

White paper

Healthcare System Framework by Innovation Think Tank for understanding needs and defining solution requirements

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Abstract

Healthcare systems worldwide are facing continued financial challenges and the COVID pandemic is intensifying these challenges accompanied by staff shortage and productivity shortfalls. Exponential increase in the patient population is putting additional burden on the overall situation. Governmental initiatives have been trying to find innovative solutions to overcome these challenges and to transform care delivery as well as to improve the overall quality of life. The goal of this research is to develop a healthcare system framework which firstly consolidates and allows the validation of trends and to give a holistic view of the entire healthcare system and its various departments, secondly to act as an engagement platform with the stakeholders by starting from the planning phase and finally an interdisciplinary co-creation infrastructure for creation and validation of Proof of Concepts by addressing the healthcare system needs. In the end, a sustainable business model that enables implementation of the solutions and its continuous improvements.

Healthcare systems for 15 countries were analyzed and common stakeholders, financing bodies, financial and clinical flow parameters were clustered to create Healthcare System Framework templates with an interdisciplinary team of 25 members from various locations. We analyzed the key performance indicators, success factors, business models, workflow steps and pain-points, interdisciplinary project teams and their locations from over 30 product and portfolio definition projects for various hospital departments and created templates for data capturing, analysis, visualization, and comparison. An Innovation Think Tank Healthcare System Framework (ITT HSF) was created to capture and validate trends, visualize its stakeholders, facts and figures, challenges, identify opportunities, best practices, and interdependencies. Based on these healthcare system characteristics and the ITT HSF, a comparison between the healthcare systems of the 15 countries was performed and solution

requirements were created. Learnings during this process also allowed an improvement of the framework.

Keywords: Healthcare Systems, Innovation Think Tank, Healthcare System Framework, Co-creation, Innovative solutions, Siemens Healthineers

Introduction

Healthcare system challenges

Today, the global healthcare system is fragile and fragmented, as evident from the ongoing COVID-19 pandemic [1], [2]. Moreover, there are significant discrepancies between the healthcare systems of the developed and developing world, as well as the urban and rural areas. In most developing countries, there is inadequate healthcare infrastructure, and a lack of human and financial resources. Rising healthcare expenditure, lack of insurance coverage, aging population, increasing burden of non-communicable diseases, staff shortages, data breaches, regulatory changes, emphasis on treatment over prevention, and lack of awareness and transparency, are some challenges currently faced by the healthcare system [1], [3], [4].

Not only the healthcare professionals, but all other stakeholders, including the Ministries of Health, pharmaceutical industry, medical device manufacturers, insurance agencies, healthcare information technology companies, hospital management, and the citizens, need to be prepared to face these challenges [5]. There is a need to strengthen health systems by delivering quality and safe patient care which should be accessible, affordable, sustainable, and equitably distributed. It is also necessary that we transition towards comprehensive, patient-centered, and preventive care, to enable value-based healthcare and positive

patient outcome [3], [6]. Technological advancements across multiple disciplines can aid in driving efficient care delivery at an optimum cost [3].

Government initiatives

The government emphasizes on development of innovative solutions for optimum healthcare delivery, better patient outcomes and improved quality of life. In the United States, certain initiatives developed by the Centers for Disease Control and Prevention (CDC) help strategize and prioritize the public health actions to tackle the country's most important health issues. Some of these initiatives cover topics such as healthcare quality, health disparities, immunization, chronic disease, and infectious disease [7]. In Germany, the B20 Health Initiative was launched to focus on healthcare innovation, global health, digital health, pandemic preparedness, antimicrobial resistance, and neglected tropical diseases. The goal is to improve healthcare system, population health, and make healthcare accessible to all by addressing the challenges in these focus areas [8].

The Healthy China 2030 initiative gives priority to health on a national level, and also emphasizes on health equity, innovation and multisectoral collaboration [9]. The Ayushman Bharat scheme in India aims towards universal health coverage for the citizens of the country by creation of health and wellness centers and by providing insurance coverage to the underprivileged [10].

In United Arab Emirates (UAE), the Dubai Health Strategy 2021 aimed at providing high quality care to chronic disease patients, raise awareness on periodic health check-ups, and encourage an early detection culture [11]. The above examples reflect some government initiatives for healthcare in selective countries.

Trends – Technologies, Clinical and Business models

In today's healthcare revolution, patients demand transparency, ease, access, and personalized products and services; they are no longer passive participants. This need of the hour can be met by implementing and integrating disruptive technologies in healthcare management.

One of the critical aspects is how these technologies can improve the welfare of societies and reduce the impact of major diseases such as coronary artery disease (CAD), stroke, respiratory infections, lung cancer, diabetes, kidney diseases and Alzheimer's.

From identifying symptoms to implementing treatment, the role of technologies into current disease pathways needs to be optimized [12], [13]. Technologies such as cloud computing, 5G, robotics, artificial intelligence (AI), augmented reality/virtual reality (AR/VR) and internet of medical things (IoMT) have proven to help optimize health care delivery and modify it with altering consumer preferences.

