicable for Supplier-side framework. So, numbers are marked from 2 to 11

Table 6.11: Q-sort (Round 2) Supplier-Side - Item Placement Ratio

Round-1:		Actual Categories												
	Constructs	2	3	4	5	6	7	8	9	10	11	NA	Total	%
Theoretical Categories	2	8										0	8	100
	3		8									0	8	100
	4			8								0	8	100
	5				8							0	8	100
	6					6						2	8	75
	7						8					0	8	100
	8							6				4	10	60
	9								8			0	8	100
	10									8		2	10	80
	11										8	0	8	100
	NA	0	0	0	0	2	0	4	0	2	0			
Total Items Placed: 84			No. of Hits: 76						Overall Hit Ratio: 0.905 / 90.5% (76/84)					

Construct#- 1:-EHRADP is not applicable for Supplier-side framework. So, numbers are marked from 2 to 11

A summarized result of Q-sorting process is given in the below Tables-6.12 (hospital), Table-6.13 (supplier):

Table 6.12: Hospital-side Q-sort Pilot Test Measures

Indices	Round 1	Round 2
Raw agreement Score	0.833	0.933
Cohen‘s Kappa	0.816	0.927
Placement (hit) ratio	0.833	0.933

Table 6.13: Supplier-side Q-sort Pilot Test Measures

Indices	Round 1	Round 2
Raw agreement Score	0.875	0.905
Cohen‘s Kappa	0.86	0.894
Placement (hit) ratio	0.875	0.905

Thus, after the Q-sort pilot-study both the hospital-side and supplier-side questionnaire was finalized with 42 items representing 11 constructs and 38 items representing 10 constructs respectively which was further subjected to large scale study *(see Appendix-C, D for questionnaires including the final list of items).*

6.2 LARGE SCALE SURVEY – Instrument Validation Process

Next step after the above pilot-study is to validate the instrument with actual survey data. Data collection approach by survey-based technique is used for validation of the test-hypotheses and conceptual framework developed from extant literature which needs to be surveyed in the study context for its applicability in the research context (Kothari, 2004; Dobrzykowski and Tarafdar, 2015; Fiaz et al., 2018). Need for this statistical survey is to formulate and execute of the research objectives and for objective assessment and effectiveness of the research objectives stated in the earlier sections of the study. This section throws light on the data collection method, the sample plan, the sampling technique and procedures followed in this study. It also explains the sample frames used for data collection and the characteristics of the survey respondents followed in this study to make it relevant for the Indian-healthcare sector considered in this research study. Post the data collection process, the next section describes the statistical analysis performed to assess the validity and reliability of the instruments for establishing the framework proposed in the research area. Thus, the conceptual study is first deployed to survey research method for collection of data and thereafter quantitative approach is followed for accepting or rejecting the proposed hypotheses (Kumar and Phrommathed, 2005).

6.2.1 Data Collection – Methods and Procedures:

Data Collection process is an important technique of research process which is used for capturing the perceptions of the samples selected and helps in better analysis of the constructs being studied by the researcher and increases the practical applicability of the research work (Kothari, 2004). In is study data collection was carried out by a well-known technique which is sample-survey approach as highlighted by various researcher of all times (Dobrzykowski and Tarafdar, 2015). The sample survey technique shows its merit in quantitative and qualitative as well as parametric and non-parametric research works by capturing a lot of perception-based information and helps in analysing the relationships between multiple variables (Kerlinger, 1986; Miller, 1991; Kothari, 2004). Thus, survey technique fosters an opportunity to validate the instrument scales and increasing generalizability of the research work much more than that done by case-study approach or other interview methods (Dobrzykowski, 2012; Dobrzykowski and Tarafdar, 2015). However, survey method suffers from the issue of managing non-response bias; so in this study special precaution has been taken to manage the non-response bias (Yu and Cooper, 1983; Blankenship and Breen, 1992).

For data collection in this study, the researcher has primarily used the online as well as offline survey approach; however responses were also taken over emails and some hospitals were given the questionnaires manually by hand-to-hand distribution during face-to-face discussions. Data collection was done for both hospital-side and supplier-side in the year 2018. First the hospital-side data collection was completed and then only supplier-side data collection started because the supplier lists were obtained from the list of principle suppliers of the responding hospitals.

6.2.2 Sampling Procedure:

6.2.2.1 Hospital Side Sampling:

This study is an empirical validation of the finalized constructs, validating the test hypotheses and finally validating and establishing the conceptual framework into an operationalized framework in the Indian healthcare context. Generally, hospitals in India are of two main types: Public facilities (government run and aided) and private facilities (owned by private owners, trusts and business bodies). In this study only the Indian private-sector tertiary-care hospitals with 25 beds and above (including Intensive-Care-Unit and

Intensive-Therapy-Unit beds) has been considered since hospitals having less than 25 beds often don't have direct procurement relationships with suppliers and they go for open market procurement or group purchasing. Public hospitals or any not-for profit private hospitals are out of purview of this study as proper EHR adoption and ERP implementation is lacking in public sector hospitals. In order to analyze all the outcomes taken as constructs in this study, it is essential to consider the hospitals that have at least some-what implemented the digital practices of EHR & ERP for them to analyze the outcomes and answer the research survey. So, to obtain a complete uniform representation of the entire Indian healthcare context, ***Stratified systematic sampling*** technique has been selected for four major metropolitan cities and the areas adjoining it for the data collection.

Stratified systematic sampling procedure is generally used where the population is either heterogeneous or where homogeneous sub-populations can be identified and isolated, such sub-populations are called as strata (Kothari, 2004). In this study, to maximize the representativeness of the sample in the Indian healthcare scenario, such that this study sample can largely describe the entire population of the research context, the private sector tertiary-care hospitals are chosen across the four metropolitan areas, the hospitals are segregated on the basis of the three broad strata (segments) in relation to specialty, namely single-specialty, multi-specialty and no specialty i.e. general hospitals. All these three strata have been considered in this study for the hospital-side data in all four metropolitan areas to achieve a clear representation of the Indian-healthcare scenario.

The research area considered in this study is a very niche area as the sample hospitals taken are only tertiary-care private hospitals in India. The other popular sampling techniques like random sampling could not be used as the sample population in each stratum is not very large and it would have been difficult to achieve the required sample size. So, the selected sampling technique is systematic sampling technique which is applied to each stratum of the target population.

For the selective population to be considered in this study a list of all the private tertiary-care hospitals was extracted across the four major metro-cities and surrounding areas like: Delhi and National Capital Region (NCR) representing the Northern-India; Mumbai and its surrounding extensions representing the Western-India; Kolkata, Howrah and 24-Parganas representing the Eastern-India and finally Chennai, Vellore and Suburbs representing the Southern part of India. The list was obtained from internet websites, Google, medical apps, medical insurance databases, etc. Once the list was obtained, each of the hospital was cross-checked to get details of the digitalization process, electronic and integration modes followed, bed-sizes, specialties, procurement processes, supply chain networks, etc.

Finally, after all the extraction process of shortlisting the hospitals to be considered 755 private hospitals and nursing homes with their respective contact details were identified across those four urban areas addressed. Further from the internet search, linked-in details, and various apps the corresponding contact details of the managers associated with these selected hospitals were also consolidated to finalize the list. From this final list, for picking up the sample hospitals every alternate hospital entries were chosen to introduce randomness and eliminate selection bias.

Table 6.14: Total City-wise & Specialty-wise list of hospitals Population obtained

AREAS	SINGLE SPECIALTY	MULTI-SPECIALTY	GENERAL HOSPITAL	CITY-WISE TOTAL
DELHI & NCR	81	165	62	308
KOLKATA, HOWRAH & 24 PARGANAS	42	72	21	135
CHENNAI & SUBURBS	38	67	37	142
MUMBAI & EXTENSIONS	46	76	48	170
SUB-TOTAL SPECIALTY-WISE	207	380	168	
			TOTAL	755

6.2.2.2 Data Collection- Hospital Side:

Post completion of the stratified systematic sampling, the process of data collection was initiated from the list of hospitals selected. The hospital-side questionnaire was sent to the contacts of the selected sample by communicating with them telephonic, online or offline modes. For maximizing the response rates, the researcher has conducted an earlier communication with the respondents, explaining them all the details of the study purpose and also clarified the expectations and confidentiality promises of the study and then only administered the survey questionnaire (Yu and Cooper, 1983; Kothari, 2004). To fasten the data collection process the researcher has also taken support from known sources in the healthcare sector, some of them were also affiliated to NAMSR (National Association of Medical Sales Representatives) and FMRAI (Federation of Medical and Sales Representatives' Associations of India)[22].

Unit of Response, Sample Size & Response-Rate: Hospital-Side:

The unit of response in the hospital-side study was taken solely from the hospitals especially focusing on the hospital-operations managers, procurement department managers, procurement executives, hospital purchasing-executive, senior executives of procurement, logistics managers, purchase managers, hospital-pharmacy store managers, hospital in-house diagnostics department managers, hospital superintendents, controlling administrative officers and stores and/or any person with similar roles and priorities, etc. who were using the EHR or ERP technologies or who were running their own hospitals. The focus of respondents were such that they should have some knowledge about the usage of digital technologies in hospitals and who were using the referred technology in this study i.e. EHR and ERP and also can compare the differences between pre-digitalized hospital scenario and outcome situations post the technology implementations. The Hospital-side sample characteristic table (Table-6.15) provides the details of

[22] http://www.fmrai.org/

respondents' designations which were obtained from the hospital-side questionnaire given in Appendix-C of the document.

For the data collection in hospitals, by following the stratified sampling technique 415 hospital respondents were approached with the questionnaire after confirmation through email or face-to-face. While responding they mentioned that due to security and business norms and hospital policies they were not willing to disclose their hospital-names and also emphasized on the confidentiality of the responses. So, special care was taken by researcher to maintain the responses as highly confidential. However, during the actual data collection like any other survey in this survey also some of the responses were incomplete or some responses did not turn-up (Hair et al., 2006). So, the final count of available hospital-side respondents was 223. From the extant empirical studies in healthcare sector the response rates of 40- 60% (as highlighted in Li and Benton, 2006; Gowen III et al., 2006; McFadden et al., 2009) was quite evident and this study which was actually 53.7 % response rate found an acceptable response from highly relevant respondents. This response is attributed to constant follow-up of researcher with all hospitals, face-to-face meets, medical affiliations from FMRAI fostering the data collection process, the confidentiality clause, and most importantly the promise to share the research results with the responding hospitals so that they can have a great value on the practical aspects in the digitalization of healthcare sector in Indian context. (*Below Table-6.15 represents the hospital-side collected sample demographics).*

Table 6.15: Hospital-side City-wise and Hospital Specialty-wise collected sample

Sample Areas	Single Specialty	Multi-Specialty	General Hospital	City-Wise Total
Northern-India (Delhi, Ncr)	**26**	**51**	**14**	**91**
Southern-India (Chennai, Vellore, Suburbs)	**14**	23	**06**	**43**
Eastern-India (Kolkata, Howrah, 24-Parganas)	**11**	**20**	**14**	**45**
Western-India (Mumbai, Suburbs)	**11**	**15**	**18**	**44**
Sub-Total Specialty-Wise	**62**	**109**	**52**	
			Total	**223**

Sample Characteristics & Demographics- Hospital-Side:

This section provides the details of Hospital-side sample demographics based on various aspects like Respondent designations*(Table-6.16)*, Hospital-size based on number of beds *(Table-6.17)*, Hospital-Specialty *(Table-6.18)*, City-wise breakup*(Table-6.19)*, and Respondent's experience in years in referred digital technology (EHR, ERP)*(Table-6.20, 6.21)*.

Table 6.16: Sample Characteristics based on Respondent's designations

Hospital-side sample characteristics based on Respondent's designation *Note: Numbers represent the counts, followed by its percentage in the sample*	
Job title	**Respondents (%)**
Hospital Patient-Service Managers	**18 (8.07%)**
Hospital Superintendent	**23 (10.31%)**
Hospital Operations Manager	**36 (16.14%)**
Purchasing Managers	**33 (14.80%)**
Purchasing Executives	**18 (8.07%)**
Procurement Managers	**35 (15.70%)**
Procurement Executives	**11 (4.93%)**
Logistics Manager	**12 (5.38%)**
Hospital Store Managers	**18 (8.07%)**
Controlling officer-Hospital Admin Staff	**10 (4.48%)**
Others	**9 (4.04%)**

Table 6.17: Sample Characteristics based on Hospital-size

Hospital-side sample characteristics based on hospital-size (no. of beds) *Note: Numbers represent the counts, followed by its percentage in the sample*	
No. of beds	**Respondents (%)**
Below 20	**0 (0%)**
20 to 50	**84 (37.67%)**
51 to 150	**48 (21.52%)**
151 to 250	**46 (20.63%)**
251 to 399	**24 (10.76%)**
400 and Above	**21 (9.42%)**

Table 6.18: Sample Characteristics based on Specialty

Hospital-side Sample characteristics based on Specialty *Note: Numbers represent the counts, followed by its percentage in the sample*	
Specialty	**Respondents (%)**
Single Specialty hospitals	**54 (24.22%)**
Multi-Specialty hospitals (including Super-specialty)	**107 (47.98%)**
Non- Specialty (General Hospitals)	**62 (27.80%)**

Table 6.19: Sample Characteristics based on Location representation

Hospital-side Sample: city-wise break-up *Note: Numbers represent the counts, followed by its percentage in the sample*	
City	**Respondents (%)**
NORTHERN-INDIA (Delhi, NCR)	**64 (28.70%)**
SOUTHERN-INDIA (Chennai, Vellore, Suburbs)	**51 (22.87%)**
EASTERN-INDIA (Kolkata, Howrah, 24-Parganas)	**62 (27.80%)**
WESTERN-INDIA (Mumbai, Suburbs)	**46 (20.63%)**

Table 6.20: Sample Characteristics based on Respondent's experience in years in referred digital technology (EHR or similar digital technologies)

Hospital-side Sample characteristics based on: Years of experience using EHR or similar digital technologies *Note: Numbers represent the counts, followed by its percentage in the sample*	
Years of digital technology experience	**Respondents (%)**
Below 2 years	**95 (42.60%)**
2 - 5 years	**86 (38.57%)**
Above 5 years	**42 (18.83%)**

Table 6.21: Sample Characteristics based on Respondent's experience in years in referred digital technology (ERP or similar integrating platforms)

Hospital-side Sample characteristics based on: Years of experience using ERP or similar integrating platforms *Note: Numbers represent the counts, followed by its percentage in the sample*	
Years of digital technology experience	**Respondents (%)**
Less than 2 years	**57 (25.56%)**
2 - 5 years	**102 (45.74%)**
Above 5 years	**64 (28.70%)**

6.2.2.3 Data Collection- Supplier Side:

This study not only focuses on the hospital-side impacts of the digital technology implementation but also analyses their impacts on the context of hospital-suppliers as well. The supplier-side framework with the proposed hypotheses is illustrated in the *Fig. 6* in the 'Hypothesis Development' section. The supplier-side data collection was based on the supplier details obtained from the hospitals while undergoing the hospital-side data collection on a referral-based approach. The hospitals were requested to share the contact details of their principal suppliers who primarily supplied almost 35% (approximately one-third) of the total suppliers of the hospitals in terms of value for that particular category of supplies. This cut-off criterion was only kept because the suppliers who are dealing with more than 30% of the hospitals' supplies can only analyze the further process and business outcomes of the hospitals and suppliers context as considered in this research study. The four major categories of suppliers which were highlighted during study were *Pharmaceutical, Surgical, Devices-Prosthetics and General Supplies*. The suppliers who had technology exposures were primarily selected for this study. From the initial discussions with the experts it was evident that out of the two digital technologies considered in this study i.e. EHR and ERP, EHR was only focused of the hospital-side focusing on patients' medical data and did not have relevance for the supplier-side scenario. Thus, digital integration using ERP or related integration tools were specifically targeted for the supplier-side results.

The supplier-side questionnaire which was finalized after the Q-sorting process was administered to all the target suppliers located across various cities and towns of India either online or in face-to-face mode by explaining them the background on this study. All the target suppliers' details were obtained only from the information provided by the selected hospitals, so there was no specific sampling method or sequence used for suppliers' context. Thus, entire consolidated list of suppliers as provided by all the responding hospitals were contacted for the data collection. The researcher has clearly explained the context of the research study and assuring them the confidentiality clauses which was clearly ensured in this research process.

Unit of Response, Sample-Size & Response-Rate- Supplier-Side:

The unit of response from the supplier-side responses were solely taken from the hospital-suppliers' executives, representatives, managers, divisional heads or team-members who were involved in the order management, supplies planning and execution, procurement, processing consignment delivery, managing hospital relations or managing the issues with the supplying hospitals. Basically, all those individuals were considered for responses that were the face of hospital-suppliers in front of the hospitals involved in this study.

The sample of the supplier-side was closely related to the responses that were obtained from the hospital-side responses. In this study, the hospital-side responses were captured from 223 hospital respondents. All of them were contacted for sharing their supplier details, but finally 210 hospital-respondents shared the contact details of their principal suppliers which were either single supplier or multiple suppliers for one hospital. For this study, the consolidated list of supplier-side sample came out as 706 supplier entities who were all contacted for the responses. The questionnaire documents were sent to all the supplier entities either through Emails or WhatsApp or face-to-face *(in some cases)*. With several follow-ups, the responses of 242 supplier entities were found to be complete and could be used for this study; thus, showing as effective response rate of 34.28% which is considered as an healthy response rate in healthcare sector consideration (Churchill, 1979); and also supplier-side sample spread across India and not only concentrated in four major metro-city areas considered in this study.

Sample Characteristics & Demographics- Supplier-Side:

The supplier-side sample size is 242 with suppliers from various supply categories like Pharmaceutical Suppliers, Surgical Suppliers, Device-Prosthetics Suppliers, General Suppliers, or any Other Supplier. The supplier-side responses are also analyzed on their years of experience in using the digital technologies *(ERP or any other integration tools). (Table-6.22, 6.23 provides the sample demographic details of all these categories)*.

Table 6.22: Supplier demographics based on the Supplier-categories

Supplier-side sample characteristics based on supply-categories from supplier firm *Note: Numbers represent frequency, followed by the percentage of the sample in parentheses*	
Category of Supplies Involved	**Respondents (%)**
Pharmaceutical suppliers	**63 (26.03%)**
Surgical supplies	**45 (18.59%)**
Devices-Prosthetics supplies	**27 (11.15%)**
General supplies	**57 (23.55%)**
Any Other Supplier	**50 (20.66%)**

Table 6.23: Supplier demographics based on Years of experience in using the Digital integration platform (ERP)

Supplier-side sample characteristics based on: Years of experience of the using the Digital integration platform (ERP) ***Note: Numbers represent frequency, followed by the percentage of the sample in parentheses***	
Years of experience using ERP or any integrating Digital platform mode	**Respondents (%)**
Below 2 years	**85 (35.12%)**
2 - 5 years	**99 (40.9%)**
Above 5 years	**58 (23.97%)**

6.3 NON-RESPONSE BIAS

Non-response bias is a challenging factor which needs to be considered in Survey-based studies. Yu and Cooper (1983) highlighted an opinion that non-response indicated that respondents did not understand the study context or refused to response. Churchill and Peter (1995) argued that although the people who are responding provide positive inclination to the study subject but whether the people who are not responding has some negative feeling about the study; then in that case it is difficult to generalize the survey sample study for the entire population. Thus, overcoming this Non-response bias is an important step before the sample can be generalized to population (Armstrong and Overton, 1977). Past researcher have highlighted that using easy terminologies, explaining the study context in detail in the questionnaire cover letter, promising confidentiality can increase the response-rates (Armstrong and Overton, 1977; Yu and Cooper, 1983; Oppenheirn, 1992). Thus, in this study the researcher has taken special care on each and every detail of the questionnaire responses and also tried to connect directly either online or telephonic or face-to face to explain the details of this study requirement; thus, resulting in a higher response rate and avoiding repetition of the data collection process, which was helpful in this study.

6.4 IDEAL SAMPLE SIZE- Discussion:

In case of empirical research-based studies for it is highly important to determine the acceptable sample-size for a particular study for making the research adequately stable, relevant, reducing error and closely corresponding to the population factors in the study context. Small sample size study has a low statistical power, low reproducibility of results and often considered as an inefficient and unreliable research (Button et al., 2013). In the extant literature, several discussions and recommendations are available to highlight the importance of sample size in survey based quantitative study for achieving the relevant construct validity and reliability (Gorsuch, 1983; Comrey and Lee, 1992; MacCallum et al., 1999). Research guidelines stated that ideal sample size is dependent on either the minimum necessary sample size or the minimum ratio of sample size to the number of variables being analysed (Velicer and Fava, 1998; Arrindell and van der Ende, 1985). MacCallum et al. (1999) emphasized the details of sample-size in factor analysis literature and highlighted that the aspects for necessary sample size is dependent upon various factor like level of communality of the variables & level of overdetermination of the factors; thus, requiring a minimum acceptable sample number to assure. Comrey and Lee (1992) presented a rough rating scale for sample sizes as: 100 = poor, 200 = fair, 300 = good, 500 = very good, 1,000 or more = excellent. Some researchers highlighted a ‘rule of 5’ which emphasized that the sample per item should be minimum 5 in the survey to be kept mandatory and acceptable (Gorsuch, 1983; MacCallum et al. 1999; Hair et al. 2006; Garson, 2008).

This study has followed the ‘rule of 5’ as specified in various studies like Hair et al., 2006. In this study the finalized items for the survey questionnaires after Q-sorting came out as 42 items for the hospital-side and 38 items for the supplier-side. Thus, for considering the ideal sample size on following the ‘rule of 5’, this study has considered the hospital-side sample size of 223 and supplier-side sample size to be 242 as per the recommendations from experts and backed by extant literature evidences to make the sample adequate for making the study relevant, valid and generalizable.

