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MOH Holdings Pte Ltd

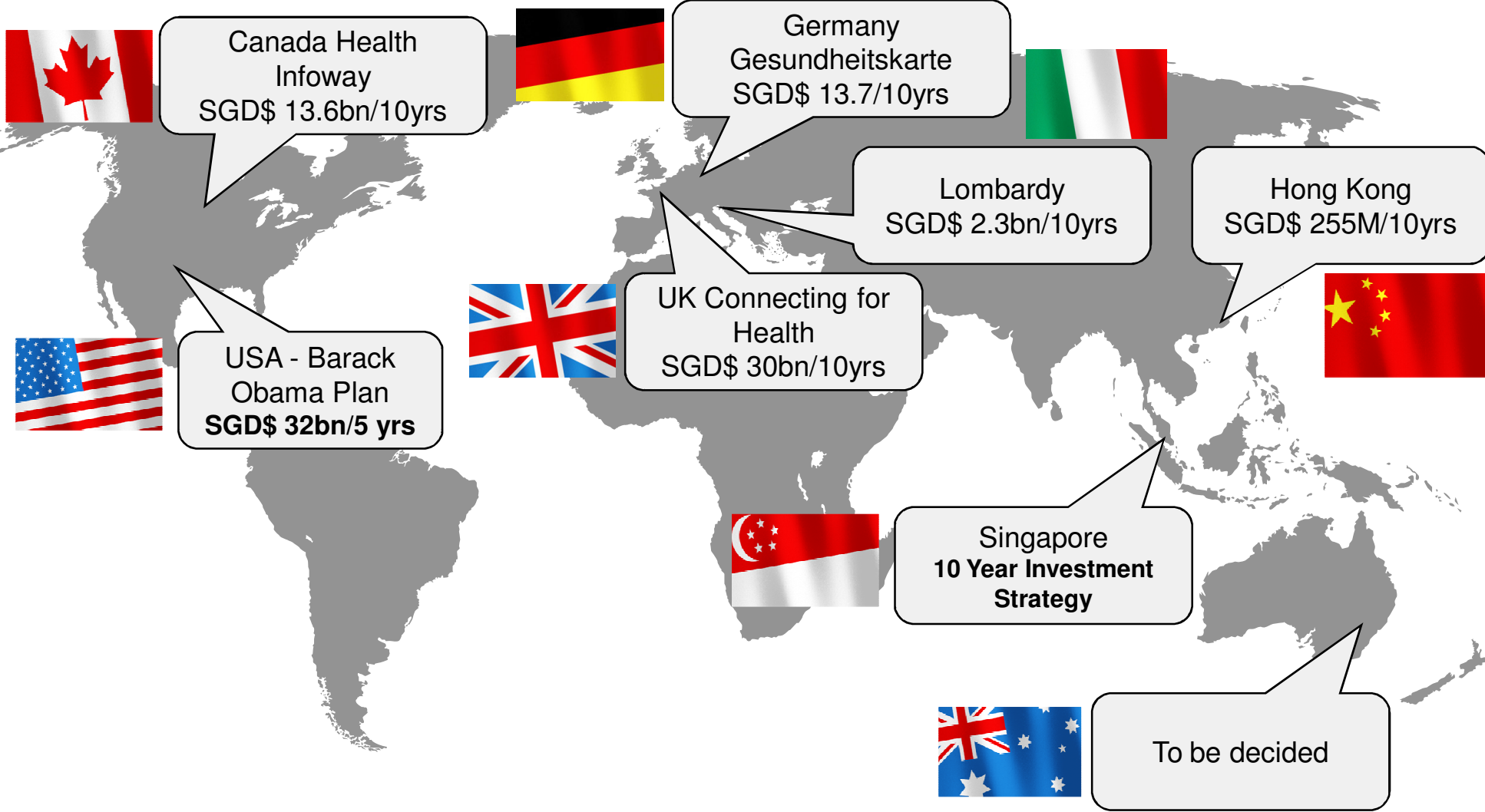


booz&co.

10 Year EHR Investment Strategy

National Health Informatics Summit, Singapore

Billions of Dollars are being invested in Electronic Health Records worldwide - *Examples*



However, success has not been uniform

Major Issues with Overseas EHR Programs


- **Lack of sustained resourcing** over time (Min. 5-10 year timeframe)
- **An insufficiently inclusive approach**, leaving out key segments of the healthcare eco-system
- **Inability to maintain momentum**. In terms of adoption rates amongst key stakeholder groups, or interest amongst key payors of healthcare.

A comprehensive investment strategy can address these issues by focusing on key questions

- What is the **total national** investment required ?
 - Over a **multi-year** timeframe e.g. 10-years
 - To **involve all key stakeholders** –both private and public sector
- What are the **potential financial and well being benefits** ?
 - Associated with each **IT-capability** that we invest in
 - For individual **stakeholder groups**
- How **best do we sequence** the development of IT-capabilities (based on the benefit each can deliver) ?
- Can a common ‘language’ and framework be used to measure the **ongoing value of these investments**, and communicate this to payors and other stakeholders?