The center of healthcare for future disease workflows is more on preventing the disease. Key stakeholders will be focusing on preventive measures that solve challenges instead of waiting for risky treatment procedures. At the base of that is personalized care of individual patients and taking account of their risk factors for the procedures [13]. Moreover, as COVID-19 pandemic has encouraged the virtual aspects of healthcare, the requirement of at home services like telehealth, digital applications, automation and connected healthcare ecosystem will continue to rise.

To create a sustainable healthcare network, it is important to have cost optimization and increase care quality. There's now a trend leaning towards value-based care and enhancing consumer experience. Even the commercial payers are inclined towards innovative reimbursement and care delivery models as the COVID-19 pandemic has highlighted challenges for providers and inequities in conventional healthcare framework [14]. With the changing trends, it is both crucial to identify these disruptive technologies, select appropriate clinical pathways as well as perform market strategies with chosen technologies to innovate into overall healthcare system.

Understanding and creation of solution requirements

Addressing the socio-technical complexity becomes crucial for a venture's success where organizations are reacting to constant systems in this changing business market environment. Rapid and consistent adoption of disruptive innovations must go hand in hand with current needs and expectations. Understanding the challenges within the workflow of hospital and with the key stakeholders in the complex system of healthcare is crucial.

An optimized framework requires to be emerged to connect strategic and operational challenges along with research and development. Enhancing the health of a population needs structured innovative framework and technologies that recognizes the

drivers of health, leverages early diagnosis, and monitors patient and disease pathways [15].

About Innovation Think Tank

Innovation Think Tank (ITT) addresses the increasing demand for self-sustaining innovation infrastructure among healthcare providers and medical device manufacturers based on its global footprint and innovative framework for healthcare and medical technologies. The ITT global infrastructure dates back to 2005, incorporating 72 activity locations including co-creation programs and established labs in Siemens Healthineers (SHS) alongside its several partner universities and hospitals. By empowering partners to reinvent themselves, ITT helps healthcare institutions find customized and innovative solutions to their challenges [16].

Prior understanding of the crucial challenges and preferences of key stakeholders is essential to determine how trends can be strategically integrated into the conventional healthcare framework. In order to provide connected and optimized structures for ITT Healthcare System Framework (ITT HSF), ITT uses its global databases to address complexity in trends, customer behavior and regulatory requirements, as well as validate it with key stakeholders in healthcare [16].

Material and methods

At ITT, we thoroughly analyzed healthcare systems of 15 countries, and clustered key stakeholders such as healthcare providers (general practitioners, hospitals, pharmacies, rehabilitation centers), financing bodies (Ministries of Health, insurance agencies), financial and clinical flows parameters (example total healthcare expenditures, referrals, emergency admissions) to create Healthcare System Framework templates.

This was followed by investigations on the impacting elements like key performance indicators (KPIs), success factors, business models, different workflow steps, and pain points from perspectives of all stakeholders and departments, within and supporting the healthcare system [Table 1].

ITT knowledge database was reviewed, and we consolidated over 30 product and portfolio definition projects for various hospital departments e.g., radiology, laboratory, operating room (OR), worked

on by our interdisciplinary teams at various locations globally [Figure 1].

Templates were created for data capturing, strategic analysis, and visualization, with an intent to represent the holistic view of the healthcare systems, which demystified to allow for comparative study of different healthcare system frameworks followed at 15 countries.

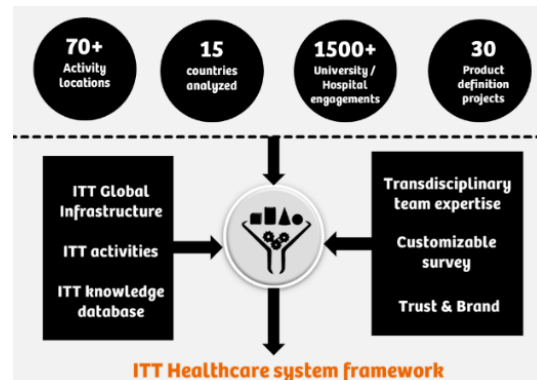


Figure 1: Creating ITT HSF through different ITT KPIs and success factors.

ITT HSF survey

After reviewing different healthcare systems, workflows, projects, and key success factors, validation of crucial information was required through stakeholder engagements. To address this, ITT has created customizable survey which can be modified according to the scope of project and specific stakeholder sites [Figure 2]. The survey consists of different templates which focus on addressing specific needs and challenges for different levels of stakeholders (government bodies, hospital management, department level, system level).



Figure 2: ITT HSF survey for capturing and validating trends, challenges and solutions. Inputs gathered from the ITT HSF survey will be used to gather requirements for the future of healthcare and improve products and services in healthcare.