6.5 METHODS OF ANALYSIS

The primary motive of this study is to quantitatively examine the impact of EHR Adoption and ERP Implementation on the process-level capabilities (Transparency & Interoperability), dynamic-capabilities (Quality, Delivery-dependability, Flexibility and Responsiveness), servicing-capabilities, operational and financial performance. Thus, it is essential to test the strength of the linkages within these research-constructs which is objectified by sample data to quantitatively validate the hypotheses developed earlier. The analysis method focuses on the analysis of the strength of relationships within these constructs and also validating the model-fit to operationalize the proposed framework of this research (Anderson and Gerbing, 1988).This involves firstly - Construct-wise Exploratory factor Analysis (EFA) Secondly - Confirmatory factor analysis (CFA) & thirdly - Structural equation modelling (SEM) often used in such quantitative research studies (Hair et al., 2006; Chakraborty 2015; Fiaz et al., 2018).

6.5.1 Exploratory Factor Analysis (EFA):

EFA is a statistical method for exploring the correlations among the observed variables/items in the process of research (Grant and Fabrigar, 2007). EFA is needed to examine whether the items of each construct holds good as a single construct and achieves uni-dimensionality by measurements of Cronbach's alpha (Nunnally, 1978; Fabrigar et al., 1999; Hayton et al., 2004). It also provides clarity on the paradigms of attitudes and mathematical as it provides more empirical results for the factors than philosophical (Gorsuch, 1988; Cudeck, 2000).

6.5.2 Confirmatory Factor Analysis (CFA):

CFA is another statistical technique popularly used in empirical social sciences research to quantify and validate the construct validity providing evidences of the convergent and the discriminant validity (Curran et al., 1996). CFA also identifies the correlations between factors to facilitate validation of the fitness of the hypothesized model using data taken from the sample; thereby establishing reliability and validity of the measurement model (Marsh et al., 1988; Curran et al., 1996).

6.5.3 Structural Equation Modelling (SEM):

SEM technique is referred to as a combination of CFA and multiple regression methods (Anderson and Gerbing, 1988; Schreiber et al., 2006). It uses factor analysis, path analysis and multiple regression analysis for testing the causal relationships among the constructs which can be simultaneous and multi-dimensional (Hooper et al., 2008). SEM technique helps to illustrate nuanced view of the path linkages and also provides the strength of relationships between the variables of the entire framework as it expresses hierarchical and non-hierarchical relationships among the variables (Bullock et al. 1994). SEM validates the research model by measuring the loadings of observed items and provides details about the validities and reliabilities of the constructs being analysed by generating the overall model-fit indices (like Chi-square/df, RMSEA, GFI, CFI, TLI, NFI, etc[23]) (Barroso et al., 2010). The primary goal of SEM is to validate the model-fit and provide a statistical validation of the hypothesized theoretical model to determine the extent to which the theoretical model is actually supported by the sample data; thus finalizing the framework, characterizing real-world processes and helping in further operationalization by generalization of the sample to the population as a whole (Lomax and Schumacker, 2004; Byrne, 2016). AMOS and LISREL are the two most widely used software packages for SEM.

There are two major types of SEM techniques: *Covariance-based SEM (CBSEM) – i.e. maximum likelihood (ML) estimation and Partial Least Squares (PLS)*. The ML based SEM is covariance based whereas the PLS method is variance based technique to find out the relationship between latent/unobserved variables (Gefen et al. 2000; Barroso et al., 2010). CBSEM (ML) is more suited for confirmatory research where prior theoretical background is strong and research targets on empirical investigation on that basis, focusing on estimating the parameters of the research model for minimizing the difference between sample covariance and the theoretical model (Gefen et al. 2000). PLS is suited primarily for exploratory research for

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[23] **Chi-square/degrees of freedom (i.e. $\chi2$ / d.f.): degree of freedom**
RMSEA: Root Mean Square Error of Approximation
GFI: Goodness of fit index
CFI: Comparative fit index
TLI: Tucker Lewis index
NFI: Normed fit index

fundamental theory development. PLS focuses on predicting the dependent variables by minimizing the variance (Wold, 1985).

In case of measurement models in research the constructs formed can be of two types: 'formative construct' and 'reflective constructs'. In 'formative construct' the item variables are generated first and then the constructs are formed which shows causality from items to constructs whereas in 'reflective constructs' the constructs are first formed and then the items are generated which are related to each other showing the direction of causality from constructs to items and also the items are internally consistent, interchangeable and considered equal. PLS can be used in both formative and reflective construct whereas CBSEM (ML based SEM) is focussed only on reflective constructs. PLS can be used in very small sample size whereas, ML based SEM is used for larger sample size to provide proper validation (Barroso et al., 2010; Gefen et al. 2000; Wold, 1985).

In this study, ML based SEM (CBSEM) has been used for the below reasons:

- This study uses only reflective constructs and ML-SEM is most largely used SEM technique for reflective constructs.
- This is a constructive study backed by theoretical underpinnings.
- Sample-size taken in this study is as per the 'Rule of 5' which most suitable for ML based SEM.
- Licensed version of AMOS 20.0 software package has been used for performing the ML-SEM.

6.6 PSYCHOMETRIC PROPERTIES OF SCALES-Validity & Reliability

Analyzing the properties of the scales to be used for measuring the items of the reflective constructs is highly crucial in research analysis. It is highlighted in various extant literatures that analysis of the **validity** and **reliability** of the instruments for measuring the constructs is primarily essential for the practical application of the research (Knight, 1997; Sessler et al., 2002). Reliability has close associations with Validity as highlighted that a measurement instrument can only be valid if it is reliable; however, the reliability measure is independent of its validity measure (Tavakol and Dennick, 2011). Thus, paying attention to both of these properties helps to insure the quality of research measurement and data collected for the study (Fernández-Berrocal et al., 2004).

6.6.1 Validity Measures:

Validity of an instrument is referred to as the degree to which a set of instruments accurately measures what it intends to measure (Sessler et al., 2002; Fernández-Berrocal et al., 2004). In this study the validity has been measured by using: ***Content Validity, Convergent Validity and Discriminant Validity.***

- ***Content Validity:*** (also known as face validity) indicates the extent to which the items of a construct can adequately represent the content of the constructs. Content validity refers to the degree to which the instrument can cover the content of the research that it is supposed to measure (Yaghmale, 2003). The measure of content validity is theoretically obtained from the comprehensive extant literature review and evaluation done by subject matter experts as done by Q-Sorting and requires no statistical measures (Yaghmale, 2003; Babbie, 1992; Nunnally, 1978).

- ***Convergent Validity:*** refers to the degree to which the measurement items of the single research construct show correlations with each other and converges to form common variance (Cunningham et al., 2001). Convergent validity of the research constructs can be measured by examining the factor loadings and the average variance extracted (AVE) of each of the constructs. AVE is referred to as the ratio of the 'sum of the squared standardized loadings' and the 'sum of the sum of squared standardized loadings and sum of the measurement error variances' (Fornell and Larcker, 1981). For achieving a significant convergent validity the value of the factor loadings and AVE needs to be ≥ 0.5 (50%).

The formula for calculating average variance extracted (AVE) is:

$AVE = (L_1^2+L_2^2+...L_k^2) / [(L_1^2+ L_2^2+...L_k^2) + Var (E_1) + Var (E_2) + ... + Var (E_k)]$ Where $L_i =$ the standardized factor loadings of 'i' on a factor E_i= the measurement error associated with each measurement variable   'k' is the number of measurement variables measuring a construct   'i' is the index of respective measurement variables and 'i' = 1 to 'k'   Var (Ei) = the error variance

- ***Discriminant Validity:*** also known as divergent validity is referred to as the concept of how the measurement items of one construct can be truly distinctive of the others or can be differentiated from the other constructs in the study (Cable and DeRue, 2002). The evidence of discriminant validity can be obtained by AVE estimates of the individual constrcuts, where AVE (Average Variance Extracted) estimates for two factors of one construct should be greater than the square of the inter-construct correlation values between the two factors (Fornell and Larcker, 1981; Hair et al. 2006). High discriminant validity resembles that a construct is distinctive and it highlights some unique phenomena that other constructs are not capturing. CFA is the majorly used technique of measuring discriminant validity. Some studies also highlighted SEM as the measurement model for discriminant validity where the significant factor loadings are ≥0.70 and fit indices ≥0.90. Using SEM, discriminant validity can be assessed between one pair of factors at a time by using a default measurement model where correlation parameters between the factor pairs are constrained as 1 and chi-square difference values are measured for constrained model and unconstrained model and if the chi-square difference of the constrained model is greater than the unconstrained model by four, then discriminant validity between the construct pairs are evident (Anderson and Gerbing, 1988; Shook et al., 2004).

6.6.2 Reliability Measures:

Reliability of an instrument is the referred to as the degree to which a set of instruments can be consistent in measuring the parameter that it is supposed to measure irrespective of multiple repeated attempts of measurements (Hair et al. 2006). The well-known reliability measures for calculating the Cronbach's Alpha, Composite Reliability, and Indicator Reliability values.

- **Cronbach's Alpha:** Cronbach's Alpha value is established as a predominant measure of reliability when multiple item measures are employed (Tavakol and Dennick, 2011). This alpha measure was first developed by Lee Cronbach in 1951 (Cronbach, 1951). It determines the internal consistencies, average correlations of the items and unidimensionality/homogeneity of the items within the constructs ranging from 0 to 1 (Santos, 1999; Hair et al., 2006). The Cronbach's alpha measures are obtained from EFA with the values ranging from 0.5 or 0.6 or >0.7. Cronbach's alpha values of 0.5 is considered as poor consistency or heterogeneity while value 0.7 are with acceptable consistencies and further values >0.8 and considered to be with high internal consistency (Santos, 1999; Gliem and Gliem, 2003; Hair et al., 2006). However, If Cronbach Alpha value is too high then it indicates that some items are redundant and testing same question in a different way. Thus, maximum recommended alpha value is 0.90 (Tavakoland Dennick, 2011).

- **Composite Reliability:** Composite Reliability (CR) is another popular measure of internal consistencies of the items of the constructs and measures the reliability of heterogeneous but similar items of the constructs as derived from CFA & SEM (Hair et al., 2006). It is defined as the 'square of summed standardized loadings' divided by the 'sum of the square of summed standardized loadings and sum of measurement error variances' (Fornell and Larcker, 1981). CR values greater than 0.6 is considered as good internal consistency of items within constructs and less than 0.6 is not acceptable for same construct (Hair et al., 2006).

$CR = [(L_1 + L_2 + ... L_k)^2 / [(L_1 + L_2 ... L_k)^2 + (Var(E_1) + Var(E_2) ... + Var(E_k))]$

Where,

L_i = the standardized factor loadings of 'i' on a factor

E_i= the measurement error

'k' is the number of measurement variables measuring a construct

'i' is the index of respective measurement variables, 'i' = 1 to 'k'

Var (Ei) = Measurement error variances

- **Indicator Reliability:** Indicator reliability measure is obtained from CFA & SEM by calculating the squared multiple correlations (SMC). SMC measures the strength of relationships of a dependent variable on the set of all independent variables. If there are k-measurement variables for a construct, then one can calculate 'k' SMCs. If each of the k-variables in the CFA is taken as a dependent variable, and performed regression on the remaining (k-1) variables, then the resulting regression measure (R^2) from each of the k regressions represents the SMC of that measurement variable which is given by the below given formula. SMC value of greater than 0.5 is acceptable for reliability indicator (Fornell and Larcker, 1981).

$SMC_i = (L_i^2) / [(L_i^2) + (Var(E_i))]$

Where,

SMCi= Squared multiple correlations of variable 'i' with all other (k-1) variables; i=1,2,….., k.

L_i = the standardized factor loadings of 'i' on a factor

E_i= the measurement error

'i' is the index of respective measurement variables, 'i' = 1 to 'k'

Var (E_i) = the error variance

6.7 Chapter Summary

The summary of this chapter is as follows:

This chapter discusses the entire research methodology applied in this study as illustrated by the flow diagram- *'Figure-6.1: Research Methodology Flow Diagram'*. As discussed, section-6.1 describes the survey based research technique which involves pre-pilot study, pilot study (q-sort), survey instrument development i.e. questionnaire development both in hospital-side and suppliers'-side. In section-6.2, description regarding the large scale validation process. It describes the hospital and supplier-side sampling procedures, data collection. Sections- 6.3 and 6.4 covers the non-response bias and discussions on ideal sample size. Further section-6.5 describes the methods of analysis which involves exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and structural equation modelling (SEM) and finally section-6.6 explains the validity and reliability measures of scale.

The next chapter i.e. chapter-7 provides the details regarding data analysis results which illustrates the results obtained from EFA, CFA and SEM both at the hospital-side and at the supplier-side.

CHAPTER-VII

7 DATA ANALYSIS RESULTS

The previous chapter i.e. chapter-6 has discussed the backbone of research study which is research methodology. The chapter has described research design stages involving item generation, pre-pilot testing, pilot testing i.e. q-sort; questionnaire development, sampling procedures and data collection process from hospital as well as supplier. The previous chapter has also highlighted methods of analysis applied in this study i.e. EFA, CFA and SEM; non-response bias measures and also includes the validity and reliability measures of scale. The current chapter titled as 'Data analysis results' provides the detailed analysis of large scale empirical study conducted in this study both at the hospitals' end as well as at the suppliers' end. It highlights the statistical quantitative techniques applied for analyzing the data and providing the results in the study.

Below section-7.1 provides the details of exploratory factor analysis (EFA) which results in construct-wise item loadings, average variance extracted (AVE) values and Cronbach's Alpha values and also provides confirmatory factor analysis (CFA) results which include model-fit indices, validity and reliability measures of both hospital-side and supplier-side.

7.1 EMPIRICAL LARGE-SCALE STUDY

This research-work focuses on the Indian-healthcare context both hospital-side and their supplier-side and results obtained from this study are being analyzed with the data using the statistical methodologies focusing on the research objectives and highlighting the findings obtained from the study.

7.1.1 Exploratory Factor Analysis:

Exploratory factor analysis (EFA) needs to be performed for checking the uni-dimensionality of the constructs (Grant and Fabrigar, 2007). Pilot testing was already done by Q-sorting technique so EFA used in this study is only construct-wise and not for entire item sets, thus there was no data or factor reduction in these items post Q-sort (Tenehaus et al., 2005; Hair et al., 2006). In general, EFA is performed for exploratory study for all the items taken together in the study but in this study construct-specific-EFA is conducted when the items' variance is calculated factor-wise (1 construct at a time). In this study, the framework is analyzed for both hospital-side and supplier side separately, thus, construct-wise EFA is performed for both hospital-side and supplier side constructs separately.

7.1.1.1 Exploratory Factor Analysis- Hospital-Side:

The below table provides the calculated values of Construct-measurement item loadings, Average variance extracted (AVE) values and the Cronbach's Alpha values of the Hospital-side data analyzed construct-wise for all the 11 constructs based on the data obtained through questionnaire survey. The *Table-7.1* lists the item-loadings obtained from the construct-wise EFA and not from the overall EFA; the AVE values computed here are the summated-averages of all the standardized item loadings.

Table 7.1: Construct-wise EFA Results - Hospital-Side

Constructs	Measurement Items	Item Loadings	AVE Values	Cronbach's Alpha
EHR Adoption (EHRADP)	EHRADP1	0.768	0.721	0.712
	EHRADP2	0.722		
	EHRADP3	0.703		
	EHRADP4	0.691		
ERP Implementation (ERPIMP)	ERPIMP1	0.755	0.7255	0.89
	ERPIMP2	0.741		
	ERPIMP3	0.738		
	ERPIMP4	0.668		
Transparency (TRNSPY)	TRNSPY1	0.845	0.81325	0.889
	TRNSPY2	0.821		
	TRNSPY3	0.82		
	TRNSPY4	0.767		
Interoperability (INTOPR)	INTOPR1	0.865	0.81425	0.889
	INTOPR2	0.855		
	INTOPR3	0.803		
	INTOPR4	0.734		
Quality (QUALTY)	QUALTY1	0.707	0.73225	0.891
	QUALTY2	0.775		
	QUALTY3	0.727		
	QUALTY4	0.72		
Delivery Dependability (DELDEP)	DELDEP1	0.582	0.551	0.894
	DELDEP2	0.541		
	DELDEP3	0.53		
Flexibility (FLXLTY)	FLXLTY1	0.881	0.7625	0.906
	FLXLTY2	0.871		
	FLXLTY3	0.672		
	FLXLTY4	0.626		
Responsiveness (RSPNSV)	RSPNSV1	0.861	0.828333	0.851
	RSPNSV2	0.847		
	RSPNSV3	0.777		
Servicing Capability (SRVCAP)	SRVCAP1	0.898	0.79075	0.834
	SRVCAP2	0.791		
	SRVCAP3	0.756		
	SRVCAP4	0.718		

Operational Performance (OPTPRF)	OPTPRF1	0.712	0.68975	0.871
	OPTPRF2	0.711		
	OPTPRF3	0.711		
	OPTPRF4	0.625		
Financial Performance (FINPRF)	FINPRF1	0.866	0.78725	0.847
	FINPRF2	0.763		
	FINPRF3	0.763		
	FINPRF4	0.757		

All construct specific EFAs had acceptable KMO values of above 0.8 and Bartlett's test of sphericity for all construct-wise EFAs was significant at 0.1%.The above results highlight that the item loadings of almost all the items are above 0.5 and the AVE values for all the constructs are above 0.5 (50%) which shows that the selected measurement items are valid for the respective constructs and also confirms the significant convergent validity of the items (Fornell and Larcker, 1981). The above EFA results also highlight the reliability measures of the items of all the constructs as Cronbach's Alpha measure of reliability is above 0.7 for all the constructs which is standardized and acceptable across studies (Hair et al., 2006). Thus, the above construct-wise EFA result confirms unidimensionality, validity and reliability of the hospital-side measurement items considered in this study.

7.1.1.2 Exploratory Factor Analysis- Supplier-Side:

Similar to the hospital-side, Construct-wise EFA is again conducted for the supplier-side measurement items. The below *Table-7.2* provides the calculated values of Construct-measurement item loadings, Average variance extracted (AVE) values and the Cronbach's Alpha values of the Supplier-side data analyzed for 10 constructs *(excluding EHR-Adoption)* from the data obtained through supplier-side questionnaire.

Table 7.2: Construct-wise EFA Results - Supplier-Side

Constructs	Measurement Items	Item Loadings	AVE Values	Cronbach's Alpha
ERP Implementation (ERPIMP)	ERPIMP1	0.89	0.8	**0.875**
	ERPIMP2	0.873		
	ERPIMP3	0.737		
	ERPIMP4	0.7		
Transparency (TRNSPY)	TRNSPY1	0.912	0.81575	**0.875**
	TRNSPY2	0.912		
	TRNSPY3	0.834		
	TRNSPY4	0.827		
Interoperability (INTOPR)	INTOPR1	0.83	0.778	**0.871**
	INTOPR2	0.802		
	INTOPR3	0.752		
	INTOPR4	0.728		
Quality (QUALTY)	QUALTY1	0.861	0.828	**0.853**
	QUALTY2	0.833		
	QUALTY3	0.816		
	QUALTY4	0.802		
Delivery Dependability (DELDEP)	DELDEP1	0.899	0.846	**0.872**
	DELDEP2	0.854		
	DELDEP3	0.785		
Flexibility (FLXLTY)	FLXLTY1	0.865	0.8215	**0.872**
	FLXLTY2	0.819		
	FLXLTY3	0.817		
	FLXLTY4	0.785		
Responsiveness (RSPNSV)	RSPNSV1	0.869	0.839	**0.858**
	RSPNSV2	0.86		
	RSPNSV3	0.788		
Servicing Capability (SRVCAP)	SRVCAP1	0.822	0.7555	**0.906**
	SRVCAP2	0.763		
	SRVCAP3	0.736		
	SRVCAP4	0.701		
Operational Performance (OPTPRF)	OPTPRF1	0.912	0.80525	**0.904**
	OPTPRF2	0.851		
	OPTPRF3	0.849		
	OPTPRF4	0.609		
Financial Performance (FINPRF)	FINPRF1	0.875	0.7635	**0.761**
	FINPRF2	0.867		
	FINPRF3	0.865		
	FINPRF4	0.447		

All construct specific EFAs had acceptable KMO values of above 0.8 and Bartlett's test of sphericity for all construct-wise EFAs was significant at 0.1%.Similar to the hospital-side EFA analysis, the same analysis method is applied for the supplier-side data as well. Hence, the above results also highlight that the item loadings of almost all the items are above 0.5 and the AVE values for all the constructs are above 0.5 (50%), confirming the significant convergent validity of the items (Fornell and Larcker, 1981). It is also evident from the results that the Cronbach's Alpha measure of reliability is above 0.7 for all the constructs thus, confirming acceptable measurement value (Hair et al., 2006). Thus, the supplier-side EFA results also confirm unidimensionality, validity and reliability of the supplier-side measurement items considered in this study.

7.1.2 CONFIRMATORY FACTOR ANALYSIS:

Confirmatory factor analysis (CFA) is used to test whether the measures of a construct are consistent with the researchers' theoretical understanding of the construct in the study i.e. to test if the data collected in the study is fitting the hypothesized model. CFA has been used to check the validity and reliability of the measurement model finalized in this study. The major results obtained from CFA are convergent validity; discriminant validity & model-fit indices. The software package- AMOS 20.0 was used in this study for performing CFA.

7.1.2.1 Confirmatory Factor Analysis- Hospital-Side:

The hospital-side model is subjected to the standardized CFA process of Model Specification, Model Identification, Model Estimation, Model Assessment and re-specification (Reisinger and Mavondo, 2007).

Model Fit: Hospital-Side

The below *Table-7.3* provides the consolidated details of the model-fit parameters of the study model in the hospital-side.