The survey initiates with identifying trends (technological, clinical, and business models) and key opinion leader (KOL) voices/institutional challenges within the location specific healthcare system. It also validates the overall local healthcare system workflow to identify any current changes which can be addressed by stakeholders. Later, it identifies and validates needs, challenges, opportunities, and best

practices related to site specific hospital workflows, departmental workflows, and system workflows, which would help to create solution requirements.

Considering validation on overall operational efficiency and patient experience, the survey finally aims to identify major site specific/project specific healthcare challenges. At last, feedbacks and validations for the survey is done by stakeholders. This customizable survey template is to be distributed among stakeholders during ongoing and upcoming ITT co-creation activities.

Category	Project data	Stakeholders	Content analyzed	KPIs (# = number of)
Healthcare system level	Hospitals and healthcare systems of the future. Healthcare system analysis for Turkey, United States (US), India, China, South Africa, Egypt, Canada, Germany, South Korea, Austria, Italy, United Kingdom (UK), UAE, Saudi Arabia, France	Government, hospitals, patients, physicians, diagnostic centers, rehabilitation centers, insurance agencies, pharmacies, pharmaceutical companies, regulatory agencies	Patient journey, total healthcare expenditure, reimbursement model, healthcare policies, current trends, pandemic management	#Patients, #Interactions, #Hospitals, #Medical errors, Healthcare budget, Return on investment (ROI), Bed occupancy
Departmental level	Radiology infrastructure of the future, radiology user interfaces of the future, laboratory workflow analysis for digitalization, other workflows (operating room (OR), emergency room (ER), intensive care unit (ICU), cardiology, catheterization laboratory)	Patients, physicians, department specific doctors, nurses, technicians, support staff, medical device companies, regulatory agencies	Business models, process steps, current trends, KPIs, success factors	#Patients, #Staff, #Modalities, #Procedures, Staff to patient ratio
System level	Computed tomography (CT), medical resonance imaging (MRI), X-ray, molecular imaging (MI), fluoroscopy, ultrasound	Patients, physicians, technicians, nurses, receptionists, support staff, medical device companies, regulatory agencies	Modality workflows, business models, lifecycle visualization, technological and clinical trends, KPIs, success factors	#Patients, #Staff, #Modalities, #Scans, Turnaround time, ROI

Table 1: Example of content analyzed for identifying needs and challenges of different stakeholders. The categories are created through deep diving into different healthcare systems of 15 locations, detailed infrastructural and operational workflows at both departmental level and system level. Respective stakeholders are identified to address their challenges related to the current framework. KPIs for each category have been listed in the table.

Results

An Innovation Think Tank Healthcare System Framework (ITT HSF) was developed that consists of following sections:

1) Healthcare system stakeholder workflow capturing templates for need analysis

2) Trans-disciplinary teams' expertise at ITT Global locations for co-ideation and

3) Local ITT programs with healthcare system stakeholders for co-implementation.

The three sections are connected and contribute to the creation of solution implementation roadmap [Figure 3].

Information collection for the frameworks is done via online surveys, interviews and onsite observations. The content of the stakeholder's workflow capturing templates is customizable. The trans-disciplinary teams support creation of decision propositions: concepts, minimum viable products (MVPs) and business plans. The local ITT programs are created based on ITT methodology and best practices ensuring focus on the host institutional challenges and stakeholders.

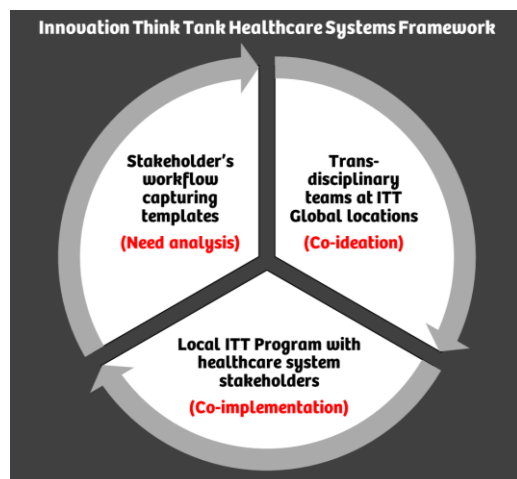


Figure 3: Innovation Think Tank Healthcare System Framework. In need analysis, the healthcare system framework online survey captures and validates trends among stakeholders during ITT programs and co-creation workshops. The survey analyzes key

challenges and disruptions in different healthcare systems which can be addressed by ITT HSF co-ideation phase where ITT global transdisciplinary team creates decision propositions on innovative solutions for the major identified challenges and needs. The ideated solutions get validated, and implementation plans are created during various location specific ITT program activities with respective healthcare system stakeholders.

The ITT HSF has six levels of impact (Level 0-5) which address different stakeholders [Figure 3]. Level 0 comprises of impacting entire healthcare system, hospital management and health population management. Level 1 dives deeper into the needs within hospital departments like radiology, laboratory diagnostics, ICU, OR, ER. Level 2 consists of the department workflows, pain points and good practices at the system level (CT, MRI, radiography). Level 3 considers addressing the challenges beyond organizational departments by co-creation activities. Level 4 is for rethinking and optimizing the conventional way to provide healthcare. Level 5 aims at overcoming geographical barriers and enabling access to care by cross-institutional or cross-location collaborations. Based on the scope of the project and focus of the location, the content for ITT HSF is modified. For example, a project where a new system needs to be designed for a certain market, healthcare trends, stakeholders and their interdependencies need to be understood.

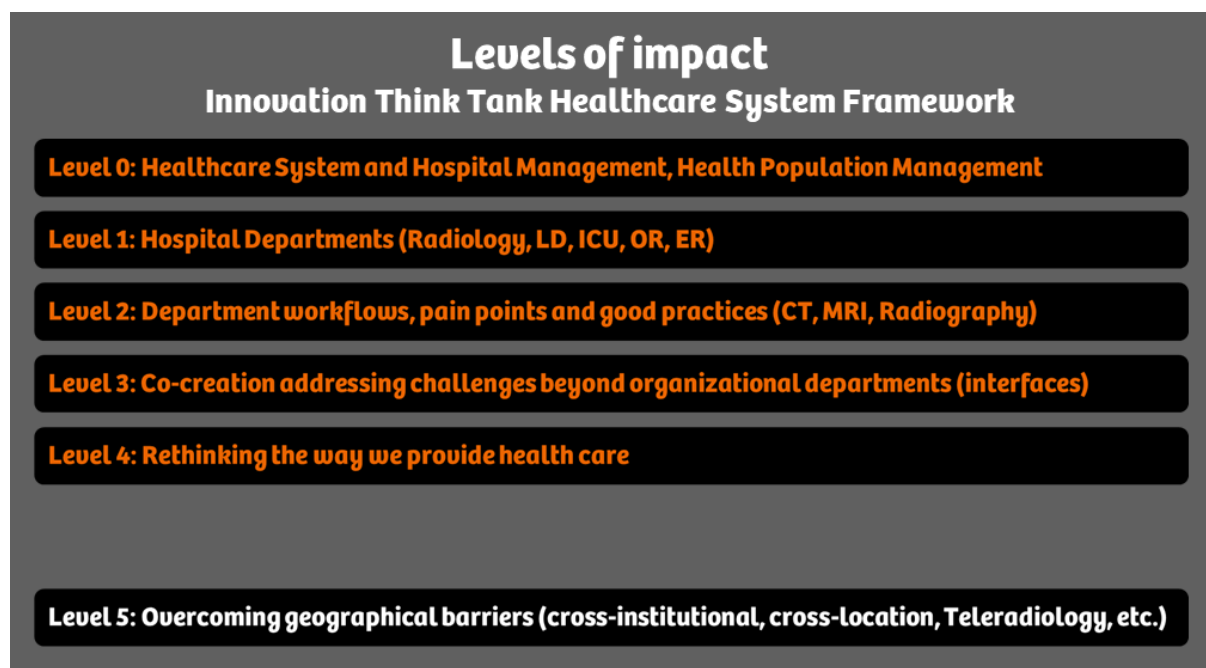


Figure 4: Levels of impact of Innovation Think Tank Healthcare System Framework. These levels distribute different stakeholders into the respective roles in healthcare framework. ITT HSF tends to impact healthcare systems around various locations and address challenges of stakeholders within that system. ITT HSF impacts overall system and workflows by optimizing conventional way of healthcare care delivery and co-creating innovative solutions with transdisciplinary global teams. ITT HSF connects key stakeholders to co-implement the solutions while overcoming geographical barriers through its sustainable global infrastructure.

The whole healthcare system includes complex interactions, and their nature will depend on each country's reality. For example, Figure 5 gives an overview of the multilayer healthcare system of Germany. By using the ITT HSF, comparative analysis of the healthcare systems of various countries can be achieved. Every healthcare system or hospital aims at providing quality healthcare with optimized patient outcome and ensuring patient as well as healthcare personnel satisfaction. For this, certain KPIs are used to measure the organizational performance [Figure 6]. To evaluate the KPIs and requirements, a

thorough understanding of the hospital workflow [Figure 7] and departmental workflow [Figure 8] is required. A bigger picture of these healthcare system, hospital, departmental and system level workflows is possible with the physical models and visualizations created at various ITT laboratories [Figure 9, 10]. Additionally, disease pathways [Figure 11] were developed by ITT to represent the patient journey throughout the disease life cycle, as one of the applications of HSF [17]. ITT has optimized the HSF for the healthcare systems of 15 countries.