Table 7.3: Model fit indices Table: Measurement Model (Hospital-side)

Model Indices	CMIN/DF	CFI	IFI	TLI	GFI	RMSEA
Measurement Model Statistics	1.331	0.957	0.958	0.951	0.830	0.039
Acceptable Criterion	≤4.000	≥0.900	≥0.900	≥0.900	≥0.900	≤0.050

Where, ***CMIN/DF*** *represents Chi-square/degrees of freedom (i.e.* χ^2*/ d.f.)*

GFI *= Goodness of fit index,*

CFI *= Comparative fit index,*

TLI*= Tucker Lewis index,*

IFI*= Incremental fit index &*

RMSEA*= Root mean square error of approximation.*

From the model-fit measures table above it is evident that the model-fit indices obtained from the hospital-side data is matching with the acceptable statistical criterion. The values of four measurement model indices i.e. CMIN/DF, CFI, IFI, TLI & RMSEA are all within the acceptable criterion and the value of GFI is 0.830 which is also slightly below perfect 0.900. Ideally, any 4 or 5 should be within recommended values for the model to be considered fit. In this study 5 indices are within acceptable range and the one which is slightly lower than acceptable range is also very near to the acceptable criterion. Thus, showing a good model-fit and hence confirming the model-fit.

Validity Of The Measurement Model: Hospital-Side

The below *Table-7.4* show the ‘Standardized Estimates’, p-values i.e. probability of rejection and AVE values of all constructs. The values obtained demonstrate that the Standardized estimates of all items of each and every construct are >0.5 and AVE values of all the constructs for the hospital-side data are >0.5. Thus, confirming the Convergent Validity of the constructs.

Table 7.4: Convergent Validity of the Measurement Model -Hospital-side

Constructs	Measurement Items	Standardized Estimates	p-values	AVE
EHR Adoption (EHRADP)	EHRADP1	0.537	****	0.721
	EHRADP2	0.647	****	
	EHRADP3	0.550	****	
	EHRADP4	0.733	****	
ERP Implementation (ERPIMP)	ERPIMP1	0.825	****	0.7255
	ERPIMP2	0.787	****	
	ERPIMP3	0.789	****	
	ERPIMP4	0.873	****	
Transparency (TRNSPY)	TRNSPY1	0.879	****	0.81325
	TRNSPY2	0.776	****	
	TRNSPY3	0.784	****	
	TRNSPY4	0.828	****	
Interoperability (INTOPR)	INTOPR1	0.927	****	0.81425
	INTOPR2	0.743	****	
	INTOPR3	0.781	****	
	INTOPR4	0.826	****	
Quality (QUALTY)	QUALTY1	0.924	****	0.73225
	QUALTY2	0.767	****	
	QUALTY3	0.726	****	
	QUALTY4	0.865	****	
Delivery Dependability (DELDEP)	DELDEP1	0.854	****	0.551
	DELDEP2	0.808	****	
	DELDEP3	0.918	****	
Flexibility (FLXLTY)	FLXLTY1	0.996	****	0.7625
	FLXLTY2	0.673	****	
	FLXLTY3	0.948	****	
	FLXLTY4	0.714	****	
Responsiveness (RSPNSV)	RSPNSV1	0.824	****	0.828333
	RSPNSV2	0.743	****	
	RSPNSV3	0.870	****	
Servicing Capability (SRVCAP)	SRVCAP1	0.710	****	0.79075
	SRVCAP2	0.962	****	
	SRVCAP3	0.704	****	
	SRVCAP4	0.653	****	

Operational Performance (OPTPRF)	OPTPRF1	0.857	****	0.68975
	OPTPRF2	0.719	****	
	OPTPRF3	0.738	****	
	OPTPRF4	0.875	****	
Financial Performance (FINPRF)	FINPRF1	0.896	****	0.78725
	FINPRF2	0.637	****	
	FINPRF3	0.827	****	
	FINPRF4	0.685	****	

***** Implies significant at p<0.001 i.e. significant at 0.1%*

In the below *Table-7.5* the diagonal elements are indicating the AVE values of the constructs, while the off-diagonal elements indicate the squared inter-construct correlations. These values confirm the convergent validity when the diagonal values i.e. AVE values are greater than 0.5 and discriminant validity is confirmed when the diagonal AVE values are greater than off-diagonal values (Hair et al., 2006; Anderson and Gerbing, 1988; Fornell and Larcker, 1981).

Table 7.5: Discriminant Validity Test Results - Hospital-side data

	QUA LTY	**EHR ADP**	**OPT PRF**	**ERP IMP**	**DEL DEP**	**INT OPR**	**FIN PRF**	**TRN SPY**	**SRV CAP**	**FLX LTY**	**RSP NSV**
QUA LTY	**0.732**										
EHR ADP	0.008	**0.721**									
OPT PRF	0.023	0.001	**0.689**								
ERP IMP	0.245	0.002	0.381	**0.725**							
DEL DEP	0.138	0.006	0.043	0.246	**0.551**						
INT OPR	0.008	0.014	0.151	0.213	0.005	**0.814**					
FIN PRF	0.114	0.001	0.005	0.020	0.078	0.015	**0.787**				
TRN SPY	0.220	0.004	0.251	0.231	0.008	0.087	0.060	**0.813**			
SRV CAP	0.225	0.002	0.139	0.010	0.138	0.063	0.038	0.015	**0.791**		
FLX LTY	0.558	0.004	0.003	0.326	0.151	0.181	0.082	0.083	0.027	**0.762**	
RSP NSV	0.155	0.056	0.265	0.073	0.111	0.096	0.008	0.008	0.000	0.171	**0.828**

****Note:** Diagonal values are AVE, non-diagonal values are squared inter-construct correlations

Reliability Of The Measurement Model: Hospital-Side

CFA confirms the reliability of the constructs by computing squared multiple correlations (SMCs) for each indicator and composite reliability (CR) of the constructs. The statistical acceptable criteria of SMC is>=0.5 and that of CR is >=0.6.

Below *Table-7.6* presents the measures of SMC and CR. The SMC & CR measures presented in the table are almost >= the acceptable criteria which is CR>0.6 & SMC>0.5. Thus, confirming the reliability of the constructs.

Table 7.6: Reliability of the Constructs - Hospital-Side data

Constructs	Measurement Items	Squared Multiple Correlations (SMC)	Composite Reliability CR)
EHR Adoption (EHRADP)	**EHRADP1**	**0.484 (~ =0.5)**	**0.812**
	EHRADP2	**0.514**	
	EHRADP3	**0.394 (~=0.5)**	
	EHRADP4	**0.547**	
ERP Implementation (ERPIMP)	**ERPIMP1**	**0.676**	**0.816**
	ERPIMP2	**0.613**	
	ERPIMP3	**0.618**	
	ERPIMP4	**0.760**	
Transparency (TRNSPY)	**TRNSPY1**	**0.776**	**0.887**
	TRNSPY2	**0.599**	
	TRNSPY3	**0.617**	
	TRNSPY4	**0.681**	
Interoperability (INTOPR)	**INTOPR1**	**0.857**	**0.888**
	INTOPR2	**0.553**	
	INTOPR3	**0.609**	
	INTOPR4	**0.685**	
Quality (QUALTY)	**QUALTY1**	**0.883**	**0.822**
	QUALTY2	**0.571**	
	QUALTY3	**0.527**	
	QUALTY4	**0.729**	
Delivery Dependability	**DELDEP1**	**0.861**	**0.567**
	DELDEP2	**0.647**	

(DELDEP)	**DELDEP3**	**0.716**	
Flexibility (FLXLTY)	**FLXLTY1**	**0.507**	**0.851**
	FLXLTY2	**0.897**	
	FLXLTY3	**0.461(~=0.5)**	
	FLXLTY4	**0.994**	
Responsiveness (RSPNSV)	**RSPNSV1**	**0.746**	**0.868**
	RSPNSV2	**0.559**	
	RSPNSV3	**0.685**	
Servicing Capability (SRVCAP)	**SRVCAP1**	**0.469 (~=0.5)**	**0.871**
	SRVCAP2	**0.500**	
	SRVCAP3	**0.856**	
	SRVCAP4	**0.512**	
Operational Performance (OPTPRF)	**OPTPRF1**	**0.784**	**0.784**
	OPTPRF2	**0.544**	
	OPTPRF3	**0.496**	
	OPTPRF4	**0.730**	
Financial Performance (FINPRF)	**FINPRF1**	**0.458 (~=0.5)**	**0.867**
	FINPRF2	**0.665**	
	FINPRF3	**0.387 (~=0.4)**	
	FINPRF4	**0.839**	

7.1.2.2 Confirmatory Factor Analysis- Supplier-Side:

Similar to hospital-side, CFA is conducted for the supplier-side data as well in order to confirm the validity and reliability of the constructs and test the model-fit of the supplier-side model.

Model Fit: Supplier-Side

Below *Table-7.7* provides the consolidated details of the model-fit parameters of the study model in the supplier-side. The model-fit measures table below demonstrates the model-fit indices obtained from the supplier-side data which is matching with the acceptable statistical criterion. The values of four measurement model indices i.e. CMIN/DF, CFI, IFI, TLI & RMSEA are all within the acceptable criterion and the value of GFI is 0.825 which is also slightly below perfect 0.900. Thus, showing a good model-fit and hence confirming the supplier-side model-fit as per standards.

Table 7. 7: Model-fit Indices Table - Measurement Model (Supplier-side)

Model Indices	CMIN/DF	CFI	IFI	TLI	GFI	RMSEA
Measurement Model Statistics	1.615	0.932	0.933	0.923	0.825	0.05
Acceptable Criterion	≤4.000	≥0.900	≥0.900	≥0.900	≥0.900	≤0.050

*Where, **CMIN/DF** represents Chi-square/degrees of freedom (i.e. χ^2/ d.f.);*
***GFI** = Goodness of fit index;*
***CFI** = Comparative fit index;*
***TLI**= Tucker Lewis index;*
***IFI**= Incremental fit index &*
***RMSEA**= Root mean square error of approximation.*

Validity Of The Measurement Model: Supplier-Side

Below supplier-side *Table-7.8* shows the 'Standardized Estimates', p-values i.e. probability of rejection and AVE values of all constructs. The values obtained demonstrate that the Standardized estimates of all items of each and every construct are >0.5 and AVE values of all the constructs for the supplier-side data are >0.5. Thus, confirming the Convergent Validity of the constructs.

Table 7.8: Convergent Validity of the Measurement Model: Supplier-Side data

Constructs	Measurement Items	Standardized Estimates	p-values	AVE
ERP Implementation (ERPIMP)	ERPIMP1	0.871	****	0.799
	ERPIMP2	0.730	****	
	ERPIMP3	0.757	****	
	ERPIMP4	0.838	****	
Transparency (TRNSPY)	TRNSPY1	0.843	****	0.799
	TRNSPY2	0.793	****	
	TRNSPY3	0.759	****	
	TRNSPY4	0.801	****	

Interoperability (INTOPR)	INTOPR1	0.631	****	0.801
	INTOPR2	0.969	****	
	INTOPR3	0.818	****	
	INTOPR4	0.787	****	
Quality (QUALTY)	QUALTY1	0.881	****	0.781
	QUALTY2	0.829	****	
	QUALTY3	0.929	****	
	QUALTY4	0.487	****	
Delivery Dependability (DELDEP)	DELDEP1	0.908	****	0.836
	DELDEP2	0.687	****	
	DELDEP3	0.914	****	
Flexibility (FLXLTY)	FLXLTY1	0.808	****	0.794
	FLXLTY2	0.767	****	
	FLXLTY3	0.718	****	
	FLXLTY4	0.884	****	
Responsiveness (RSPNSV)	RSPNSV1	0.827	****	0.819
	RSPNSV2	0.764	****	
	RSPNSV3	0.868	****	
Servicing Capability (SRVCAP)	SRVCAP1	0.888	****	0.843
	SRVCAP2	0.800	****	
	SRVCAP3	0.782	****	
	SRVCAP4	0.902	****	
Operational Performance (OPTPRF)	OPTPRF1	0.937	****	0.834
	OPTPRF2	0.689	****	
	OPTPRF3	0.979	****	
	OPTPRF4	0.730	****	
Financial Performance (FINPRF)	FINPRF1	0.660	****	0.665
	FINPRF2	0.628	****	
	FINPRF3	0.548	****	
	FINPRF4	0.823	****	

**** Implies significant at $p<0.001$ i.e. significant at 0.1%

In the below *Table-7.9* the diagonal elements are indicating the AVE values of the constructs, while the off-diagonal elements indicate the squared inter-construct correlations. As described in hospital-side, here also these values confirm the convergent validity and discriminant validity when the diagonal

AVE values are greater than off-diagonal values (Hair et al., 2006; Anderson and Gerbing, 1988).

Table 7.9: Discriminant Validity Test Results - Supplier-side data

	Quality	**OPT PRF**	**ERPI MP**	**DEL DEP**	**INT OPR**	**FINP RF**	**TRN SPY**	**SRV CAP**	**FLX LTY**	**RSP NSV**
Quality	**0.781**									
OPT PRF	0.155236	**0.834**								
ERPI MP	0.046225	0.234256	**0.799**							
DEL DEP	0.024649	0.024025	0.168921	**0.836**						
INT OPR	0.036864	0.006889	0.087025	0.134689	**0.801**					
FINP RF	0.0009	0.011236	0.002304	0.005625	0.000256	**0.665**				
TRN SPY	0.054756	0.024025	0.028224	0.015876	0.076729	0.029584	**0.799**			
SRV CAP	0.023104	0.028224	0.034596	0.010201	0.000625	0.014884	0.000121	**0.843**		
FLX LTY	0.011025	0.099856	0.178084	0.049729	0.024025	0.007921	0.053361	0.026244	**0.794**	
RSP NSV	0.077284	0.1849	0.116281	0.0016	0.000961	0.0121	0.0441	0.000009	0.011025	**0.819**

****Note:** Diagonal values are AVE, non-diagonal values are squared inter-construct correlations

RELIABILITY OF THE MEASUREMENT MODEL: SUPPLIER-SIDE

Reliability of the supplier-side data is computed in a similar manner as done for the hospital-side. For the supplier-side constructs also the reliability is measured by squared multiple correlations (SMCs) for each items and composite reliability (CR) of the constructs. As mentioned earlier, the statistical acceptable criteria of SMC is>=0.5 and that of CR is >=0.6.The below *Table-7.10* presents the computed values of SMC and CR for the supplier-side which are also within the acceptable range thus confirming the reliability of the constructs.

Table 7.10: Reliability of the Constructs - Supplier-Side data

Constructs	Measurement Items	Squared Multiple Correlations (SMC)	Composite Reliability (CR)
ERP Implementation (ERPIMP)	ERPIMP1	0.758	0.878
	ERPIMP2	0.533	
	ERPIMP3	0.574	
	ERPIMP4	0.703	
Transparency (TRNSPY)	TRNSPY1	0.710	0.926
	TRNSPY2	0.629	
	TRNSPY3	0.575	
	TRNSPY4	0.642	
Interoperability (INTOPR)	INTOPR1	0.398	0.860
	INTOPR2	0.939	
	INTOPR3	0.668	
	INTOPR4	0.619	
Quality (QUALTY)	QUALTY1	0.776	0.897
	QUALTY2	0.688	
	QUALTY3	0.863	
	QUALTY4	0.237	
Delivery Dependability (DELDEP)	DELDEP1	0.825	0.883
	DELDEP2	0.472	
	DELDEP3	0.835	
Flexibility (FLXLTY)	FLXLTY1	0.653	0.892
	FLXLTY2	0.588	
	FLXLTY3	0.516	
	FLXLTY4	0.782	
Responsiveness (RSPNSV)	RSPNSV1	0.684	0.877
	RSPNSV2	0.583	
	RSPNSV3	0.754	
Servicing Capability (SRVCAP)	SRVCAP1	0.814	0.842
	SRVCAP2	0.641	
	SRVCAP3	0.611	
	SRVCAP4	0.814	
Operational Performance (OPTPRF)	OPTPRF1	0.878	0.884
	OPTPRF2	0.474	
	OPTPRF3	0.959	

	OPTPRF4	**0.533**	
Financial Performance (FINPRF)	**FINPRF1**	**0.436**	**0.858**
	FINPRF2	**0.394**	
	FINPRF3	**0.300**	
	FINPRF4	**0.677**	

7.2 Chapter Summary

The summary of this chapter is as follows:

This chapter discusses the entire set of results obtained from empirical data analysis. The first section-7.1.1 provides the results of exploratory factor analysis (EFA) of hospital and supplier data. The EFA results include construct-measurement item loadings, average variance extracted (AVE) values and Cronbach's alpha values that confirms unidimensionality, validity and reliability of the measurement items. The next section-7.1.2 provides the results of confirmatory factor analysis (CFA) of hospital-side and supplier-side to check the validity and reliability of the measurement model. The CFA results include model fit indices *(C_{MIN}/DF, CFI, IFI, TLI, GFI, RMSEA),* convergent validity measures, discriminant validity measures and reliability measures *(squared multiple correlations, composite reliability).*

The next chapter i.e. chapter-8 deal with testing of hypotheses obtained by structural equation modelling (SEM) of both hospital-side and supplier-side. The finalized results of linkages among the constructs are obtained by SEM results provided in the next chapter.

CHAPTER-VIII

8 TESTING OF HYPOTHESES

The previous chapter i.e. chapter-7 has clearly illustrated the results of exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) both at the hospital-side and supplier-side. The results have shown construct-wise item loadings, average variance extracted (AVE) values, Cronbach's Alpha value, model-fit indices, validity and reliability measures of both hospital-side and supplier-side data. This chapter i.e. Chapter-8 titled as 'Testing of Hypotheses' provides the results of Structural equation modelling (SEM) for both hospital and supplier data. The SEM results show model fit indices for confirming the model fit and checks the structural model. The significance of path-coefficients obtained from SEM results tests the hypotheses results for finalizing the conformity of framework.

Testing of the hypotheses derived from the literature and sample is an important aspect of SEM technique. The structural model is examined for model-fit, estimation of the path-coefficients and finally validating whether the hypothesized model fits the sample data (Anafarta, 2011). In this study also, the SEM model-fit indices are calculated to validate the model-fit and path-coefficients are checked to test the statistical significance of the hypotheses.

The below section-8.1 provides the details of SEM results and hypotheses results of hospital-side.

8.1 STRUCTURAL EQUATION MODELLING & TESTING OF HYPOTHESES: Hospital-Side

Structural Equation Modelling (SEM) technique is used to find the interrelationships within all the constructs considered in this study. SEM was performed using AMOS 20.0 software to compute the structural model-fit indices and also test the Hospital-side hypotheses.

The below *Table-8.1* provides the model-fit indices of the structural model of the hospital-side which shows that with the hypothesized model being tested across the sample of (n=223) came up as $\chi 2$ / d.f. = 1.718; CFI= .903; IFI=.904; TLI=.900; GFI=.801; NFI=.803; RMSEA=.05.

Ideally, for SEM model fit indices to be acceptable in confirming the hypotheses and model-paths any 4 or 5 should be within recommended values. In this study, 5 indices are within the acceptable range and two indices (GFI, NFI) are slightly lower than acceptable ranges which are also very near to the acceptable criterion. Thus, confirming a good model-fit.

Table 8.1: Model Fit Indices - Structural Model (Hospital-side)

Model Fit Indices	CMIN/DF	CFI	IFI	TLI	GFI	NFI	RMSEA
Structural Model	1.718	.903	.904	.900	.801	.803	.05
Acceptable Criterion	≤4.000	≥0.900	≥0.900	≥0.900	≥0.900	≥0.900	≤0.050
*Where, **CMIN/DF** represents Chi-square/degrees of freedom (i.e. χ^2 / d.f.);* ***GFI** = Goodness of fit index;* ***CFI** = Comparative fit index;* ***TLI** = Tucker Lewis index;* ***NFI**= Normed fit index;* ***IFI** = Incremental fit index;* ***RMSEA** = Root mean square error of approximation.*							

The below Table-8.2 provides the computed values of all the hypotheses relationships in the hospital-side model and the details of their path-coefficients (estimates) and level-of significance (p-value) for the hospital-side model and hence indicates the supporting or not-supporting evidence of the hypotheses.

Table 8.2: Hypotheses Testing Results - Hospital-side

S.No	Hypotheses	Hypothesized Paths	Estimates	Significance Value (p-value)	Significance	Hypotheses Results
1.	H1a	EHR-Adoption→Transparency	.096	.277	**Not Significant**	**Not Supported**
2.	H1b	EHR-Adoption→ERP-Implementation	.544	0.000****	**Highly Significant**	**Supported**
3.	H1c	EHR-Adoption→Interoperability	.383	0.020**	**Significant**	**Supported**
4.	H2a	ERP-Implementation → Transparency	.441	0.000****	**Highly Significant**	**Supported**
5.	H2b	ERP-Implementation → Interoperability	.021	.662	**Not Significant**	**Not Supported**
6.	H3a	Transparency →Quality	.272	0.000****	**Highly Significant**	**Supported**
7.	H3b	Transparency →Delivery-dependability	.224	.006***	**Significant**	**Supported**
8.	H3c	Transparency →Flexibility	.011	.893	**Not Significant**	**Not Supported**
9.	H3d	Transparency →Responsiveness	.022	.805	**Not Significant**	**Not Supported**
10.	H4a	ERP-Implementation →Quality	.302	0.000****	**Highly Significant**	**Supported**
11.	H4b	ERP-Implementation →Delivery-dependability	.629	0.000****	**Highly Significant**	**Supported**
12.	H4c	ERP-Implementation →Flexibility	.701	0.000****	**Highly Significant**	**Supported**
13.	H4d	ERP-Implementation →Responsiveness	.333	0.000****	**Highly Significant**	**Supported**
14.	H5a	Interoperability →Quality	.183	.129	**Not Significa**	**Not Supported**

					nt	
15.	H5b	Interoperability →Delivery-dependability	.121	.419	**Not Significant**	**Not Supported**
16.	H5c	Interoperability →Flexibility	.391	0.002***	**Significant**	**Supported**
17.	H5d	Interoperability →Responsiveness	.510	.004***	**Significant**	**Supported**
18.	H6	Quality →Servicing Capability	.403	0.000****	**Highly Significant**	**Supported**
19.	H7	Delivery-dependability →Servicing Capability	.347	0.000****	**Highly Significant**	**Supported**
20.	H8	Flexibility →Servicing Capability	.006	.899	**Not Significant**	**Not Supported**
21.	H9	Responsiveness →Servicing Capability	.016	.766	**Not Significant**	**Not Supported**
22.	H10a	Servicing Capability →Operational Performance	.260	.002***	**Significant**	**Supported**
23.	H10b	Servicing Capability →Financial Performance	.391	0.000****	**Highly Significant**	**Supported**
	***** Implies significant at p<0.001 i.e. significant at 0.1%* **** Implies significant at p<0.01 i.e. significant at 1%* *** Implies significant at p<0.05 i.e. significant at 5%* ** Implies significant at p<0.1 i.e. significant at 10%*					

As per the hospital-side results obtained in this study below are the details:

The path coefficients between EHR-Adoption and ERP-Implementation, EHR-Adoption and Interoperability, ERP-Implementation and Transparency, Transparency and Quality, Transparency and Delivery-dependability, ERP-Implementation and Quality, ERP-Implementation and Delivery-dependability, ERP-Implementation and Flexibility, ERP-Implementation and Responsiveness, Interoperability and Flexibility, Interoperability and Responsiveness, Quality and Servicing Capability, Delivery-dependability and Servicing Capability, Servicing Capability and Operational Performance, Servicing Capability and Financial Performance are having significant values with p-values<0.001 or <0.01. Hence, hypotheses H1b, H1c, H2a, H3a, H3b, H4a, H4b, H4c, H4d, H5c, H5d, H6, H7, H10a, and H10b are supported in the hospital-side study.