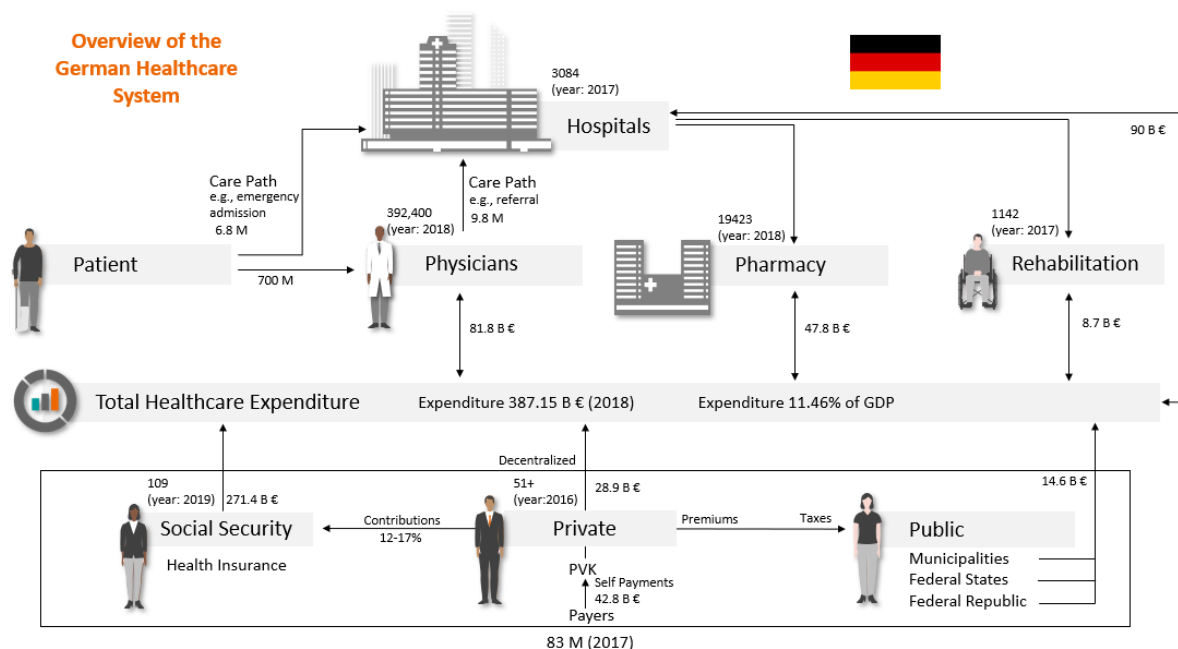


Figure 5: Example of overview created for healthcare system in Germany. Germany has a multi-payer healthcare system where social security, public and private health insurance all play a major role. This visualization showing the decentralized German healthcare model captures the patient journey, major stakeholders involved, their interdependencies, and the healthcare expenditure associated with each. Similar healthcare system frameworks have been created for 14 other countries.

Staff & Workflow Management	Emergency	Equipment Management	Patient Safety & Quality Care	Public Health & Access to Care	Finance
 <input type="checkbox"/> Patient waiting time and registration <input type="checkbox"/> Communication between primary care physician, proceduralist and patient <input type="checkbox"/> Training <input type="checkbox"/> Bed/room turnover and Readmission/ rescheduling rate <input type="checkbox"/> Mistake events/ error rates <input type="checkbox"/>	 <input type="checkbox"/> Ambulance services, Time Between Symptom Onset and Hospitalization <input type="checkbox"/> Patient mortality rate <input type="checkbox"/> Interdepartmental patient transfer <input type="checkbox"/> Patient waiting times by process step <input type="checkbox"/>	 <input type="checkbox"/> Error rates <input type="checkbox"/> Equipment purchase and installation <input type="checkbox"/> Equipment Utilization <input type="checkbox"/> Licensure and certification <input type="checkbox"/> Device maintenance <input type="checkbox"/>	 <input type="checkbox"/> Medication errors <input type="checkbox"/> Patient follow-up <input type="checkbox"/> Staff-to-patient ratio <input type="checkbox"/> Overall Patient Satisfaction <input type="checkbox"/>	 <input type="checkbox"/> Childhood immunizations <input type="checkbox"/> Educational programs <input type="checkbox"/> Physical accessibility to healthcare facilities <input type="checkbox"/> Financial accessibility to healthcare facilities <input type="checkbox"/>	 <input type="checkbox"/> Average insurance claim processing time and cost <input type="checkbox"/> Claims denial rate and average treatment charge <input type="checkbox"/> Operating cash flow <input type="checkbox"/> Patient drug cost per stay <input type="checkbox"/>

Figure 6: Example of KPI validation template. Here, we have mentioned KPIs for staff and workflow management, emergency department, equipment management, patient safety and quality care, public health and access to care, and finance. ITT teams have developed several templates for KPI validation for hospitals and healthcare systems which are shared with the hospital management and other healthcare professionals to evaluate their organizational success in terms of achieving stated goals. Such templates are used to capture the pain points, analyze the root cause, identify interdependencies and solution best practices.

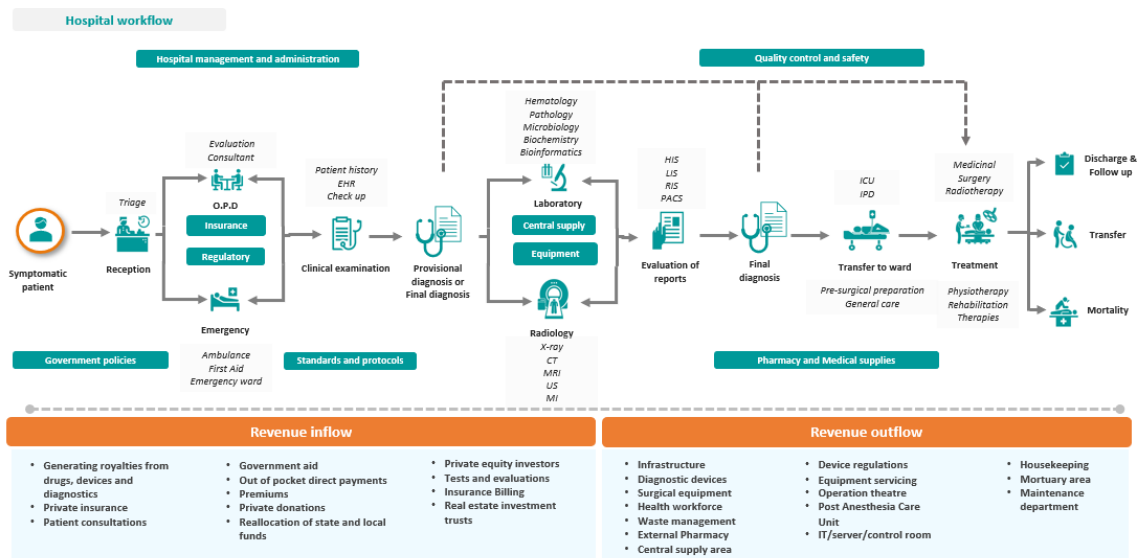


Figure 7: Example of hospital workflow template visualizing the patient journey in a hospital. The Innovation Think Tank Healthcare System Framework analyses different hospital departments with respective stakeholders, system factors and financial flow as depicted here. Hence, basic template for standard hospital operations was created which can also be customized according to the project scope and location-based requirements. The pain points, best practices and ideations can be identified by the healthcare stakeholders by analyzing this workflow.

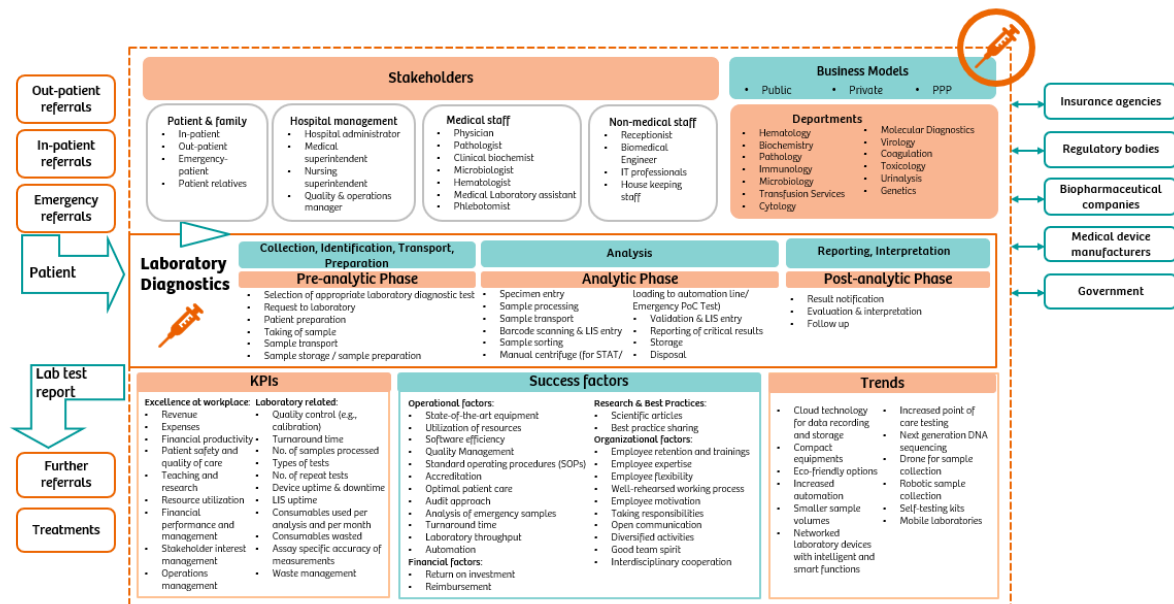


Figure 8: Example of departmental view template from Innovation Think Tank Healthcare System Framework. The figure shows a holistic view for the laboratory diagnostics department. Information on the stakeholders involved (both within and outside hospital), laboratory units, input, process (inclusive of test ordering, pre-analytic, analytic, post-analytic phase), outcome measures, trends, success factors, and business models are depicted here. At ITT, we have created departmental frameworks for laboratory, radiology, cardiology, emergency room, intensive care unit, operating room, and catheterization laboratory.