The path coefficients between EHR-Adoption and Transparency, ERP-Implementation and Interoperability, Transparency and Flexibility, Transparency and Responsiveness, Interoperability and Quality, Interoperability and Delivery-dependability, Flexibility and Servicing Capability, Responsiveness and Servicing Capability are having insignificant values. Hence, hypotheses H1a, H2b, H3c, H3d, H5a, H5b, H8 and H9 are rejected.

Below Figure- 8.1 and 8.2 illustrates SEM results of hospital-side framework.

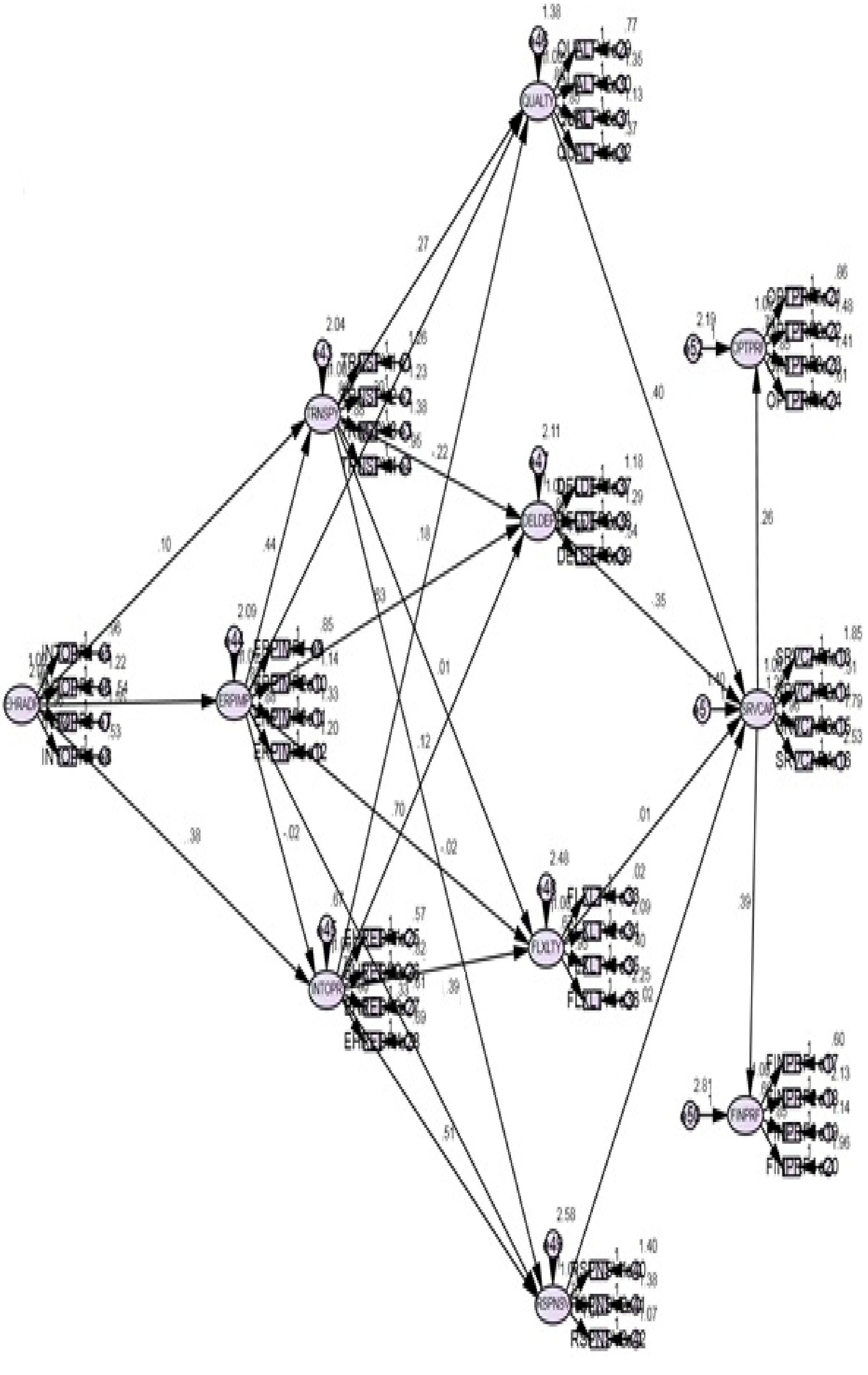

Figure 8.1: Estimates & Significance - Hospital-Side

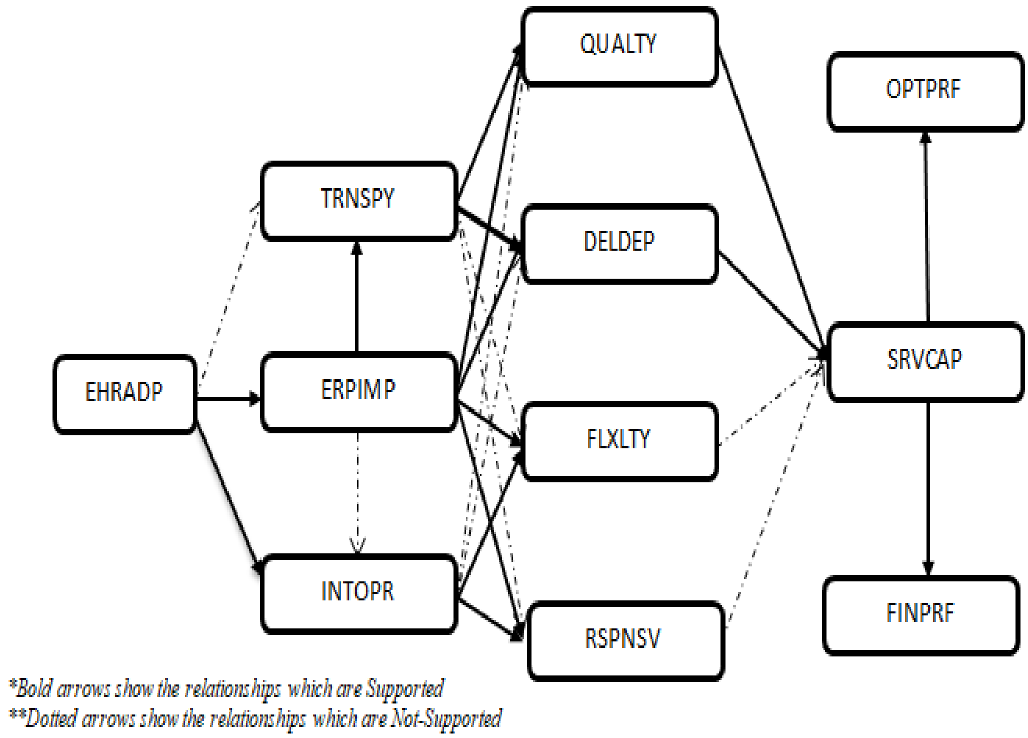

Figure 8.2: Hypotheses Outcomes - Hospital-Side Framework

The below section-8.2 provides the details of SEM results and hypotheses results of supplier-side.

8.2 STRUCTURAL EQUATION MODELLING & TESTING OF HYPOTHESES: Supplier-Side

Table 8.3: Model Fit Indices - Structural Model (Supplier-side)

Model Fit Indices	CMIN/DF	CFI	IFI	TLI	GFI	NFI	RMSEA
Structural Model	1.773	.912	.912	.904	.801	.820	.05
Acceptable Criterion	≤4.000	≥0.900	≥0.900	≥0.900	≥0.900	≥0.900	≤0.050

Where, ***CMIN/DF*** *represents Chi-square/degrees of freedom (i.e. χ^2 / d.f.);*
GFI *= Goodness of fit index;*
CFI *= Comparative fit index;*
TLI *= Tucker Lewis index;*
NFI *= Normed fit index;*
IFI *= Incremental fit index;*
RMSEA *= Root mean square error of approximation.*

Table 8.4: Hypotheses Testing Results - Supplier-side

Hypotheses	Hypothesized Paths	Estimates	Significance Value (p-value)	Significance	Hypotheses Results
H1a	***ERP-Implementation →Transparency***	.130	.010***	**Significant**	**Supported**
H1b	***ERP-Implementation → Interoperability***	.328	0.000****	**Highly Significant**	**Supported**
H2a	***Transparency →Quality***	.434	0.000****	**Highly Significant**	**Supported**
H2b	***Transparency → Delivery-dependability***	.021	.841	**Not Significant**	**Not Supported**
H2c	***Transparency →Flexibility***	.241	.023**	**Significant**	**Supported**
H2d	***Transparency →Responsiveness***	.266	.009***	**Significant**	**Supported**
H1c	***ERP-Implementation →Quality***	.301	0.000****	**Highly Significant**	**Supported**
H1d	***ERP-Implementation → Delivery-dependability***	.385	0.000****	**Highly Significant**	**Supported**
H1e	***ERP-Implementation →Flexibility***	.450	****	**Highly Significant**	**Supported**
H1f	***ERP-Implementation →Responsiveness***	.360	****	**Highly Significant**	**Supported**
H3a	***Interoperability →Quality***	.356	****	**Highly Significant**	**Supported**
H3b	***Interoperability → Delivery-dependability***	.294	****	**Highly Significant**	**Supported**
H3c	***Interoperability →Flexibility***	.001	.992	**Not Significant**	**Not Supported**
H3d	***Interoperability →Responsiveness***	.113	.092*	**Not Significant**	**Not Supported**
H4	***Quality →Servicing Capability***	.162	.011***	**Significant**	**Supported**
H5	***Delivery-dependability → Servicing Capability***	.092	.143	**Not Significant**	**Not Supported**
H6	***Flexibility → Servicing Capability***	.125	.062*	**Not Significant**	**Not Supported**
H7	***Responsiveness → Servicing Capability***	.062	.389	**Not Significant**	**Not Supported**
H8a	***Servicing Capability → Operational Performance***	.178	.011***	**Significant**	**Supported**
H8b	***Servicing Capability → Financial Performance***	.094	.114	**Not Significant**	**Not Supported**

***** Implies significant at p<0.001 i.e. significant at 0.1%*
**** Implies significant at p<0.01 i.e. significant at 1%*
*** Implies significant at p<0.05 i.e. significant at 5%*
** Implies significant at p<0.1 i.e. significant at 10%*

The above supplier-side results obtained in this study are as follows:

The path coefficients between ERP-Implementation and Transparency, ERP-Implementation and Interoperability, Transparency and Quality, Transparency and Flexibility, Transparency and Responsiveness, ERP-Implementation and Quality, ERP-Implementation and Delivery-dependability, ERP-Implementation and Flexibility, ERP-Implementation and Responsiveness, Interoperability and Quality, Interoperability and Delivery-dependability, Quality and Servicing Capability, Servicing Capability and Operational Performance are having significant values with p-values<0.001, or <0.01. Hence, hypotheses H1a, H1b, H2a, H2c, H2d, H1c, H1d, H1e, H1f, H3a, H3b, H3d, H4 and H8a are supported in the supplier-side study.

The path coefficients between Transparency and Delivery-dependability, Interoperability and Flexibility, Interoperability and Responsiveness, Delivery-dependability and Servicing Capability, Flexibility and Servicing Capability, Responsiveness and Servicing Capability, Servicing Capability and Financial Performance are having not significant p-values. Hence, hypotheses H2b, H3c, H3d, H5, H6, H7 and H8b are rejected in the supplier-side study.

Below Figure- 8.3 and 8.4 illustrate SEM results of supplier-side framework.

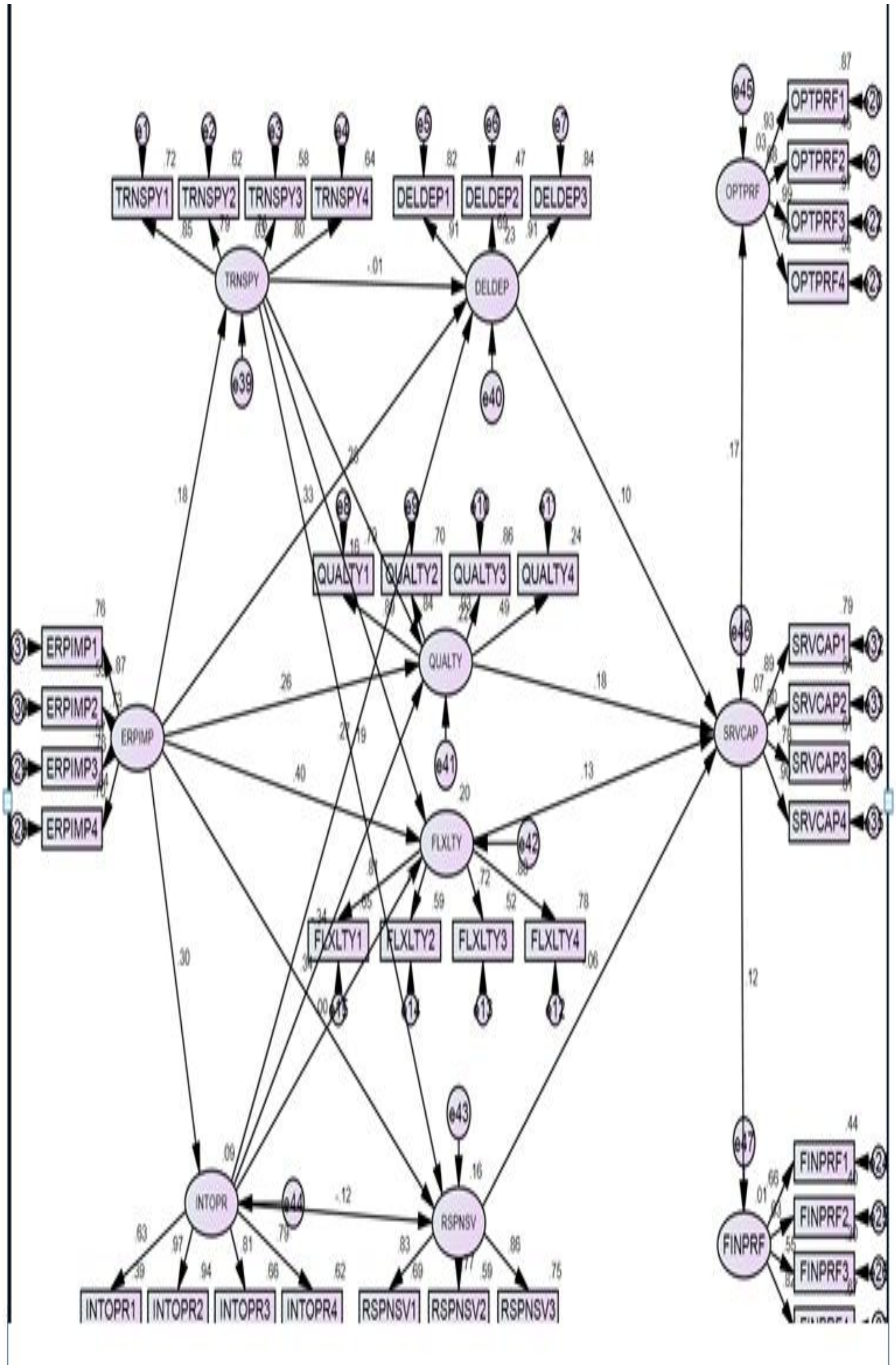

Figure 8.3: Estimates & Significance - Supplier-Side

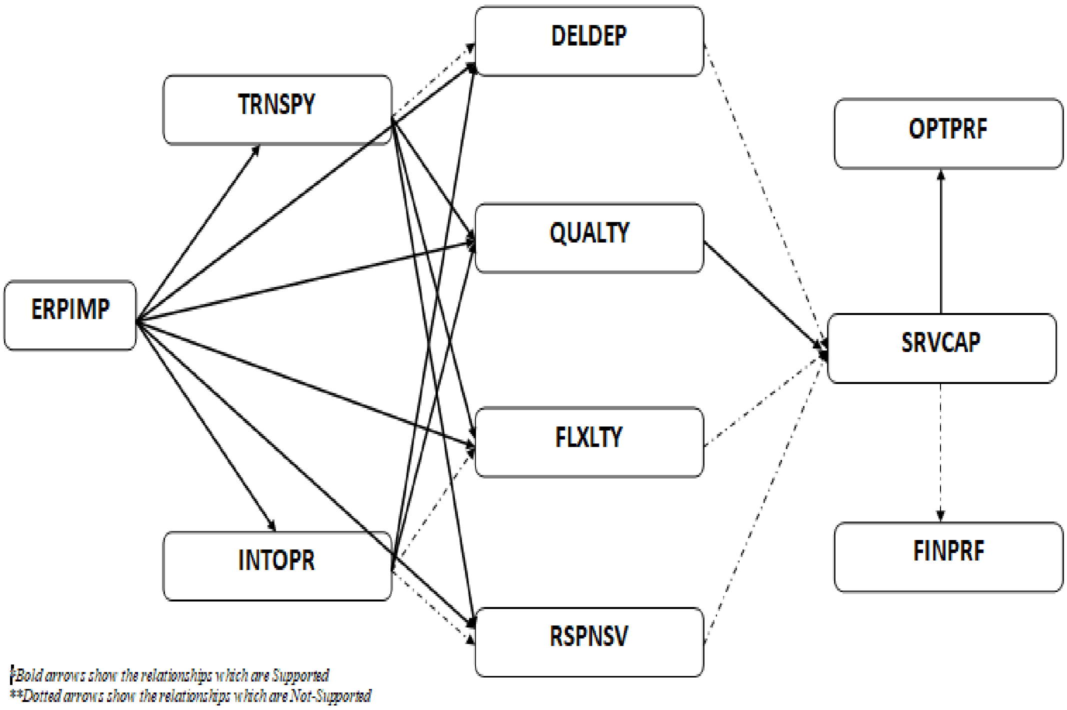

Figure 8.4: Hypotheses Outcomes - Supplier-Side Framework

8.3 Chapter Summary

The summary of this chapter is as follows:

This chapter has illustrated the results obtained from Structural equation modelling (SEM) which finds the interrelationships between the constructs. It provides model-fit indices of the structural model which are $\chi 2$ / d.f.; CFI; IFI; TLI; GFI; NFI; RMSEA. The hypotheses estimate results illustrate the significance level of hypotheses results which finally highlight the supported and not-supported hypotheses which finally confirms the linkages of the constructs.

The next chapter i.e. chapter-9 provides discussions of the findings for both hospital and supplier-side obtained in this study.

CHAPTER-IX

9 DISCUSSION ON THE FINDINGS

The previous chapter i.e. chapter-8 has the SEM results of both hospital and supplier-side data. The chapter illustrated the model-fit indices and significance of path-coefficients of the hypotheses resulting in highlighting the supported and not-supported construct linkages.

The current chapter i.e. Chapter-9 titled as ‘Discussion on the findings’ analyses and discusses the results and findings that have emerged from the calculations obtained from EFA, CFA and SEM. The chapter clearly discusses the linkages and findings obtained in this study for both hospital and supplier-side data.

The below section-9.1 discusses the hospital-side results and findings:

9.1 HOSPITALS-SIDE RESULTS AND FINDINGS:

The empirical findings obtained from the statistical analysis done in this study validates the data collected and the conceptual findings from research literature. This study highlights the usage of two major digital technologies i.e. EHR & ERP in the hospitals and their antecedent-consequence linkages with business outcomes moving from four fold levels of Process-level capabilities (Transparency, Interoperability); Dynamic-capabilities (Quality, Delivery-dependability, Flexibility, Responsiveness); Servicing Capability and finally Performance (Operational, Financial). The conceptual outcomes and constructs were initially obtained on the basis of exhaustive literature review of extant studies and focused group discussions by experts and practitioners. The conceptual framework and linkages as obtained from the literature was taken from various healthcare or non-healthcare supply chain related academic or practitioners' research/ report/ white papers. The construct linkages conceptualized the hypotheses to have positive impact between the antecedent and consequences. This current hospital-side research framework had total 11 constructs and 23 proposed hypotheses which were tested empirically.

The following section discusses the details of the acceptance and non-acceptance of those hypotheses which were tested.

Discussion on Supported Hypotheses of Hospital-Side framework:

The empirical findings obtained from the hospital-side sample data are collected from the tertiary-care hospitals in and around four major metropolitan cities in India *(as considered in this study context).* The observations depict that the Hypothesis- H1b i.e. EHR-Adoption in hospitals positively impacts and supports ERP-Implementation. Extant literature as well as industry experts and reports have emphasized that electronic/ digital management of patient records (medical/ clinical/ diagnostic) maintained by hospital providers over time can help in standardization of medical processes and workflows. ERP systems/ software provide business process management platforms for effective integration of varied workflows (manage/ automate/ collaborate) related to facets of care delivery functions related to technology, services and resources. Combination of EHR & ERP in hospital system potentially manages patient information, data archives and supply chain information; thereby facilitating and improving the harmony among hospital working systems, showcasing suitable synchronization of the related stakeholders. EHR-Adoption establishes the necessary data points and processes which creates the essential backdrop as inputs for ERP-Implementation in hospitals and its successful synchronization.

The Hypothesis- H1c i.e. EHR-Adoption has positive impact on Interoperability, got supported. Interoperability being a process- level capability, EHR-Adoption allows the electronic sharing of patient information across different systems, platforms and healthcare providers. EHR platform creates the ease and necessary interaction between various divisions of healthcare service delivery, which in its absence, would have remained in silos. EHR-Adoption provides healthcare users with the ability to track medical records/ diagnostic data and treatment progress for patients across locations and processes; involving multiple healthcare providers, physicians and specialists. This provides impetus to enable the healthcare system to be interoperable; thereby aiding an overarching holistic view of patient care. This provides all stakeholders a unified view of patients' longitudinal health record data on real time basis.

The next hypothesis that got support is hypothesis - H2a i.e. the impact of ERP-Implementation on Transparency. ERP systems in hospitals enable data movement away from their disparate legacy systems in silos to a single well-connected comprehensive platform. Hospitals and healthcare providers store essential data of their business processes and their patients. Implementing ERP software for healthcare has largely helped the hospitals to foster better coordination, enhanced integration and much better information sharing. Using ERP systems the hospital users can conveniently update all the data placed within the program, which can be accessed, handled or viewed across all required parties. They also ensure more efficient and reliable processes across their entire network. ERP implementation helps the hospital stakeholders to consolidate and better organize their data in a much more secure and confidential manner. Healthcare ERP platform makes all communication between patients and providers on a real time basis which eliminates information distortion or error in understanding; thereby enhancing transparency in the system.

The next consequent construct linkages tested in this research framework are the impact of antecedents on the dynamic capabilities- Quality, Delivery-dependability, Flexibility and Responsiveness. The hypotheses - H4a, H4b, H4c and H4d which denote the linkages of ERP-Implementation with dynamic capabilities- Quality, Delivery-dependability, Flexibility and Responsiveness respectively got supported. Dynamic capabilities of organizations come up as crucial factors or assets which can generate their internal and external competences. Hospitals across the globe have four major objectives to fulfill. Firstly, to impart high-quality patient care; then secondly, to be dependable in care-delivery; thirdly, to provide care in a flexible manner and then to be responsive in treatment or care delivery to patients. Extant literature has highlighted these dynamic capabilities as the crucial aspects for healthcare organizations and emphasized that ERP-Implementation can foster these capabilities as ERP software comes with a robust database that can store large, quantitative data in an integrated manner. In this study, the research conducted in the Indian hospital context also supports that an integrated ERP enabled healthcare system can facilitate easy and quick access to patient records, crucial records on doctors and employees. The automation of hospital business functions via ERP implementation helps the healthcare industry to bind together its core services, support services and seamless and effective management of all internal and external official operations. ERP systems, with the help of an integrated database, the doctors or healthcare practitioners can get access to the real-time information about patients, their diagnostic reports which facilitate further communication on possible treatments. This easy information transfer can make the treatment impartation much more efficient and effective in the healthcare industry. The automated actions facilitated by ERP in hospitals help in carrying forward the tests and other healthcare procedures in an easier and hassle-free manner, which improves care-quality provided by hospitals and results in enhanced patient satisfaction. Transparent, reliable and on-time communication facilitated under ERP helps the hospitals to make timely and wise decision making with regard to treatments and other services. Interactive ERP-modules, when implemented in hospitals, makes a patient care process more reliable and dependable; thereby enhancing the delivery-dependability in the hospital system.

In this study the linkages between the process level capability- Transparency with the dynamic capabilities are also tested and observed that Hypotheses-H3a and H3b i.e. transparency supports Quality and Delivery-dependability.

Transparency in the hospital processes improves the quality of care provided to the patients. Transparency can help the hospital staff, physicians as well as patients/ patient-parties to make informed choices and decisions when selecting a health plan or planning for alternative treatment processes. Increased healthcare transparency enhances trust-level among the hospital stakeholders which can foster patient-physician relationships and health care systems. Due to improved transparency within the system, the hospital functions become streamlined and well-coordinated to further improve quality, safety and efficiency throughout the healthcare system by mapping with clinical benchmarks. With the focus on clarity and real-time information sharing, the processes become transparent and the system becomes much more understandable for both internal as well as external stakeholders. Due to clarity in clinical and administrative processes within hospitals, the entire system becomes reliable for hospital staff as well as patients. With transparency factors in place, the hospital processes can be dependable in care-delivery and satisfy its patients by providing the standardized and optimized treatment to their patients .

The hypotheses H5c & H5d which denotes the linkages of the other process-level capability i.e. Interoperability with flexibility and responsiveness also got supported in this study for the hospital context. Technology adoption in healthcare has enabled the hospital to operate from multiple locations and become interoperable. Digitalized patient data can be accessed over IoT or cloud platforms on the go; which has potentially transformed the healthcare capabilities. By creating and implementing advanced interoperability, with the aim to capture and interpret data across systems and applications, healthcare organizations can be flexible to access the patient data, operational details and crucial clinical information. By achieving interoperability, the ability of computerized/ automated systems to connect and communicate with one another improves. This readily helps in providing treatment or care from physicians across any virtual location, which ensures the hospital operations to be flexible enough for their patients. Enhanced digital connections and automated data sharing, speeds up reaction times of hospital care delivery processes, as the stakeholders can communicate in a much faster and easier manner; thereby fostering responsiveness of the hospital's treatment process. Interoperability enables safer and seamless transitions of care, which leads to better patient outcomes and thus enhances flexibility and responsiveness capabilities in hospitals. This study conducted in the Indian hospitals scenario also signifies that the interoperability achieved in hospital processes by technology adoptions can enhance real-time information sharing, improve interactions, add to flexible care-delivery options and also boost innovativeness and agility in care-delivery; thereby supporting flexibility and responsiveness capabilities of hospitals.

The hypotheses- H6 & H7 which are linkages of the two dynamic capabilities- Quality and Delivery dependability with Servicing capability construct also got supported for hospitals in this study. Dynamic capabilities of firms form the backbone for achieving competencies. Servicing capability of hospitals are the key features which can trigger skills, abilities, and processes needed to develop a positive impact across the market and also help in building close relationships with patients. In this hospital-side study context, Quality and Delivery-dependability show support towards enhancing Servicing capabilities of hospitals. Quality is the utmost attribute which is perceived by the customers. Ensuring proper quality of care brings patient satisfaction which creates trust and loyalty and thus boosts the service capability of hospitals. Enhanced Servicing capability helps in building good relationships between hospital staff and patients and thus intensifies trust factor and they come back to the same hospital or recommend others. In a critical sector like healthcare where the service is highly demanding in terms of emotional aspects as well, the hospitals need to ensure value based care for their patients. The services provided by hospital-staff needs to be on-time, reliable and dependable in the eyes of patients. Care-delivery dependability has been acknowledged as a crucial capability in hospitals as it ensures to demonstrate responsible behaviors. Considering the health and lives of patients, it is very important for the Indian hospitals to have these capabilities so that they can have a better servicing capability to have a competitive edge over others. Indian healthcare sector needs to support a large population and thus it is of utmost importance to focus on delivering quality service and to be dependable in care-delivery so as to improve the servicing capability of hospitals.

Hospitals can only gain a competitive edge if they can ultimately focus on the performance aspects. The results obtained from this research work highlight that the hypotheses H10a & H10b which represent the linkages of servicing capability with operational and financial performance respectively got supported. Performance measurement and outcomes are the utmost focus of all business especially healthcare where the needs of patients are severe. In case of Indian hospitals, the operational efficiency of hospitals are of major concern due to limited hospital capacity, low physician-patients ratio, critical supply chain and high service quality care focus. With operations so critical to care delivery, hospitals continuously strive to improve their operational outcomes. In Indian hospital scenario, the demand for patient beds often exceeds the number of beds available, mostly facing hospital capacity problems. The negative impacts of these hospital operational issues include surgery cancellations, increased length of stay, declining patient and staff satisfaction, and turning away transfer patients. It is imperative for hospitals to focus on streamlining the processes, reduce cycle time, improve on-time delivery, effective allocation of beds in a hospital, manage bed-occupancy rates and length of stay; which are of primary focus to reflect on the measures of functional ability of hospital operational performance. This study highlighted that hospital attention to have a better servicing capability will improve the operational performance aspects of hospitals. Digital technology adoptions in hospital situations have been emphasized as key aspects for operational performance improvements. Using data driven technologies effectively to integrate, coordinate and streamline the hospital processes so as to improve collaboration has been considered as the flag bearer of the new age hospital scenario.

The other performance attribute which is financial performance measure is also taken up as a major need for all organizations. With the rising costs of healthcare, hospitals are facing a continued pressure to lower costs, deliver cost savings and also obtain more hospital profitability, while delivering quality care. Hospitals have mostly turned their attention to work on financial performance aspects like cost-per-case, net revenue per discharge, return on investments, return on assets, or market share as an area for potential financial improvements. Focusing on various aspects of servicing capabilities have come up as major antecedents to improve financial performance attributes in Indian hospital context. Hospitals need to focus on clinical improvement, reduce clinical variation, adopt innovative and value based patient care services, enhance standardization, reduce errors, and quality improvement efforts in order to improve the financial performance of hospitals. Thus, it can be emphasized that the hospital providers use their systems efficiently and effectively, reducing errors, managing data properly, standardizing the process and ensuring value-based care-delivery. Hospitals can specifically enhance the overall performance by boosting on service quality, patient satisfaction, reducing readmissions rates, hassle-free care-delivery, understanding revenue cycle performance and investing in effective technologies. So, as per the discussion above it is observed that the hypotheses which were proposed from extant literature also got supported from the data obtained from Indian tertiary care hospitals and validated in this study.

Discussion on Not-Supported Hypotheses of Hospital-side framework:

In this study, some of the construct linkages that were proposed from the extant literature was not supported in the Indian hospitals context. Following section discusses the not accepted hypotheses to analyze the reasons for the non-acceptance.

The hypothesis H1a i.e. the linkage of EHR-Adoption with Transparency was not supported in this study. The direct linkage of EHR-Adoption with transparency is not supported in the Indian hospital context rather the study has shown that EHR when combined with ERP, supports transparency in hospital processes. As the use of EHR has started to diffuse, a foundation is laid for enhanced transparency within and between health care organizations.

In Indian hospitals, where the complete electronic health records handling and practices have not yet been so handy and patients are also not so comfortable with taking the healthcare facilities online, there is still a barrier between EHR usability, trust and complete transparency. It is emphasized among hospitals in India that just digitizing the patient manual records to electronic format is not enough to facilitate e-health and m-health and make the process transparent. There is a need for hospitals to implement integrative platforms like ERP to provide real-time coordination among the vertical so as to bring collaboration across departments. This came out as a major finding as EHR alone in hospitals cannot bring transparency in the system; whereas hospitals also need integrative ERP platforms to make the system transparent.

The hypothesis H2b, which denotes the linkage of ERP-Implementation with Interoperability in hospitals, is not supported in the Indian hospital context. Extant literature emphasizes that ERP implementation, through its omnipresence and real-time continuous availability of information sharing through multiple data sharing platforms, should foster Interoperability which has been supported in the western healthcare management literature. But in Indian hospital context we find that there is a departure from the expected proposed norm. This might be attributed to the typical nature of practices in the Indian hospital context, where still most of the operations and activities are done on a manual basis and is gradually being digitized. Most of the data-entry, patient records handling and information are primarily handled manually. Although ERP implementation is done but that is still taken as a secondary backup option rather than a primary centralized option to be followed. So in such scenarios, interoperability may suffer to a larger extent because of the manual operations which happen in Indian context. As of now in Indian hospitals, complete enterprise level hospital ERP implementation has not happened in most of the hospitals and only follow department-wise digitization of records which are not interoperable across organizations. Thus, the hospital data analyzed in this study does not support the linkages of ERP-Implementation with Interoperability whereas in the supplier context, or B-2-B scenario ERP-Implementation shows support with Interoperability.

The hypotheses H3c and H3d, which denote the linkages of Transparency with flexibility and responsiveness respectively are not supported in the Indian hospital context. Transparency has been taken up as an internal process-level capability and focuses on the information sharing and coordination within the internal processes of hospitals. Whereas, the dynamic capabilities- flexibility and responsiveness are considered as the capabilities for serving patients and more of an external feature. Although, extant literature had shown support of Transparency with flexibility and responsiveness but in Indian hospital context, the attributes of providing flexible care to the patients, delivering quick and agile treatment, responsively catering to the niche patient needs and offering convenience/ ease of patient care are often handled by organizational norms, policies and regulations and are taken up as external attributes for customer oriented capabilities. Thus, linkages of the processes level capability- transparency and dynamic capabilities- flexibility and responsiveness does not find support in Indian hospital scenarios where they remain as separate non-linked parameters.

On the other hand, the hypotheses H5a and H5b which denote the linkages of the second process-level capability- Interoperability with quality and delivery-dependability is not supported. Interoperability aspect highlights the ability of hospitals to provide care from multiple locations across the system. The responses collected from the Indian tertiary-care hospital respondents, considered in this study, have expressed perceptions (through the questionnaire) which are focused towards providing quality care and dependable care-delivery to patients, but are not only inclined or obsessed about fastidiousness regarding care-service delivery location. This happens to be a deviation from the extant literature and contributes to the study outcomes (specific to the context and region, India). This gives us an insight regarding scope for in-depth research in future, considering from the different perspective of patient response data. In Indian healthcare context, where quality and delivery-dependability are more process centric approaches, the current response set being hospitals, might not have found significance.

The hypotheses H8 and H9 which denote the linkages of flexibility and responsiveness with servicing capability respectively are not supported. Flexibility and responsiveness, which represents the two pillars of dynamic capabilities, have evolved to be more aligned with patient-centricity. Flexibility indicates the level of changing facilities which are offered to cater patient needs and facilitate the provisions of care delivery in a dynamically changing care-service backdrop. On the other hand, responsiveness indicates the hospital's level of providing quick and agile care-delivery provisions to patients. These capabilities happen to be largely inclined and guided by organizational norms, policies and regulations; thereby fostering patient-centric care-delivery. Servicing capability highlights and emphasizes on the process-centric approach of providing value-added services. Consequently, servicing capability logically draws support from two out of four dynamic capabilities i.e. quality and delivery-dependability (as elaborated in the study context), but does not get supported empirically by flexibility and responsiveness.

The below section-9.2 discusses the supplier-side results and findings:

9.2 SUPPLIERS-SIDE RESULTS AND FINDINGS:

Similar to the hospital-side framework validation, a separate supplier-side framework was also conceptualized in this study and the results obtained for the suppliers empirically validate the data collected and the conceptual findings from research literature. The supplier-side outcomes represents the business-to-business (B-2-B) scenario of the healthcare supply chain network which focuses on the linkages of hospital suppliers with the Indian tertiary-care hospitals. Suppliers involved for hospitals are responsible for stocking or supplying products, OT equipment, medical devices, syringes, prescriptions drugs, gloves, pens/stationeries, computers, etc. The digital transformation of the healthcare supply chain emphasizes technology enabled integration and streamlining the supplier-hospital system to improve efficiency and performance. In the supplier-side study, the digital technology usage being validated was ERP-Implementation and their antecedent-consequence linkages with business outcomes moving from four fold levels of Process-level capabilities (Transparency, Interoperability); Dynamic-capabilities (Quality, Delivery-dependability, Flexibility, Responsiveness); Servicing Capability and finally Performance (Operational, Financial). EHR-Adoption was not a part of supplier-side study as patient health records are in purview of hospitals only. This supplier-side research framework had a total 10 constructs and 20 proposed hypotheses which were tested empirically.

The following section discusses the details of the acceptance and non-acceptance of those hypotheses for supplier-side framework which were empirically validated.

<u>Discussion on Supported Hypotheses of Supplier-side framework:</u>

In this study context, the suppliers' data are obtained on a referral basis from the hospitals considered in this study. The list of suppliers, who were primarily the principal suppliers of the hospitals have been involved as respondents for this study. This B-2-B supplier-side context shows a slightly different result from that of hospital-side framework results. The supplier-side results depict that hypotheses H1a and H1b got accepted which means ERP-Implementation positively supports both the process-level capabilities considered in this study i.e. Transparency and Interoperability. ERP systems are the platforms that are implemented in order to boost integration and to expand boundaries beyond the enterprise. Real-time information sharing among the suppliers and proper supplier-hospital coordination by ERP systems can improve the level of access to data and information, improved price and cost transparency, avoid improper inventory issues, eliminate asymmetric information problems, minimize miscommunications, streamline the order management processes and align suppliers' strategies, expertise, capacities and capabilities. Proper clarity and balance between order management, inventory, sales demand, supplier needs, and market environment can be struck through implementation of an integrative ERP-system. Thus, it enables more transparent dealings allowing the suppliers to proactively address various business situations; thereby enhancing transparency within systems. ERP systems also allow the organizations to operate from multiple locations and help them to get connected to the business network from any virtual or remote locations. Hospital suppliers' needs, being critical, have supported the linkage of ERP-implementation with interoperability as the suppliers need to provide various orders to hospitals even on an emergency basis and if they can operate from any location then the process becomes uniformly accessible, faster and efficient. Thus, making the system interoperable by using technologies like ERP has been identified as an effective pathway to enhance organizational process-level capabilities.

The hypotheses- H1c, H1d, H1e, H1f which represents the linkages of ERP-Implementation with the dynamic capabilities *(quality, delivery-dependability, flexibility and responsiveness)* also got supported. In case of a critical and competitive healthcare scenario, it is essential for hospital suppliers to compete against the dynamic capabilities. It is strongly emphasized for hospital suppliers to enhance the dynamic capabilities for hospital-suppliers in Indian context. It is essential for suppliers to provide the supplies as per the needs of hospital authorities or physicians and ensure a high level of satisfaction. Ensuring proper quality supplies as well as value for supplies can provide a competitive edge for Quality of hospital suppliers. In case of healthcare, the supplier needs to always be dependable so as to ensure a good relationship with their customers who are hospitals so that they can win business in future. By delivering the services and supplies on-time, efficiently and without fail can make the suppliers dependable for various hospitals. Healthcare system needs to plan for 24*7 readiness as it is always difficult to predict the exact requirement. Thus, hospital-suppliers need to be flexible in handling orders as and when needed and should respond to emergency situations in an agile manner. Thus, technologies like ERP show high support for suppliers to handle dynamic situations on-the-go as and when required.

The hypotheses- H2a, H2c and H2d which represent the linkages of transparency with quality, flexibility and responsiveness respectively have also shown support for the Indian hospital-suppliers context. Transparent platform allows quicker or real-time information flow across business systems which helps the hospital-suppliers to process orders at an emergency basis as well which can boost flexibility and responsiveness. Transparency in the supplier's end can help the suppliers to have a faster response-time which can always make their customer to be satisfied and delightful. In case of emergency situations, providing service at the right time plays an exceptionally key role for providing better quality service to customers. Thus, transparency within the system has been attributed as a key driver for achieving the aforementioned dynamic capabilities.

The hypotheses H3a and H3b which denote the linkages of Interoperability with Quality and Delivery-dependability also supported in the hospital-suppliers' context. In case of critical service-sector like healthcare the suppliers' service level largely depends upon their ability to create good relations with hospital management and physicians. Suppliers can ensure continuity of newer contracts only when their customers (hospitals) are satisfied with the suppliers and can depend on them for emergency stocks. In healthcare sectors, a large chunk of orders are directed by physicians as physician-preference-items and thus the healthcare supplier needs to provide the goods and services from multiple locations. Thus, the location constraint and not being interoperable have been highlighted as a major loss for losing the contracts of hospitals if the hospitals are neither getting quality supplies nor are they able to depend on suppliers for reliable deliveries. The suppliers need to deliver required supplies to hospitals at the right time and at the right place; thereby emphasizing on the two major dynamic capabilities i.e. quality and delivery dependability to support interoperable facilities.

The next level hypothesis which got supported is H4 i.e. linkage of quality and servicing capability. Servicing capability happens to be a key aspect for business scenarios, especially in the healthcare supply chain context. In the case of Indian hospital suppliers, the key dynamic capability that has been highlighted as a major differentiator to achieve competitive advantage is quality. Quality happens to be the primary focus that can help the suppliers to have good faith in the eyes of their customers (hospitals) and also gain recommendations from physicians and hospital-staff. Having quality supply as a unique dynamic capability, the suppliers have a good reputation in the market, loyal long-term collaborative relationships with hospitals and ultimately achieve a much better servicing capability.

The hypothesis H8a which denotes the linkage of servicing capability with the operational performance outcome is also supported. The final business outcome- Operational performance has been highlighted as the most important aspect for hospital supplier selection and choice. Managing the servicing capability of suppliers and delivering the supplies at the right time and at right place and right condition, minimizing the lead time, properly managing order cycles, streamlining the supply processes with least possible error and also investing in proper forecasting techniques to manage demands and supply uncertainty has been emphasized as the key aspects for Indian hospital suppliers' performance. Hospitals are supported by a range of operational activities that are dependent on the capabilities of their principal suppliers which includes inventory management, order cycles, and distribution activities of supplies to point-of-care locations. Proper optimization of operational efficiency, order streamlining and cost optimization is focused as the crucial goals for Indian hospital suppliers. Thus, operational performance has been given a large importance for supplier-side outcomes as well. So, as per the discussion above it is observed that the hypotheses which were proposed from extant literature also got supported from the data obtained from Indian hospital-suppliers as validated in this study.