Figure 9: Implementation examples in physical models for healthcare systems and departments at Innovation Think Tank Labs. These models are the fundamental component of ITT labs across various locations. They provide a big picture where we can visualize the stakeholders and the interdependencies between them, hospital and departmental workflows, pain points, best practices and potential solutions. Some of the models shown here are from the emergency, inpatient, outpatient, radiology and MRI departments.



Figure 10: Workflow visualization examples from Innovation Think Tank Labs. These visualizations give thorough understanding of the challenges, requirements and solution ideations within the focused storyline of various workflows (departmental, system, disease, patient specific). ITT teams globally co-create design solutions to improve the visualization models.

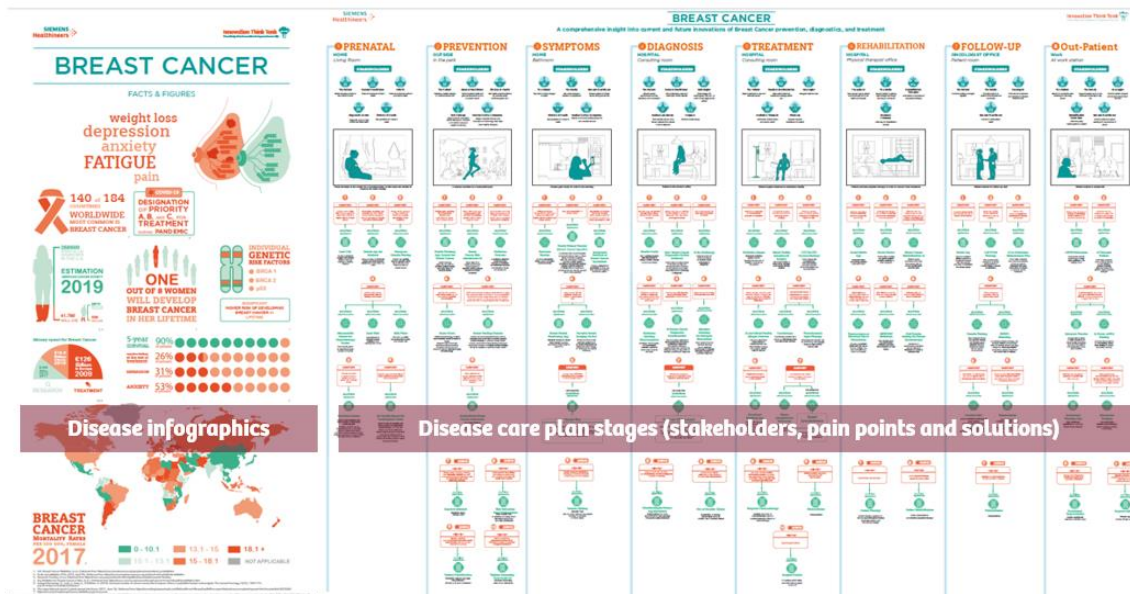


Figure 11: Disease pathway for breast cancer and 21 other most impactful diseases have been created by transdisciplinary ITT teams globally, as an application of ITT HSF. It consists of infographics and care plan stages (inclusive of healthcare system stakeholders, pain points and solutions). The disease pathways can be adapted according to the trends, challenges and location specific requirements of universities and hospitals, in collaboration with ITT regional laboratories.

Discussion

Many stakeholders contribute and thus have to be considered in the healthcare system framework, healthcare institutions, patients, healthcare insurers, government bodies, non-governmental organizations (NGOs), international financial institutions (IFIs) to name a few.

It is important to understand and consider the expectations of all these stakeholders to ensure value add (value creation and value capture) in the overall equation, this can be a challenging factor for the implementation of HSF. Creating an environment with continuous effort to strengthen stakeholder trust is the key to success.

ITT addresses this by its sustainable global footprint and continuous engagement with stakeholders through ITT co-creation activities [16].

Every project stream and key stakeholders at different locations have unique challenges and requirements according to local healthcare infrastructure. Thus, initiating a new framework requires a lot of insights on current trends and market needs. A highlighted focus on the different aspects of healthcare system frameworks is critical to the successful implementation of solution development and co-creation towards a constructive

vision of the future of healthcare. ITT HSF supports this by creating customizable survey template that can be diversified according to scope of the project or site-specific requirements. The overall output from these surveys can be consolidated for comparative analysis, and co-ideation of required solutions with interdisciplinary teams for creating decision proposition.