Discussion on Not-Supported Hypotheses of Supplier-side framework:

The proposed supplier-side framework was conceptualized on the basis of literature review and understanding by supply-chain expects. Some of the construct linkages were not accepted in the Indian hospital-suppliers' context. Following section logically analyses the not accepted hypotheses to discuss the reasons for the non-acceptance.

The hypothesis H2b, which denotes the linkage of transparency with delivery-dependability was not supported for supplier-side framework. In case of any business, if two entities maintain transparency in their process then they are expected to positively impact delivery-dependability. This linkage is also supported in the hospital-side framework of this study. However, in the context of Indian hospital procurement contracts with principal suppliers, there are mostly long term relationships and contracts which are renewed in 3-5 years and previous delivery performance of suppliers usually impacts the chance of renewal of the contracts. As this is a cross-sectional study, current practices of transparency and technology enablement in the Indian supplier network which is being practiced nowadays might have impact in future rather than present. If the principal supplier contracts were short-term, as it happens in western healthcare scenarios, where one order delivery dynamically impacts the next order, then delivery dependability would have been a major concern. Thus, due to long-term contracts of hospitals with suppliers, the relationship between transparency and delivery-dependability did not turn significant.

The hypotheses H3c and H3d i.e. the linkages of Interoperability with flexibility and responsiveness respectively are not accepted in current Indian hospital-supplier scenario study. Indian healthcare sector is gradually evolving with digital practices and interoperable processes, but still there are a lot of challenges in process standardization, technical barriers, data quality issues and confidence of people in technology usages. Indian hospital suppliers are still struggling to inculcate technology enabled interoperable practices due to financial barriers, trust issues, administrative inefficiencies, reporting problems and also IT inefficiency in various places; may be leading to compatibility issues which can lead to inappropriate process-response and flexibility. Linkages of interoperability with flexibility and responsiveness were not supported in the current supplier-side study context might be due to these technological barriers, issues with proper standardization and resistance to change. The principal suppliers of major hospitals, which are considered in this study, are predominantly primary and long-term suppliers of the tertiary-care hospitals. Thus, they mostly plan their orders much in advance and mostly on an ongoing basis and do not try to gain orders only on the basis of flexible and responsive service. Therefore, these dynamic capabilities i.e. flexibility and responsiveness although supported in literature, but do not find acceptance in Indian hospital-supplier context.

The hypotheses H5, H6 and H7 which represents the linkages of delivery-dependability, flexibility and responsiveness with servicing capability respectively has not been supported in the current empirical data sample of Indian hospital-supplier context. In B-2-B scenario where the principal suppliers are delivering order shipments (almost 35% of the supply product category by value) to tertiary-care hospitals, their servicing capabilities largely depend on quality of products and services rather than delivery dependability, flexibility and responsiveness. As most of the principal suppliers are niche suppliers and often command a huge market share, their renewal of contract depends little on their flexibility, dependability and responsiveness fronts and more on quality aspects. They are more concerned about the manufacturing orientation and product criteria specification adherence.

The linkage of servicing capability with the business outcome- financial performance which is represented by H8b does not find support in Indian hospital-supplier context. Every business needs to optimize their cost and manage finances efficiently, similarly hospital suppliers are also no different. But Indian hospital principal suppliers are mostly the primary suppliers of hospitals who usually enter into long term contracts of 3-5 years with the hospitals. There is no direct impact of servicing capability on financial performance because suppliers mostly focus on operational performance primarily efficiency, order cycles, timely delivery of supplies, streamline process, lead time, turn-around-time and also manage demand and supply uncertainties to maintain their capabilities and competitive advantage. In healthcare, some of the suppliers are niche and sell patented products or medicines; so in some cases hospitals don’t have many alternatives. As this is a cross-sectional study and data is collected only from principal suppliers, so the direct linkage of servicing capability with financial performance is not significant. As an extension to this research work, if study is done in a time-series model then the results might exhibit significant linkages and different results which might be taken up as future scope of this study. As supplier data considered in this study was only principal suppliers who mostly have long-term contracts in Indian scenario, so the linkage might have been non-significant; but if the supplier data was open-market hospital suppliers then the result might differ. An exhaustive hospital-supplier oriented study focusing various types of suppliers in Indian hospitals on a time-series data collection model can be a future scope and extension to this study.

9.3 Chapter Summary

The summary of this chapter is as follows:

The chapter has clearly analyzed and highlighted hypotheses testing result for both hospital-side and supplier-side framework. The discussion provided in this section highlights the analysis on significance and non-significance of each of the hypotheses considered in this study and elicits the contribution of this research work. As shown in the results tables-35 and 36, it is evident that many relationships were supported in the hospital-side and supplier-side framework. The supported linkages in the hospital-side framework were: Relationships between EHR-Adoption and ERP-Implementation, EHR-Adoption with Interoperability, ERP-Implementation with Transparency, Transparency with Quality, Transparency with delivery-dependability, ERP-Implementation with Quality, ERP-Implementation with Delivery-dependability, ERP-Implementation with Flexibility, ERP-Implementation with Responsiveness, Interoperability with Flexibility, Interoperability with Responsiveness; further the relationships between Quality and Servicing-capability, Delivery-dependability with Servicing-capability, Servicing-capability with Operational and financial performance were also supported for hospital-side data.

On the other hand the supported linkages in supplier-side framework were: Relationships between ERP-Implementation with Transparency and Interoperability, Transparency with Quality, Flexibility and Responsiveness, ERP-Implementation with Quality, Delivery-dependability, Flexibility and Responsiveness, Interoperability with Quality and Delivery-dependability; further the relationships between Quality with Servicing-capability and Servicing-capability with Operational performance were also supported for supplier-side data.

The next chapter i.e. chapter-10 concludes the thesis by discussing the contributions and managerial-implications of the study.

CHAPTER-X

10 CONCLUSION & IMPLICATIONS

The previous chapter i.e. Chapter-9 has talked over the hospital-side and supplier-side results obtained in this study. The supported relationships have been highlighted with details and the not-supported relationships have also been analyzed with justifications.

The current chapter i.e. Chapter-10 titled as 'Conclusion' presents the concluding thoughts obtained from the outcomes of this study. The chapter also discusses the contributions and implications of this study towards academic body of knowledge, business or managerial implications and also contributions offered to the underpinning theories.

10.1 CONCLUSION OF STUDY

The main intention of this research work was to analyze the impacts of the digital technologies like EHR- Adoption and ERP-Implementation towards the business outcomes of the hospitals and suppliers and also analyze the level-wise impacts on process-level capabilities (Transparency, Interoperability); then Dynamic Capabilities (Quality, Delivery-dependability, Flexibility, Responsiveness); then the Servicing Capability and finally Performance outcomes (Operational, Financial). With this study, a comprehensive framework has been conceptualized and validated with the unfolding of step-by-step outcomes involving antecedents and consequences relationships. This study used two sided data-sets obtained from the hospitals and their principal-suppliers in the Indian healthcare context.

In the hospital-side framework, the results from hospital-side empirical data validation highlight that in case of EHR-Adoption and ERP-Implementation in the hospitals; EHR-Adoption positively impacts ERP-Implementation and also positively bolsters Interoperability in the system fostering network-wide integration. The study outcome highlights that direct impact of EHR-Adoption on transparency is not manifested; however EHR-Adoption indirectly impacts Transparency through ERP-Implementation.

Moving to the next level of Dynamic Capabilities, empirical findings emphasize that ERP-Implementation positively impacts all the four capability constructs of Quality, Delivery-dependability, Flexibility and Responsiveness. Transparency further has been manifested to be positively impacting Quality and Delivery-dependability while Interoperability has been found to positively impact Flexibility and Responsiveness subsequently. It is further evident that out of the four Dynamic capabilities chosen, Quality and Delivery dependability have strong positive impacts on Servicing Capability of the hospitals which in turn has been found to be strongly and significantly impacting both Operational and Financial Performances positively.

On the other hand, the supplier-side framework analyses present a contrasting portrayal of relationship as this framework analyses only the impact of ERP-Implementation on the business outcomes passing through process-level capabilities, Dynamic-capabilities &Servicing capabilities of the firms. The results highlight that ERP-Implementation positively impacts both Transparency and Interoperability; and towards next level ERP-Implementation impacts all the considered Dynamic-capabilities i.e. Quality, Delivery-dependability, Flexibility, Responsiveness; Transparency further positively impacts Quality, Flexibility and Responsiveness; while Interoperability further positively impacts Delivery-dependability and Quality.

The outcomes of this hospital as well as supplier-side empirical analyses find suitable and strong justifications. For the supplier-side consideration, Quality is the only construct which has been found to be most important aspect affecting servicing capability and in turn only on operational performance and not on financial performance. On the other hand in case of hospital-side model, quality and delivery dependability, both finds significant positive impact on servicing capability and in turn on both financial and operational performance. This happens to be the main point of deliberation and the significant approach differences emerge here on the EHR and/or ERP implementation contexts between the two sides. While for hospital-side EHR and ERP adoption and implementation outcomes show positive impact on both through the two major aspects of delivery-dependability and quality on servicing capability. Most importantly it emerges that the respondents perceive the positive impact both at financial outcomes (ROA, ROI, NRPD and Market share) and operational outcome fronts (Cycle time, Accuracy, on-time delivery and service delivery forecasting). On the other hand the suppliers while considering the ERP implementation only gives importance and perceives the role of ERP on all the capability dimensions, however perceives only quality to be relevant and vital on affecting servicing capability and only finds relevance on operational performance. This outcome appears justified as the suppliers aim remains fixed at maintaining the quality and in turn maintaining a superior servicing capability and only the cycle time reduction, accuracy in delivery and lead time minimization aspect and hence fosters operational performance.

It was visible that Quality was the most important for both hospitals and suppliers as hospital want to delivery best quality care to patients and suppliers want to achieve best quality service in terms of supplied outputs to have long-term good relationships with the hospitals. This further impacts Servicing Capability which in turn impacts the Operational Performance. The reason for the aspect of financial performance to be not positive may be due to the cost involved in the initial ERP implementation setup and further maintenance of the IT integration platforms. The financial benefits can only occur when the setups provide ROI in a long-term aspect and as ERP-implementation among the hospital-suppliers are in a nascent stage, may be the data obtained has highlighted this aspect.

Hence, these hospital-side and supplier-side validations clarify the relationships and level-wise outcomes of the hospital-side scenarios which are very helpful for hospital managers and business planners to analyze the aspects of each of the situations and plan accordingly.

10.2 CONTRIBUTION & IMPLICATIONS OF THE STUDY

This section highlights the contributions and implications of this study towards academic body of knowledge, business or managerial implications and also contributions offered to the underpinning theories.

10.2.1 Academic contributions of the study:

1. The study focuses at understanding the impact of key digital resources (practices), namely EHR adoption and ERP implementation with the process level capabilities, namely Transparency and Interoperability.

2. This study aims at establishing the intermediary steps (variables eliciting the different capability levels) between the digital resources enabling practices and the final outcome variables with empirical validations from the Indian healthcare sector.

3. This research work forms an outcome based framework for the Indian hospital-side and Supplier-side scenarios from the theoretical backdrop of Javidan (1998) Capability-vs-Competency theory, and applies the theory into applications in the healthcare sector for the first time in Indian context. Thus, operationalizing the theory with the healthcare concepts which makes its niche place in the healthcare fraternity.

4. The study not only examines the linkages between antecedent and consequence variables, but also aims at establishing the Dynamic Capabilities (Quality, Delivery dependability, Flexibility and Responsiveness) as key intermediate level between practices and Servicing Capability, achieving superiority of which happens to be the primary objective of serving firms.

5. This study further aims at empirically quantifying the impact of Servicing Capability on the final business outcome variables (Operational and Financial performance). Though the study is in healthcare (hospital & hospital-supplier) context, still they happen to be profit-focused business entities because the main focus of the study concerns private sector tertiary-care hospitals and their suppliers who are predominantly for-profit firms.

6. The study happens to be one of its kinds and aims at providing a large scale empirical validation representing the four major metro cities in Indian and thus viewing the complete sample of the Indian healthcare which has been scarce in the Indian healthcare scenario, involving tertiary-care private hospitals and hospital-suppliers; thereby adding to the extant body-of-knowledge.

10.2.2 Business/Managerial implications of the study:

From industry perspective, the outcomes are targeted to have immense implications for the vision of digitalization of hospitals and hospital-suppliers to implement EHR and ERP practices and understand their impacts on the performance outcomes and also analyzing the intervening stages with different capability levels.

The study can also motivate the managers of non-digitalized healthcare centers in India to adopt the digital practices like EHR and ERP and be able to make decisions regarding the choice of shifting towards implementation of enabling digitalized practices and their subsequent operational and financial outcomes quantitatively.

In the backdrop of current healthcare vision especially in the context of the primary objectives highlighted in the *National health Policy (2017)*, this study finds special significance and relevance. The primary focus of the government vision in India is towards digitalization of the healthcare sector for the vision 2020 to ensure district-level electronic database of information on health system components, strengthening the health surveillance system, establishing federated integrated Health information architecture, Health-information-exchanges and National Health Information Network by 2025[24].

In the aforesaid context, this study is focused to be a major path breaking contribution towards the Healthcare Digitalization and Integration. Although, this research work is empirically validating the relationships of the framework in the private sector tertiary-care hospitals in India, the outcomes might have a much broader zone of acceptance across public or public-private hospitals (in Public Private Partnership-mode) to adopt the digital practices and clearly understand its business implication. The study is definitely expected to increase the understanding of EHR adoption and ERP implementations in India and help to uplift the digital healthcare practices vision of India (as envisioned in the *National health Policy, 2017)* and for future visions ahead.

10.2.3 Contribution to the theoretical supporting:

Theoretical backdrop is very vital for conceptualizing and proposing research models. In this study, as finalized during the synopsis presentation, the logic supporting the conceptual framework is derived from two base theories *(Capabilities-vs-competency theory by Javidan, 1998 & Resource based view (RBV) theory by Barney, 1991)* and two ancillary theories *(Cybernetic control theory, Vancouver, 1996 & Dynamic capabilities theory by Teece et al., 1997)*.

- **Contribution of Capabilities-vs-Competency theory:**

Capabilities-vs-competency theory by Javidan (1998) suggested the competency hierarchy which explained that at the bottom of the hierarchy remains the resources, which are the building blocks of capabilities, which in-turn forms the competencies of the firm; further impacting performance. Resources are the inputs to the organization’s value chain. Every firm has its own bundle of resources. However, they are unable to put its resources into best use.

The backbone of this study framework is derived from ‘Capability-vs-competency’ theory and the conceptual flow of this study framework is based

[24] http://vikaspedia.in/health/nrhm/national-health-policies/national-health-policy-2017

upon the conceptual premises put forth by Mansour Javidan which systematically, based on chronological rationale, links organizational resources, capability, competency and performance.

Extant literature spanning over three decades also supports the conceptualization of this theoretical underpinning. Kogut and Zander (1992) stated that combined resources allow the synthesis of capabilities. Bi et al. (2017) tested the theory to empirically validate e-business capability and value in the fast growth of enterprises. Zhang et al. (2016) applied the core competency theory by Javidan (1998) and showed that capabilities lead to core competencies which remain often embedded in functional areas which are further boosted by internal interactions between functional divisions; thereby highlighting that the solution-capabilities lead to value creation and strategic coordination.

In this study, the theoretical framework, as proposed by Javidan (1998) has helped in the framework development and the logical flow connecting the antecedent and consequence variables. In this study, digital technologies like EHR and ERP have been logically established as the resources, in turn further linking to capabilities and competencies.

The contribution of this empirical study towards this theoretical base happen to be the validation of the claim, put forth in the theory, with empirical evidences in critical service sector (especially healthcare) in the hospital and its supplier contexts. Another vital highlight of this study is the operationalization of Javidan's theoretical proposition and converting them into testable hypotheses based on empirical investigation in Indian healthcare context.

- **Contribution of Resource based view (RBV) theory:**

The RBV theory claims that firms compete based on bundle of resources that are valuable, rare, difficult to imitate, and non-substitutable (VRIN) by competitors (Barney, 1991). These unique resources enable firms to achieve competitive advantage and superior long-term performance. Barney (1991) suggested that organizational resources and capabilities are key factors for competitive advantage and its sustainability. This theory was further evolved in the relational resource based view (RRBV) by (Dyer and Singh, 1998) who suggested that partners generate relational rents through relationship-specific assets, knowledge-sharing routines, complementary resources and capabilities. Dyer and Singh (1998) highlighted that such rents cannot be generated by either firm in isolation and only created through joint partner contributions.

In this study, ***EHR and ERP*** are conceptualized and logically established as the ***<u>unique resources</u>*** to the firm (hospitals/ hospital-suppliers). The ***<u>internal capabilities</u>*** developed from their usage and interactions are ***transparency and interoperability***. The ***<u>dynamic capabilities</u>*** (as conceptualized in this study) developed from these resources are ***quality, delivery-dependability, flexibility and responsiveness;*** and ***servicing capability*** as the ***<u>competitive advantage</u>*** further leading to performance outcomes of the firms. RBV emphasises that along with firm's resources these capabilities are also highly important for competitive advantage.

Additional extant literature further emphasizes similar claims along the same thoughts. Bi et al. (2015) draws upon RBV theory, to develop and test a theoretical model exploring the interrelationships between IT resources (IT expertise, IT infrastructure), IT capability (IT integration), IT-enabled inter-firm processes (activity integration, coordination, partnership enhancement), and organizational performance in the fast growth SME context. Vargas and Lloria (2017) explored the links between RBV, intellectual capital and knowledge creation theory to explore the linkages between resources, enabling capabilities, competitive advantage and organizational performance with empirical validations from Spanish biotechnology firms.

Results of this study based on hospital-side sample elicits that EHR-Adoption positively impacts and supports ERP-Implementation; EHR also supports Interoperability of the hospitals. ERP-Implementation further supports Transparency, Quality, Delivery-dependability and Responsiveness. Transparency also supports Quality and Delivery-dependability. Interoperability in-turn supports Flexibility and Responsiveness. Quality and

Delivery-dependability further supports Servicing Capability of hospitals and Serving Capability further supports both Operational and Financial Performance of the hospitals.

The supplier-side sample results depict that ERP-Implementation supports Transparency, Interoperability; Quality, Delivery-dependability, Flexibility and Responsiveness. Further Transparency supports Quality, Flexibility and Responsiveness; Quality in turn supports Servicing Capability and Finally Servicing Capability supports Operational Performance of the hospital-suppliers.

Thus, the specific contribution to this theory based on this empirical validation supports how VRIN features (outcome competencies) can be achieved by firms (validated for hospitals and their suppliers in Indian healthcare context).

- **Contribution of Cybernetic control theory (CCT) theory:**

Cybernetic control theory explains how cyber resources (EHR and ERP systems as described in the current study context) offer a means by which managers can effectively develop their business strategy and organization capabilities (Vancouver, 1996). This is an ancillary theory taken in this study as this theory is completely aligned to this theoretical premise. This theory also emphasizes on the concepts of receiving timely feedback, analyzing deviations from expectations and taking necessary decisions to correct deviations. CCT highlights that organization needs to analyze the key performance indicators, take appropriate action and observe system responses (Vancouver, 1996). Consistent with this theory, ERP and EHR systems provide the means by which organizations can capture, process, and deliver a wide array of key performance indicators in real-time.

HassabElnaby et al. (2012) applied cybernetic control theory to explain how ERP systems are effective for developing business strategy and organizational capabilities; RBV theory and dynamic capabilities theory to discuss assets as important factor in improving performance (Barney, 1991; Teece et al., 1997), and agency theory to describe how performance measures motivate managers to emphasize on key financial and non-financial performance indicators (Feltham and Xie, 1994).

Thus, the specific contribution to this theory from this empirical validation is to analyze the level-wise impacts of EHR and ERP on the process level capabilities (transparency, interoperability); dynamic capabilities (quality, delivery-dependability, flexibility and responsiveness); servicing capability and performance (operational, financial) can be achieved by hospitals and suppliers in the healthcare scenario especially in the Indian context.

- **Contribution of Dynamic capabilities theory:**

Dynamic capabilities (DC) theory by (Teece et al., 1997) suggests that capabilities contribute to performance outcomes because they embody dynamic routines that can be manipulated into unique configurations to drive product and service differences. Teece and Pisano (1994) proposed dynamic capabilities theory as the “subset of the competences/capabilities which allow the firm to create new products and processes and respond to changing market circumstances”. Competitive advantage rests on distinctive processes, shaped by the firm’s asset positions and the evolutionary paths followed. DC emphasize management capabilities and inimitable combinations of resources that cut across all functions, including R&D, product and process development, manufacturing, human resources and organizational learning. The study thus highlights the impacts of resources on the dynamic capabilities of the firms.

Studies highlighted DC as the ability of firms to work towards differentiating from their competitors and fostering competency or competitive advantage i.e. the firm’s behavioral orientation towards competitive advantage and forms embedded processes to construct firms’ core capabilities (Helfat and Peteraf, 2003; Cepeda and Vera, 2007; Zahra et al., 2006; Braganza et al., 2017; Winter, 2003) and referred DC as the firms’ ability towards differentiating from their competitors thereby gaining competitive advantage.

This study specifically utilizes this theory to analyze the impact of dynamic capabilities considered in this study in the Indian hospital-suppliers context.

Thus, in a nutshell, the first base theory *'Capability-vs-competency' theory (Javidan, 1998)* is used to propose the flow of the framework. The second base theory *'Resource based view (RBV) theory'* (Barney, 1991) highlights that how resources like EHR and ERP create Valuable, Rare, Inimitable and Non-Substitutable (VRIN) attributes. Drawing linkages from two ancillary theories ['Cybernetic control theory' by Vancouver (1996) and 'Dynamic capabilities theory' (Teece et al., 1997)], the complete antecedent-consequence relationships are proposed in this study. *'Cybernetic control theory'* states how cyber resources like ERP or other platforms help in better performance and can be used to support digitalization of healthcare sector. The *'Dynamic capabilities theory'* highlights how dynamic capabilities hold importance in generating competencies.

However, the study attempts to empirically examine that how level-wise analysis is needed for impact analysis of EHR and ERP towards final outcome of performance. The study conceptualizes transparency and interoperability as the firm's internal process level capabilities as direct consequences of EHR and ERP implementation. Quality, delivery-dependability, flexibility and responsiveness have been conceptualized as the firm's dynamic capabilities, downstream to transparency and interoperability. Further downstream, servicing capability and in turn operational and financial performances have been placed as ultimate outcome consequences for firms (hospitals and hospital-suppliers). Thus, the empirical findings validate the complete framework.

10.3 Chapter Summary

The summary of this chapter is as follows:

This chapter pens the concluding thoughts obtained from results of this study both in the hospital-side and supplier-side view. The chapter also highlights the contributions and implications of this study towards academic body of knowledge, business or managerial implications and also contributions offered to the underpinning theories. The discussions provided in this chapter regarding conclusion, contributions and implications would provide clarity for researchers towards digital technologies implementation in hospitals and hospital-suppliers and the managers, stakeholders and implementers of healthcare sector can learn the contributions of EHR and ERP on level-wise capabilities, competencies and performance and get an understanding of digital transformation of healthcare sector which is the vision today.

The next chapter i.e. chapter-11 finally provides the limitations and future scope of study.

CHAPTER-XI

11 LIMITATIONS AND FUTURE SCOPE

The previous chapter i.e. Chapter-10 has discussed the concluding thoughts, academic contributions, managerial implications and contributions on this study towards theoretical underpinnings.

This chapter i.e. Chapter-11 titled as 'Limitations and Future scope of study' which is the last chapter of this thesis. The chapter discusses few vital limitations and highlights on some of the future areas of research which can be taken up for further studies in research context.

11.1 LIMITATIONS OF THIS STUDY

A complete research work without any limitation is not possible. Although utmost care has been taken to provide a holistic viewing perspective and near generalizable outcome in the context of healthcare, still the study happens to have a few limitations. This study in the healthcare context, especially involving hospitals and suppliers, aimed at contributing to the overall body of knowledge and establishing understandings through theoretical and practical implications; thereby aiming at achieving the overarching goal of plugging the existing research gaps as highlighted by the extant literature to be prevalent in the Indian-healthcare context. However few practical hurdles and research limitations do infest this holistic effort, standing in the way of investigating the research objectives as defined in the business problem and study research objectives. The major limitations of this study are:

- Separate impacts of digital technologies (i.e. EHR and ERP) on hospitals size (large versus small hospital) have not been considered in the purview of this study. Impact analysis of ERP as three separate categories (low, medium or high level), remain missing in this study, which can be later addressed as a further extension of this research.
- This study offers a cross-sectional view of the current healthcare situation in India towards applications of EHR and ERP, but the longitudinal time-based data is not analyzed.
- This study offers an analysis of non-circular relationships between the dynamic capabilities and further analysis of circular relationships between the dynamic capabilities remains for future.
- The sample size being limited, separate sets of hospital-side data and supplier side data are pooled and not mapped as linkages of suppliers with the hospitals. Thus, categorization of suppliers was not done separately. Thus, the study followed a referral-based data collection approach for the supplier-side.
- The sample size being limited the analysis based on the hospital types as collected in the stratified sampling are not conducted in this study. Separate analysis can be a logical extension of this work.
- This study is completely focused on only private sector tertiary-care hospitals for validation of this framework in study but other healthcare sectors like primary hospitals, secondary hospitals, public sector hospitals, teaching hospitals are yet to be validated.

11.2 FUTURE SCOPE OF RESEARCH:

This study has got prospects for future scope in healthcare sector as well as having a potential scope of generalizability in the other sectors as well. The study opens up towards newer areas of research in healthcare digitalization.

A few future scopes are:

- As this study is empirically validated in only one single sector of healthcare (private sector tertiary-care hospitals) due to its good merits but this framework can be further validated in the other healthcare sectors like primary hospitals, secondary hospitals, public sector hospitals, teaching hospitals, etc. for its better applicability and further analyzing the holistic view. This study can further be generalized in other sectors as well.

- Further categorization of the impacts of ERP into low, medium and high level and EHR aspects like medical transcription analysis, medical-app analysis is a very potent future scope of research.
- Various types of suppliers can also the validated using this research framework as an extension to this study in future.

11.3 Chapter Summary

The summary of this chapter is as follows:

This chapter throws light on some of the limitations of this research work which could not be handled in this study due to constraints. The highlighted limitations open up as major areas of future scope of research work which has been mentioned in this chapter.

CONCLUDING THOUGHTS OF THESIS

This research study largely focuses on healthcare sector and specifically highlights and emphasizes the aspects of implementation of digital technologies, namely Electronic Health Records (EHR) & Enterprise Resource Planning (ERP) in hospitals and their suppliers. This in depth empirical study attempted at laying the basic foundations of the path trotting towards a focal area involving critical and complex synergies between linked stake-holding partners, characterized by immense challenges of maintaining and delivering superior care-quality and providing value-based care at optimal cost. The criticality of this sector, makes the study and its implications more relevant as it directly involves outcomes which are linked to patient lives, care-delivery related services, hospital operations and associated financial implications; thereby characterizing the sector as even more challenging. In the backdrop of prolonged continuous expeditions towards ensuring superior digitally-enabled care delivery as highlighted by various health-reports and national health-policies of India, this study draws attention towards immense importance of practical goals and put forth a better nuanced understanding aiming at fulfilling the over-arching visions of healthcare digitalization and application of digi-techs in Indian healthcare sector context. This study analyses the adoption of two major technologies (EHR & ERP) in Indian healthcare context especially in private-tertiary-care hospitals and their suppliers. The uniqueness of this research lies in the level-wise analysis of technologies adoption towards process-level capabilities (Transparency & Interoperability) and their impact on major Dynamic capabilities (Quality, delivery-dependability, flexibility and responsiveness) with further consequences towards firm's competency like servicing-capability and finally the outcome variables like operational and financial performance in Indian healthcare sector (hospitals & hospital-suppliers). The study conceptualizes a research framework based on theoretical underpinnings and exhaustive literature review and finally validates that with empirical data from sample hospitals and their recommended principle suppliers. The large-scale empirical data is collected using *Stratified systematic sampling* technique from four major metropolitan cities (Delhi, Mumbai, Kolkata, and Chennai) and adjoining areas to achieve a clear and uniform representation of Indian-healthcare scenario. The study applies EFA, CFA and SEM for quantitative validation and clearly analyses and highlights the hypotheses testing result for both hospital-side and supplier-side framework and analyses the details of supported linkages in the hospital-side and supplier-side framework. The study establishes the intermediary steps (variables eliciting the different capability levels) between the digital resources enabling practices and the final outcome variables with empirical validations from the Indian healthcare sector. This research work forms an outcome based framework for the Indian hospital-side and Supplier-side scenarios thereby operationalizing the framework with the healthcare concepts which makes its niche place in the healthcare fraternity. This study uniquely paves its path towards motivating the managers of non-digitalized healthcare centers in India to adopt the digital practices like EHR and ERP and be able to make decisions regarding the choice of shifting towards implementation of enabling digital practices and their subsequent operational and financial outcomes quantitatively. The study can be extended not only in the context of digitalization of healthcare in private-sector hospitals but also can be analyzed in public-sector as well. Moreover, the framework which analyses the level-wise impact of digital technologies can be applicable in various other sectors as well. Therefore, this research work can significantly make a difference towards awareness of healthcare digitalization concepts and also provide necessary insight towards adoption of digital technologies in Indian-healthcare sector.

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APPENDICES

The below section i.e. the 'Appendix' section covers the details of items, Q-sort rounds, questionnaires and some extra statistical tools that was mentioned in the study.

APPENDIX-A

Items considered for Round-1 of Q-sort: Hospital-side

Constructs	Measurement Items	References
Hospital EHR Adoption	**Our hospital has adopted EHR module/processes:**	
	- For Electronic Clinical Documentation. *(N.B. functions include patient demographics, physician notes, nursing assessments, medication details, discharge summaries, etc.)*	Jha et al., 2009; Dobrzykowski and Tarafdar, 2015
	- For viewing the reports and results. *(N.B. functions include electronic management of Lab reports, radiology reports, diagnostic reports, consultant reports.)*	Dobrzykowski and Tarafdar, 2015
	- For computerized provider	Jha et al., 2009;

	order entry. *(N.B. functions include medication orders, nursing orders, and consultation requests.)*	Plantier et al., 2017
	- For clinical decision support for physicians and hospital staffs. *(N.B. functions include clinical guidelines, drug analysis details and drug dosing support.)*	Fontenot, 2013
	-Which increases people connectivity.*	Narattharaksa et al., 2016; Dobrzykowski and Tarafdar, 2017
	- Which increases medical knowledge in people.*	Narattharaksa et al., 2016
Hospital ERP Implementation	**Post ERP Implementation, as compared to the competing Non- ERP hospitals in the region our hospital is able to:**	
	-Provide access to more data	HassabElnaby et al., 2012
	-Provide more integrated, timely, accurate and reliable information.	Hong et al, 2010; HassabElnaby et al., 2012
	-Provide information to all its stakeholders at a much greater	Miller and Sim, 2004; Mozafari et al., 2012; Garefalakis et

	speed and accuracy	al., 2016
	-Access real-time information from across verticals/locations which was difficult before ERP was implemented.	Klaus et al., 2000; Miller and Sim, 2004
	-A better work environment.*	Akkermans et al., 2003
Hospital Transparency	**Our hospital clarifies the principal supplier(s) about our hospital's:**	
	-True motivations, goals, and agenda.	Eggert and Helm, 2003; Spagnuelo and Lenzini, 2017
	-Economic strategies and situations.	Eggert and Helm, 2003
	-Organizational policies.	Lamming et al., 2004
	-Technical expertise/skills.	Bartlett et al., 2007
	-all the compliances for organizational transparency.*	Schneller and Smeltzer, 2006
Hospital Interoperability	Our hospital follows standardized systems for all data and information with internal and external vendors.	Tolk and Muguira, 2003 ; Ide and Pustejovsky, 2010 ; Chen et al., 2008 ; Zdravkovic et al., 2017
	Our hospital is able to seamlessly share and use data or	Ide and Pustejovsky, 2010 ; Chen et al.,

	information from multiple sites.	2008 ; Tolk and Muguira, 2003 ; Zdravkovic et al., 2017
	Our hospital support common functions and procedures across all the location where they operate.	Ide and Pustejovsky, 2010 ; Chen et al., 2008 ; Tolk and Muguira, 2003 ; Zdravkovic et al., 2017
	The language of communication used by our hospital is understandable without ambiguity by the systems at all locations.	Ide and Pustejovsky, 2010 ; Chen et al., 2008 ; Tolk and Muguira, 2003 ; Zdravkovic et al., 2017
Hospital Quality of Care	Our hospital is able to compete based on quality.	Chaudhry et al., 2006 ; Mosadeghrad, 2013; Sagier and Nathan, 2013
	Our hospital offer high quality care services to their patients	Chaudhry et al., 2006; Gemmel, 2017
	Our hospital's Patient care services are highly reliable.	Chaudhry et al., 2006; Gemmel, 2017
	Our hospital offers care services which are of value.	Naidu, 2007; Sagier and Nathan, 2013
	Our hospital offers quality patient care.*	Naidu, 2007; Sagier and Nathan, 2013

Hospital (Care) Delivery Dependability	Our hospital delivers the kind of services which are needed.	Dabholkar et al., 1996 ; Li et al., 2005
	Our hospital delivers services to the customer on time.	Li et al., 2005; Rai and Nathawat, 2017; Gemmel, 2017
	Our hospital provides dependable delivery.	Boano et al., 2016
	The care provided is completely as per the needs of the patients.*	Gemmel, 2017
Hospital Care Flexibility	**Our hospital:**	
	-Frequently evaluates and addresses formal and informal patient complaints as per patient convenience.	vanGool et al.,2017; Matanock et al., 2014;Rotar et al., 2016
	- Frequently interacts with patients/patient parties (customers) to set care process standards.	Cohen-Mansfield and Bester, 2006
	-Frequently follow-ups with patients/patient parties (customers) for quality/service feedback.	Li et al., 2005; Wekre et al., 2011
	- Frequently measures/evaluates customer satisfaction on the go to implement flexible care delivery options.	Schobel et al., 2016; vanGool et al., 2017
	- Is flexible to take various payment options*	Matanock et al., 2014

Hospital Responsiveness	Our hospital has operating processes which suits majority of the patients' convenience ease.	RamseookMunhurrun et al., 2010; Saghier and Nathan, 2013
	Our hospital delivers care services quickly to the patients as and when needed (agility).	Naidu, 2009
	Our hospital customizes patient-care services in innovative manner to cater to niche patient needs.	Selvakumar, 2016;Sachdev and Verma, 2004;Raposo et al., 2009;Leen et al., 2004; Li et al., 2005;Irfan et al., 2012
	Our hospital accepts most major credit cards.*	Matanock et al., 2014
	Our hospital has operating hours convenient to all their patients.*	Naidu, 2009; Saghier and Nathan, 2013
	Our hospital is the first in the market in introducing new technologies.*	Naidu, 2009; Saghier and Nathan, 2013
	Our hospital frequently interacts with customers to set responsiveness for us.*	Naidu, 2009; Saghier and Nathan, 2013
Hospital Servicing Capability	**Over the years compared to the competing hospitals in the region our hospital's capability to:**	
	-Create new/innovative patient	Zhang and Chen,

	care service has enhanced	2008; Kumar et al., 2017
	-Provide unique service experience has enhanced.	Zhang and Chen, 2008
	-Provide cost-effective patient-care services of various kinds have enhanced.	Andaleeb, 1998; Zhang and Chen, 2008
	-Provide customized value-adding service to patients has enhanced.	Coulter and Jenkinson, 2005; Donabedian, 1986
Hospital Operational Performance	**Compared to competing hospitals in the region our hospital has achieved:**	
	-Reduction in patient service (care) cycle times (catering to more patients)	Nyaga et al., 2010; Jiang et al., 2012
	-Improved patient service processing accuracy (highly streamlined and minimal error).	Nyaga et al., 2010; Jiang et al., 2012
	-Improved on-time delivery of patient service (without delays and unnecessary deferment of treatment).	Nyaga et al., 2010; Jiang et al., 2012
	-Improved patient service forecasting.	Nyaga et al., 2010; Jiang et al., 2012
	-Better forecasting ability compared to competing	Nyaga et al., 2010; Jiang et al., 2012

	hospitals.*	
Hospital Financial Performance	**Compared to competing hospitals in the region our hospital has experienced growth in:**	
	-Return on Asset.	Cao and Zhang, 2011; Dobrzykowski et al., 2012
	-Return on investment.	Cao and Zhang, 2011; Dobrzykowski et al., 2012
	-Net revenue per Discharge.	Cao and Zhang, 2011; Dobrzykowski et al., 2012
	-Market share (either in revenue or patient cap).	Cao and Zhang, 2011; Dobrzykowski et al., 2012
**indicates that the item was removed after Q-sort and not present in the final questionnaire.*		

APPENDIX-B

Items considered for Round-1 of Q-sort: Supplier-side

Constructs	Measurement Items	References
Supplier ERP-Implementation	**Post ERP Implementation, compared to other competing non- ERP enabled hospital-suppliers belonging to our category, our firm is able to provide our customer hospitals with:**	
	-Access to more data of hospitals and other suppliers.	HassabElnaby et al., 2012
	-More integrated, timely, accurate and reliable information from the hospitals.	HassabElnaby et al., 2012; Hong et al, 2010
	-Provide information to all its stakeholders at a much greater speed and accuracy.	Garefalakis et al., 2016; Mozafari et al., 2012; Miller and Sim, 2004
	-Access real-time information from across verticals/locations which was difficult before ERP was implemented.	Miller and Sim, 2004; Klaus et al., 2000; Garefalakis et al., 2016
	-A better work environment.*	Akkermans et al., 2003 ; HassabElnaby et al., 2012

Supplier Transparency	**Our firm clarifies our customer hospitals about our firm's:**	
	-True motivations, goals, and agenda.	Eggert and Helm, 2003; Spagnuelo and Lenzini, 2017
	-Economic strategies and situations.	Eggert and Helm, 2003
	-Organizational policies.	Lamming et al., 2004
	-Technical expertise/skills.	Bartlett et al., 2007
	-all the compliances for organizational transparency.*	Schneller and Smeltzer, 2006
Supplier Interoperability	This supplier follows standardized systems for all data and information with internal and external customers (hospitals).	Ide and Pustejovsky, 2010 ; Chen et al., 2008 ; Tolk and Muguira, 2003 ; Zdravkovic et al., 2017
	This supplier is able to seamlessly share and use data or information from multiple sites.	Ide and Pustejovsky, 2010 ; Chen et al., 2008 ; Tolk and Muguira, 2003 ; Zdravkovic et al., 2017
	This supplier support common functions and procedures across all the location where they operate.	Ide and Pustejovsky, 2010 ; Chen et al., 2008 ; Tolk and Muguira, 2003 ;

		Zdravkovic et al., 2017
	The language of communication used by this supplier is understandable without ambiguity by the systems at all locations.	Ide and Pustejovsky, 2010 ; Chen et al., 2008 ; Tolk and Muguira, 2003 ; Zdravkovic et al., 2017
Supplier Quality	This supplier is able to compete based on quality.	Chaudhry et al., 2006 ; Mosadeghrad, 2013; Sagier and Nathan, 2013
	This supplier offer high quality equipments, medicines, samples, services to their delivery hospitals and stakeholders.	Chaudhry et al., 2006; Gemmel, 2017
	Orders and deliveries are highly satisfactory.	Chaudhry et al., 2006; Gemmel, 2017
	Offer orders and deliveries in goods and services of value.	Naidu, 2007; Sagier and Nathan, 2013
	This supplier improves the quality of care for their hospitals*	Naidu, 2007; Sagier and Nathan, 2013
Supplier Delivery Dependability	This supplier delivers the kind of services which are needed.	Dabholkar et al., 1996; Li et al., 2005
	This supplier delivers services to the customer on time.	Li et al., 2005; Rai and Nathawat, 2017;

		Gemmel, 2017
	This supplier provides dependable delivery.	Boano et al., 2016
	This supplier provides supplies completely as per the needs of the hospital.*	Gemmel, 2017
Supplier Flexibility	**This supplier:**	
	- Frequently evaluate the formal and informal complaints of our stakeholders and customers	vanGool et al.,2017; Matanock et al., 2014 ; Rotar et al., 2016
	- Frequently interact with customers to set standards.	Cohen-Mansfield and Bester, 2006
	- Frequently does follow-up with customers for quality/service feedback.	Li et al., 2005; Wekre et al., 2011
	- Frequently measure and evaluate customer satisfaction.	vanGool et al., 2017; Schobel et al., 2016
	- Is flexible to take various payment options*	Matanock et al., 2014
Supplier Responsiveness	-Our firm has operating processes which suits majority of the hospitals' convenience ease.	Saghier and Nathan, 2013; RamseookMunhurrun et al., 2010
	-This supplier provides plenty of convenient contacts for the hospitals.*	Naidu, 2009
	- Our firm delivers care services quickly to the patients as and	Selvakumar, 2016; Sachdev and Verma,

	when needed (agility).	2004; Raposo et al., 2009 ; Leen et al., 2004; Li et al., 2005; Irfan et al., 2012;
	-Our firm has operating hours convenient to all their hospitals and other stakeholders*	Matanock et al., 2014
	- Our firm accepts all modes of monetary transactions (cash, credit card, money transfers, net-banking).*	Naidu, 2009; Saghier and Nathan, 2013
	- Our firm customizes patient-care services in innovative manner to cater to niche patient needs.	Naidu, 2009; Saghier and Nathan, 2013
	- This supplier delivers the goods quickly.*	Naidu, 2009; Saghier and Nathan, 2013
Supplier Servicing Capability	**Compared to the competing hospital-suppliers in the region our firm's is capable of:**	
	-Creating new/innovative services, over the years, compared to the competing hospitals in the region.	Zhang and Chen, 2008; Kumar et al., 2017
	-Providing unique service experience, compared to the competing suppliers in the	Zhang and Chen, 2008

	region.	
	-Providing cost-effective services of various kinds have enhanced over the years compared to the competing suppliers in the region.	Andaleeb, 1998; Zhang and Chen, 2008
	-Providing customized value-adding service to hospitals, as enhanced over the years compared to the competing suppliers in the region.	Coulter and Jenkinson, 2005; Walker et al., 2005; Donabedian, 1986
Supplier Operational Performance	-Supplier has achieved reduction in service cycle times (catering to more orders) compared to competing suppliers.	Nyaga et al., 2010; Jiang et al., 2012
	-Supplier has achieved improved service processing accuracy (highly streamlined and minimal error) compared to competing suppliers.	Nyaga et al., 2010; Jiang et al., 2012
	-Supplier has achieved improved on-time delivery of service (without delays and unnecessary deferment of treatment) compared to competing suppliers.	Nyaga et al., 2010; Jiang et al., 2012
	-Supplier has achieved improved service forecasting	Nyaga et al., 2010; Jiang et al., 2012

	accuracy compared to competing suppliers.	
	-Supplier has better forecasting ability compared to competing hospitals.*	Nyaga et al., 2010; Jiang et al., 2012
Supplier Financial Performance	**Compared to competing suppliers in the region our firm has experienced growth in:**	
	-Return on Asset.	Cao and Zhang, 2011; Dobrzykowski et al., 2012
	-Return on investment.	Walker et al., 2005; Cao and Zhang, 2011; Dobrzykowski et al., 2012
	-Net revenue per Discharge.	Cao and Zhang, 2011; Dobrzykowski et al., 2012
	-Market share.	Walker et al., 2005; Cao and Zhang, 2011; Dobrzykowski et al., 2012
**indicates that the item was removed after Q-sort and not present in the final questionnaire.*		

APPENDIX-C

Questionnaire Document: Hospital-Side

PhD Research Work

Antecedent-Consequence relationship between EHR Adoption and ERP Implementation with Servicing Capability and Performance: A Study in Indian Healthcare

HOSPITAL SURVEY QUESTIONNAIRE

Sent to potential respondents by forwarding email, distributed in hand or by survey tool

- **Hospital-side Questionnaire Survey Cover Letter:**

***Dear Participant/Respondent*,**

This questionnaire survey is prepared for a doctoral research study in the area of Digitalization of healthcare sector in India. This study context is attempting to understand the impact of digitalized healthcare records i.e. electronic health records (EHR-Adoption) and enterprise integration by enterprise resource planning (ERP) in the Indian healthcare network (hospitals & hospital-suppliers). Further analysis is done to find out the impact of EHR Adoption & ERP-Implementation on hospitals' and suppliers' process level capabilities like Transparency and Interoperability (in this study) and further their impact on Dynamic Capabilities like Quality, Delivery Dependability, Flexibility & Responsiveness (in this study) and thereby analyzing the impact on Servicing Capability (competency/ competitive advantage) and finally analyzing the impact on Hospitals' or Hospital-suppliers' Operational and Financial performance. The target hospitals are tertiary-care hospitals and target suppliers may be of following categories: Pharmaceutical, Surgical, Devices-Prosthetics and General Hospital suppliers. *(Please share details of your 'Principle Suppliers' for the research purpose to collect data from the suppliers' side. The term 'Principle Supplier(s)', in this study are those supplier(s) which supplies one-third (approx. 30-35%) of the total supplies (in INR) in any particular category to the concerned hospitals.)*

Please fill this questionnaire and handover to researcher or the respondents, who will respond over emails, need to answer from their email-id using the link sent or by answering the attached word document and send the researcher's email (tulikachakravorty9@gmail.com) by filling only once (repeated responses need not be sent). The researcher will share the results of this study with the hospital authorities and practicing managers who participate in this survey for a better understanding of the level-wise impact of EHR-Adoption and ERP-Implementation on the Performance outcomes being studied with the intermediary capabilities and competency in a B-2-B context (concerned with hospital & hospital-suppliers) in Indian tertiary care hospital context so that they can be benefitted.