The validated inputs from stakeholder trends and challenges can be applied to a variety of fields, such as system design, mechatronics and medical electronics components, optimized workflow, operational efficiency, strategic business model development, branding and commercialization, and so on, to create finished medical products and innovative solutions for healthcare providers and beyond. 16 years of experience in R&D projects, as well as a focus on product and portfolio definition, and healthcare provider-focused programs has helped ITT in becoming a strong brand. Its methodology involves and develops selected transdisciplinary talent, and it has been integrated into the curriculum and expertise development programs of several notable institutions. Over 1500 people from over 50 universities, hospitals, and government organizations have participated in the last 12 months in ITT activities focused on healthcare of the future [16].

This unique presence within both the healthcare providers and medical device manufacturers globally enables ITT to analyze the key impact factors and location specific socio-technical needs which can optimize process of healthcare delivery [16].

One example of the application of such framework is the 22 disease pathways, as described above [17]. It is planned to publish applications of the ITT HSF on dedicated locations and projects in the upcoming white papers.

Conclusion

ITT provides a robust healthcare system framework which considers not only needs of key stakeholders but also investigates big picture of current trends, site-specific challenges and identifies innovative strategies to bring valuable impact on the conventional way of healthcare delivery. ITT has created customizable survey templates to identify and validate the needs and challenges for different scope of projects as well as location specific healthcare systems. ITT co-creates and co-implements valuable decision propositions via MVPs, physical models, and visualizations along with its global infrastructure of transdisciplinary teams and its various location activities for stakeholder engagements.

References

1. Venky Ananth, Ed Francis, "Covid-19 impact on the healthcare industry: Challenges and opportunities", Infosys 2020. (<https://www.infosys.com/industries/healthcare/insights/documents/covid19-impact-challenges-opportunities.pdf>)
2. Dr. Ralf Meinhardt, Dr. Herbert Staehr, "Transforming care delivery: Increasing value in care - better health outcomes at lower costs", Siemens Healthineers Insights Series, Issue 19. (<https://www.siemens-healthineers.com/insights/transforming-care-delivery>)
3. Fit for the future: The common challenges facing healthcare systems—and how to meet them, McKinsey, October 11, 2019 (<https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/fit-for-the-future-the-common-challenges-facing-healthcare-systems-and-how-to-meet-them>)
4. Rita Sharma, "Top 10 Challenges Healthcare Companies Face Today", Finoit. (<https://www.finoit.com/blog/top-10-healthcare-challenges/>)
5. Greiner AC, Knebel E, "Chapter 2: Challenges Facing the Health System and Implications for Educational Reform", Health Professions Education: A Bridge to Quality. Washington (DC): National Academies Press (US); 2003. (<https://www.ncbi.nlm.nih.gov/books/NBK221522/>)
6. Jeffrey Braithwaite, Russell Mannion et. al., "The future of health systems to 2030: a roadmap for global progress and sustainability, International Journal for Quality in Health Care", Volume 30, Issue 10, December 2018 (<https://academic.oup.com/intqhc/article/30/10/823/5253761>)
7. National Health Initiatives, Strategies & Action Plans, Centre for disease control and prevention. (<https://www.cdc.gov/publichealthgateway/strategy/index.html>)
8. Health Initiative, B20 Germany 2017 (<https://www.b20germany.org/priorities/health-initiative/>)
9. Healthy China 2030 (from vision to action, WHO (<https://www.who.int/teams/health-promotion/enhanced-wellbeing/ninth-global-conference/healthy-china>)
10. Ayushman Bharat, National Health Authority India. (<https://pmjay.gov.in/about/pmjay>)
11. Dubai Health Strategy 2021, Telecommunication and digital government regulatory authority, UAE (<https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/local-governments-strategies-and-plans/dubai-health-strategy-2021>)
12. 2020 Global Health Care Outlook, Deloitte, 2019 (<https://www2.deloitte.com/us/en/pages/life-sciences-and-health-care/articles/global-health-care-sector-outlook.html>)
13. Blake Morgan, "The Future of Healthcare Personalization", Forbes, May 2021 (<https://www.forbes.com/sites/blakemorgan/2021/05/03/the-future-of-healthcare-personalization/?sh=65f9466b7e38>)
14. Jeanna Palmer, Lori Oliver, Kathleen Sutton, "Value-Based Care in 2021: 5 Emerging Trends in Value-Based Care", National Law Review 2021, Volume XI, Number 55. (<https://www.natlawreview.com/article/value-based-care-2021-5-emerging-trends-value-based-care>)
15. Amjad Fayoumi, Richard Williams, "An integrated socio-technical enterprise modelling: A scenario of healthcare system analysis and design." Journal of Industrial Information Integration, Volume 23, 2021, 100221. (<https://www.sciencedirect.com/science/article/abs/pii/S2452414X21000212>)
16. Sultan Haider, "Addressing healthcare needs with Innovation Think Tank global infrastructure and methodology" Innovation Think Tank 12-2021 (<https://www.siemens-healthineers.com/en-in/careers/innovation-think-tank>)
17. Annual External Innovation Think Tank Exhibition (eITT), Disease pathways, 2021 (<https://www.siemens-healthineers.com/news-and-events/conferences-events-new/eitt>)

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