Kindly fill-in the responses spending 15 minutes of your time for research work and help us in understanding the *'Antecedent-Consequence relationship between EHR Adoption and ERP Implementation with Servicing Capability and Performance'* and providing a detailed scenario of the level-wise impact of digitalization in hospitals and their suppliers which is still in a nascent stage in Indian context. In-case of any queries, please feel free to call or WhatsApp the researcher (Tulika Chakravorty) at +91-9032909537 or send a mail to tulikachakravorty9@gmail.com

Sincerely,

Tulika Chakravorty
Doctoral Research Scholar
UPES-Dehradun, Uttarakhand, INDIA.

Note: *The aim of this questionnaire is to collect data only for PhD research study and the researcher confirms that this data will be kept confidential only for academic usage and no data will be shared with any individual or any other organization and names or personal details of respondents will not be revealed.*

PhD Thesis Questionnaire: Hospital-side

PART-A

- **Hospital Name (Optional): ________________________________**
- **Hospital City***:__________________
- **Hospital Specialty:** (please put a tick mark)
  Single Specialty ( )
  Multispecialty including Super-specialty ( )
  Non-Specialty/General hospitals ( )

- **Number. of Hospital Beds (Including ICCU and ITU) :** (please put a tick mark)

  Below 20 ( )
  between 20 to 50 ( )
  between 51 to 150 ( )
  between 151 to 250 ( )
  between 251 to 399 ( )
  Above 400 ( )

- **Category of Supplier being handled by individual hospital respondents** [please tick marks against the appropriate option(s)]:
  Pharmaceutical suppliers ( )
  Surgical-suppliers ( )
  Devices-Prosthetics suppliers ( )
  General hospital suppliers ( )

- **Your Job title (Please check the closest title which applies).**
  - *Hospital Patient-Service Managers* ( )
  - *Hospital Superintendent* ( )
  - *Hospital Operations Manager* ( )

- *Purchasing Managers* ( )
- *Purchasing Executives* ( )
- *Procurement Managers* ( )
- *Procurement Executives* ( )
- *Logistics Manager* ( )
- *Hospital Store Managers* ( )
- *Controlling officer-Hospital Admin Staff* ( )
- *Any other designation* ________________*(please specify)*
- *Don't wish to disclose* ( )

- **Years of experience in same/similar role:**

  Below 5 years ( )

  5years to less than 10 years ( )

  10 years & above ( )

- **Digital Technologies in the hospital:**
  - *EHR (or electronic patient records in any form) :* ( )
  - *ERP (or enterprise wide integration system in any form) :*( )
  - *Both EHR & ERP (in any forms) :* ( )

- **Years of experience in using the above digital technologies:**

  Below 2 years ( )

  2-5 years ( )

  Above 5 years ( )

DECLARATION: The answers provided here will not be disclosed anywhere or misused by any individual under any circumstances.

** **Please share the names of the principle supplier(s) for the category chosen by phone or over email to (tulikachakravorty9@gmail.com) as we need to contact the suppliers also for this study.**

PART-B

** Please put a tick mark against each rating response*

Hospital EHR adoption:

S. No	**Questionnaire Items** **Our hospital has adopted EHR module/processes:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	- For electronic clinical documentation. *(N.B. functions include patient demographics, physician notes, nursing assessments, medication details, discharge summaries, etc.)*	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	- For viewing the reports and results. *(N.B. functions include electronic management of Lab reports, radiology reports, diagnostic reports, consultant reports.)*	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	- For computerized provider order entry. *(N.B. functions include medication orders, nursing orders, and consultation requests.)*	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	- For clinical decision support for physicians and hospital staffs. *(N.B. functions include clinical guidelines, drug analysis details and drug dosing support.)*	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Hospital ERP Implementation:

S. No	**Questionnaire Items** **Post ERP Implementation, as compared to the competing Non-ERP hospitals in the region our hospital is able to :**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	-Access more data	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-Provide more integrated/ updated information.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Provide more information with greater accuracy.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Access real-time information from all locations which were difficult before ERP was implemented.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Hospital Transparency:

S. No	**Questionnaire Items** **Our hospital clarifies the principal supplier(s) about our hospital's:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	- True motivations/ goals/ agenda.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	- Economic strategies/ situations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Organizational policies.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Technical expertise/skills.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Hospital Interoperability:

S. No	Questionnaire Items	Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)						
1	Our hospital follows standardized processes for sharing data/ information with vendors.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our hospital is able to seamlessly manage data/ information from multiple sites.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	Our hospital supports standardized functions/ procedures across all operable locations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	Our hospital exhibits capability of using standardized communication protocols without ambiguity across locations/platforms.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Hospital Quality of Care:

S. No	Questionnaire Items	Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)						
1	Our hospital is able to compete based on quality measures/ standards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our hospital offer high quality care/ services *(as we find from discharge feedbacks)*.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	Our hospital's care/ services are highly satisfactory *(as we find from discharge feedbacks)*.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

4	Our hospital offers care/ services which are of value *(as we find from discharge feedbacks).*	**1**	**2**	**3**	**4**	**5**	**6**	**7**

<u>Hospital (Care) Delivery Dependability:</u>

S. No	**Questionnaire Items**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	Our hospital delivers the niche/ appropriate care services dependably when needed.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our hospital delivers services to the customer on time.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	Our hospital provides care service delivery definitely without fail.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

<u>Hospital Care Flexibility:</u>

S. No	**Questionnaire Items** **Our hospital frequently:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	-Evaluates the formal/ informal complaints/ feedbacks given by our patients on real time basis conveniently.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	- Interacts with patients/patient parties (customers) to set care process standards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Follows up with patients/patient parties (customers) for	**1**	**2**	**3**	**4**	**5**	**6**	**7**

	quality/service feedback.							
4	-Measures/evaluates patient needs quite frequently to implement flexible care delivery options.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

<u>Hospital Responsiveness:</u>

S. No	**Questionnaire Items**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	Our hospital has responsive operating processes which suits majority of our patients' convenience.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our hospital delivers care services quickly to the patients in an agile manner.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	Our hospital customizes patient-care services in innovative manner to cater to niche patient needs.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

<u>Hospital Servicing Capability:</u>

S. No	**Questionnaire Items** **Over the years compared to the competing hospitals in the region our hospital's capability to:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	-Create new/innovative patient care service has enhanced	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-Provide unique service experience has enhanced.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Provide cost-effective patient-care services of various kinds have	**1**	**2**	**3**	**4**	**5**	**6**	**7**

	enhanced.							
4	-Provide customized value-adding service to patients has enhanced.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Hospital Operational Performance:

S. No	**Questionnaire Items** **Compared to competing hospitals in the region our hospital has achieved:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	-Reduction in patient service (care) cycle times (catering to more patients)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-Improved patient service processing accuracy (highly streamlined and minimal error).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Improved on-time delivery of patient service (without delays and unnecessary deferment of treatment).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Improved patient service forecasting.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Hospital Financial Performance:

S. No	**Questionnaire Items** **Compared to competing hospitals in the region our hospital has experienced growth in:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	-Return on Asset.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-Return on investment.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Net revenue per Discharge (NRPD).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Market share (either in revenue or patient cap).	**1**	**2**	**3**	**4**	**5**	**6**	**7**

APPENDIX-D

Questionnaire Document: Supplier-Side

PhD Research Work

Antecedent-Consequence relationship between EHR Adoption and ERP Implementation with Servicing Capability and Performance: A Study in Indian Healthcare

HOSPITAL-SUPPLIER SURVEY QUESTIONNAIRE

Sent to potential respondents by forwarding email, distributed in hand or by survey tool

- **Supplier-side Questionnaire Survey Cover Letter:**

Dear Participant/Respondent,

This questionnaire survey is prepared for a doctoral research study in the area of Digitalization of healthcare sector in India. This study context is attempting to understand the impact of digitalized healthcare records - Electronic Health Record (EHR) and enterprise integration by enterprise resource planning (ERP) in the Indian healthcare network (hospitals & hospital-suppliers). Further analysis is done to find out the impact of EHR Adoption & ERP-Implementation on hospitals' and suppliers' process level capabilities like Transparency and Interoperability (in this study) and further their impact on Dynamic Capabilities like Quality, Delivery Dependability, Flexibility & Responsiveness (in this study) and thereby analyzing the impact on Servicing Capability (competency/ competitive advantage) and finally analyzing the impact on Hospitals' or Hospital-suppliers' Operational and Financial performance.

The target suppliers may be of following categories: Pharmaceutical, Surgical, Devices-Prosthetics and General Hospital suppliers. The suppliers who are being contacted in this study are referred by one or more hospitals. Please fill this questionnaire and handover to researcher or the respondents, who will respond over emails, need to answer from their email-id using the link sent or by answering the attached word document and send the researcher's email (tulikachakravorty9@gmail.com) by filling only once (repeated responses need not be sent). The researcher will share the results of this study with the hospital-suppliers who participate in this survey for a better understanding of the level-wise impact of ERP-Implementation on the Performance outcomes being studied with the intermediary capabilities and competency in a B-2-B context (concerned with hospital & hospital-suppliers) so that they can be benefitted.

Kindly fill-in the responses spending 15 minutes of your time for research work and help us in understanding the *'Antecedent-Consequence relationship between EHR Adoption and ERP Implementation with Servicing Capability and Performance'* and providing a detailed scenario of the level-wise impact of digitalization in hospitals and their suppliers which is still in a nascent stage in Indian context. In-case of any queries, please feel free to call or WhatsApp the researcher (Tulika Chakravorty) at +91-9032909537 or send a mail to tulikachakravorty9@gmail.com

Sincerely,

Tulika Chakravorty
Doctoral Research Scholar
UPES-Dehradun, Uttarakhand, INDIA.

Note: *The aim of this questionnaire is to collect data only for PhD research study and the researcher confirms that this data will be kept confidential only for academic usage and no data will be shared with any individual or any other organization and names or personal details of respondents will not be revealed.*

DECLARATION: The answers provided here will not be disclosed anywhere or misused by any individual under any circumstances.

PhD Thesis Questionnaire: Supplier side (Hospital Suppliers)

PART-A

- Supplier Name (Optional) ______________________________
- Supplier City:___________________
- **Supplier Categories**: (please put a tick mark)
  - *Pharmaceutical Supplier ( )*
  - *Surgical Supplier ( )*
  - *Device-Prosthetics Supplier ( )*
  - *General Supplier ( )*
  - *Any Other Supplier ( )*

- **Type of Supplier** [please tick marks against the appropriate option(s)]:

  Manufacture & Supply ( )

  Procure & Supply ( )

  Modify and Supply ( )

- **Integration Technology implemented by the Supplier:**
  - *ERP (or enterprise wide integration system): ( )*
  - *Other integration technology: ( )*
  - *If other mention the technology name:* ____________________

- **Years of experience in using the above digital technology:**

  Below 2 years ( )

  2-5 years ( )

  Above 5 years ( )

NB: EHR Adoption is not applicable in the Supplier-side, so data taken for technology adoption is only ERP.*

PART-B

** Please put a tick mark against each rating response*

ERP Implementation: Supplier-side

S. No	Questionnaire Items Post ERP Implementation, compared to other competing non-ERP enabled hospital-suppliers belonging to our category, our firm is able to provide our customer hospitals with:	Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)						
1	-More access to data.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-More integrated/ updated information.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-More information with greater accuracy.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Detailed access to real-time information from all locations which were difficult before ERP was implemented.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Transparency: Supplier-side

S. No	Questionnaire Items Our firm clarifies our customer hospitals about our firm's:	Perceptual Ratings:- Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)						
1	-True motivations/ goals/ agenda.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-Economic strategies/ situations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Organizational policies.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Technical expertise/skills.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Interoperability: Supplier-side

S. No	Questionnaire Items	Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)						
1	Our firm follows standardized processes for sharing data/ information with customers (i.e. hospitals).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our firm is able to seamlessly manage data/ information from multiple sites.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	Our firm supports standardized functions/ procedures across all operable locations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	Our firm exhibits capability of using standardized communication protocols without ambiguity across locations/platforms.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Quality: Supplier side

S. No	Questionnaire Items	Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)						
1	Our firm is able to compete with others based on quality.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our firm is capable of offering high quality shipments *(equipments/ medicines/ prosthetics/ implants / ancillary services)* to our customer hospitals.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

3	Our firm is capable of providing the order deliveries ensuring high satisfaction level.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	Our firm offers order deliveries in terms of goods/ services of value.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

<u>Delivery Dependability: Supplier side</u>

S. No	**Questionnaire Items**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	Our firm delivers niche products/ equipments/ services dependably when needed.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our firm delivers services to the customers on time.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	Our firm provides delivery definitely without fail.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

<u>Flexibility: Supplier-side</u>

S. No	**Questionnaire Items**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	Our firm frequently evaluates the formal/ informal complaints raised by our customers *(hospitals)* in real time as per convenience.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our firm frequently interacts with customers *(hospitals)* to agree upon the set standards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

3	Our firm carries out frequent follow-ups with customers *(hospitals)* for feedback regarding our services.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	Our firm frequently measures/ evaluates customer *(hospital)* needs.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

<u>Responsiveness: Supplier-side</u>

S. No	**Questionnaire Items**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	Our firm has responsive operating processes which suits majority of our customers' *(hospitals')* convenience/ ease of operations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	Our firm delivers services quickly to the customers *(hospitals)* in an agile manner.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	Our firm customizes services in innovative manner to cater to niche customer *(hospital)* needs.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

<u>Supplier's Servicing Capability:</u>

S. No	**Questionnaire Items** **Compared to the competing hospital-suppliers in the region our firm is capable of:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	-Creating new/innovative services.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-Providing unique service experience.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

3	-Providing cost-effective services of various kinds.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Providing customized value-adding service to our customers *(hospitals)*.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Operational Performance: Supplier-side

S. No	**Questionnaire Items** **Compared to competing suppliers in the region our firm has achieved:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	-Reduction in service cycle times (catering to more orders).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-Improvement in service processing accuracy (highly streamlined and minimal error).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Improvement in on-time delivery of services (without delays and deferment).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Improved service forecasting ability.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Financial Performance: Supplier side

S. No	**Questionnaire Items** **Compared to competing suppliers in the region our firm has experienced:**	**Perceptual Ratings: Scale of 1 to 7 (1 represents Strongly Disagree; 7 represents Strongly Agree)**						
1	-Growth in Return on Asset	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	-Growth in return on investment	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	-Growth in Net Revenue Per Discharge	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	-Growth in Market share	**1**	**2**	**3**	**4**	**5**	**6**	**7**

APPENDIX-E

Other Measures:

In this study, proactive measures were taken to avoid Common Method Bias (CMB) as the responses were all taken anonymously without any other influence and the survey instrument was designed in such a manner that the questions of predictor (independent) and criterion (dependent) variables were put in different segments of the questionnaires.

Common Method Bias:

In case of Survey based methods there are variations which are caused by measurement instruments rather than respondents or the items of the constructs. The instrument introduces a bias due to which variances occurs; referred to as Common Method Bias (CMB). The simplest and most popular method of testing CMB is Harman's single factor test (Podsakoff et al., 2003).

Harman's Single Factor Test:

Harman's single factor test (HSF) is a technique of testing CMB in which all items of all the constructs considered in the study are included into one general factor for determining if the majority of variance can be accounted to one-factor. HSF test can be conducted by using both exploratory factor analysis (EFA) & confirmatory factor analysis (CFA). Using EFA, all the items are loaded to un-rotated EFA with one general factor and keeping the basic assumption as, if the average variance extracted (AVE) is more than 50% i.e. single factor will emerge and CMB is present. Using CFA, a comparison test is carried out between model-fit indices and chi-square differences between single factor model and multi-factor model. This shows that a single factor can account for all variance and thus, CMB is present (Podsakoff et al., 2003; Podsakoff et al. 2012). Study outcomes were as per the outcomes of HSF test recommendations. For both hospital and supplier data, HSF was below the recommended level and no single-factor emerged having more than 50% AVE.

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CURRICULUM VITAE & LIST OF PUBLICATIONS

Brief Profile: About the scholar

Tulika Chakravorty is a Doctoral Scholar of Logistics & Supply Chain Management of University of Petroleum and Energy Studies, Dehradun (UPES). She did her graduation in engineering (B.Tech) from Integral University, Lucknow in 2009 and pursued her post-graduation (M.S) in Quality Management from BITS-Pilani, Rajasthan in 2013. She is a working professional in the corporate sector, currently working as Senior Consultant with Accenture Solutions Pvt. Ltd, Hyderabad. She is having 12 years of corporate experience in various domains like Supply Chain, Healthcare, Banking, Insurance, etc with various domestic and international clients like AstraZeneca, JP Morgan Chase, Telstra, Samsung, etc. She has also conducted various MDPs for industry professional in international universities in areas like – Supply chain management, Operations management, Healthcare supply chain, Big data in healthcare, Biomedical engineering and hospital technology, Project management, Decision making, Management information system, etc.

Her area of research is Healthcare management focusing on Digitalization of hospital supply chain, using Digi-techs, IoT technologies, Big-data, etc. She has got various publications in Scopus as well as UGC listed journals like IJPHRD, JITIM, IJOM, IJSCM, etc. and also attended international conferences and got publications.

List of Publications:

Journal Publications:

- **Chakravorty, T**., Jha, K., Barthwal, S. & Chakraborty, S. **(2020)** Digital Technologies as antecedents to Process Integration and Dynamic Capabilities in Healthcare: An Empirical Investigation. *Journal of International Technology and Information Management (JITIM), Vol-28, Issue-4, Article-4, June-2020, 84-111.* ***[ABDC Listed]***

- **Chakravorty, T.,** Jha, K., & Barthwal, S. (2019). Linking EHR and ERP Adoption with Flexibility in Care-Delivery and Operational Performance: A Conceptual Review in Hospital Supply Chain. *Indian Journal of Public Health Research & Development*, *10*(6), 102-108. ***[Scopus indexed]***

- **Chakravorty, T**., Jha, K., & Barthwal, S. **(2019)**. Linking EHR and ERP in Healthcare Operations: A Conceptual Note. *IUP Journal of Operations Management*, *18*(2), 56-61.

- **Chakravorty, T**., Jha, K., & Barthwal, S. **(2018)**. Digital Technologies as Enablers of Care-Quality and Performance: A Conceptual Review of Hospital Supply Chain Network. *IUP Journal of Supply Chain Management*, *15*(3), 7-25.

Conference Publications:

- **Chakravorty, T.,** Jha, K., Barthwal, S. **(2019),** “Linking EHR and ERP as antecedents to Interoperability in Healthcare Operations: A Conceptual Study”, *Doctoral Colloqim, 2019, May 24, UPES Dehradun, Uttarakhand, India.*

- **Chakravorty, T.,** Chakraborty, S., Jha, K., Barthwal, S., (2017), “Digital agro- aids adoption as enabler to agro knowledge management, agro- process quality and agro-productivity”, *Agro*

Supply Chain Conference 2017 (ASCC 2017), Nov 3-4, UPES Dehradun, Uttarakhand, India.

- **Chakravorty, T.,** Barthwal, S., Jha, K. (2017), "Impact of ERP-Implementation on the Dynamic Capabilities and patient-care servicing capability in hospitals", *International Conference on Management of Infrastructure 2017 (ICMI 2017), Feb, 9-10, UPES Dehradun, Uttarakhand, India.*

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FIRST PAGE OF PLAGIARISM CERTIFICATE

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PRIMARY SOURCES

1	Hassan R. HassabElnaby, Woosang Hwang, Mark A. Vonderembse. "The impact of ERP implementation on organizational capabilities and firm performance", Benchmarking: An International Journal, 2012 Publication	%1
2	Samyadip Chakraborty, Rajesh Kalepu. "IT and green practices as enablers of service-oriented capabilities and patient-focused care in healthcare industry", International Journal of Innovation and Sustainable Development, 2019 Publication	<%1