Booz & Co have been lead advisors and developed investment strategies for many advanced eHealth programs around the world


 **Germany Health Card**

- Lead advisor on national e-Health program
- Connecting **80 million** citizens, **~2 million** healthcare professionals
- Applications include insurance data, medication safety, ePrescriptions, emergency data, eReferrals, EHR




 **Australia Access Card**

- Lead advisor on the strategy for a new national social services ID card
- 20 million** citizens, **500K providers**
- Implementation strategy based on Booz & Co's proprietary methodology the Transformation Lifecycle (TLC)

 **State of Lombardia / Italy**


- Lead Advisor
- 9.4 million** citizens and **~53,000** providers
- Innovative Public Private Partnership
- Applications included a health card, EHR, prescription mgt, document and workflow mgt and outpatient booking




 **Canada Health Infoway** 

- Advised on 10-year investment strategy and implementation plan for a national EHR
- Connecting **32 million** citizens and **53,000** physicians
- Later refined investment strategy, financial model and implementation plan for the province of **Ontario** (**12.3m** citizens and **20,200** physicians)
- Application suites for EHR, MD, hospital and LTC



 **VHA / USA**

- Advised the Veterans Health Administration on the development of the ViSTA EHR
- Connecting **25.3m** US veterans, their families and **180,000** healthcare professionals
- Over **100** discreet applications in an open architecture

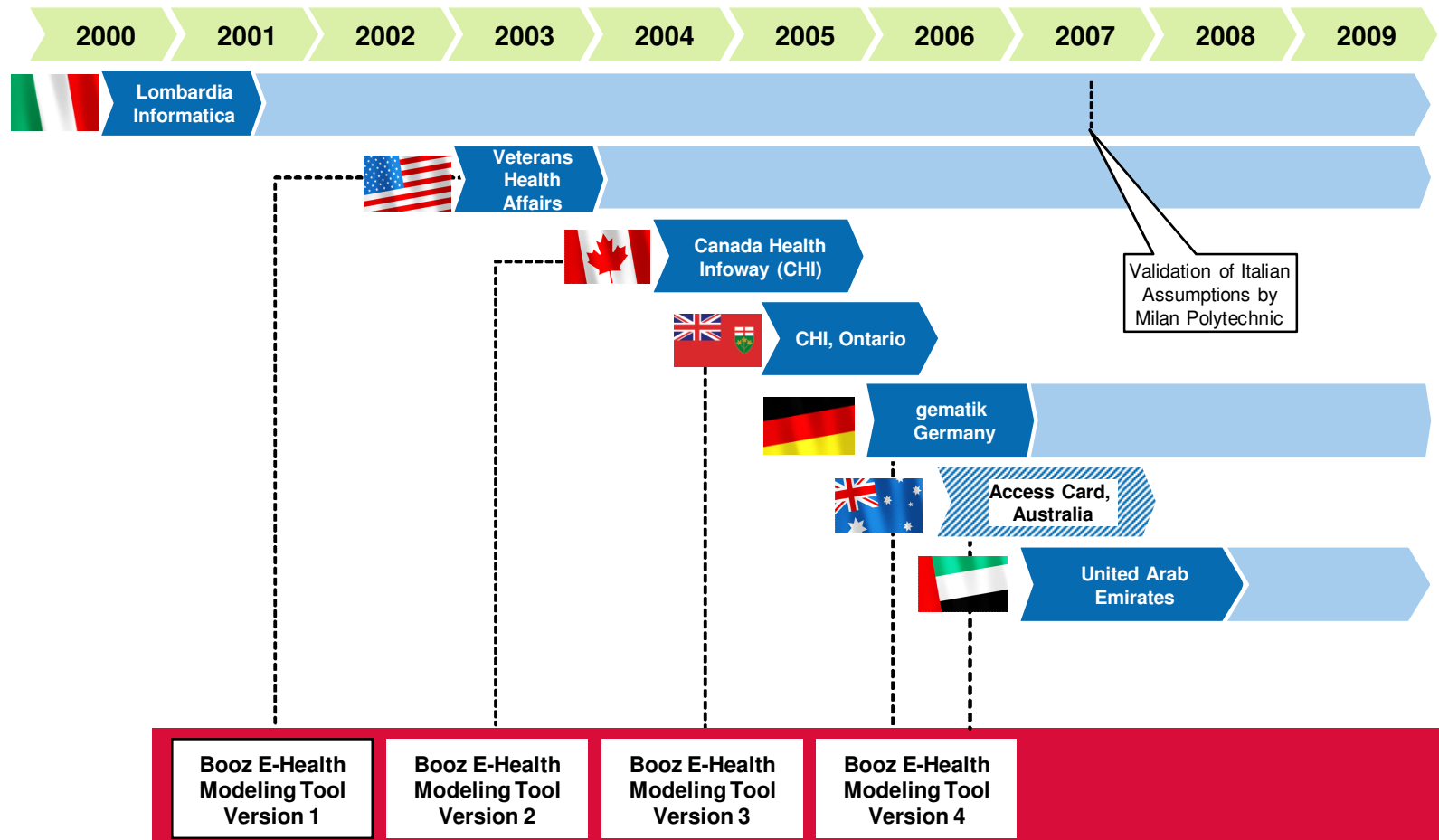
 **Mubadala / UAE**

- Lead advisor for the investment strategy and implementation of a national Integrated Health Network
- 4.6 million citizens**

...and have experience from over 30 other significant e-Health initiatives in the last 4 years

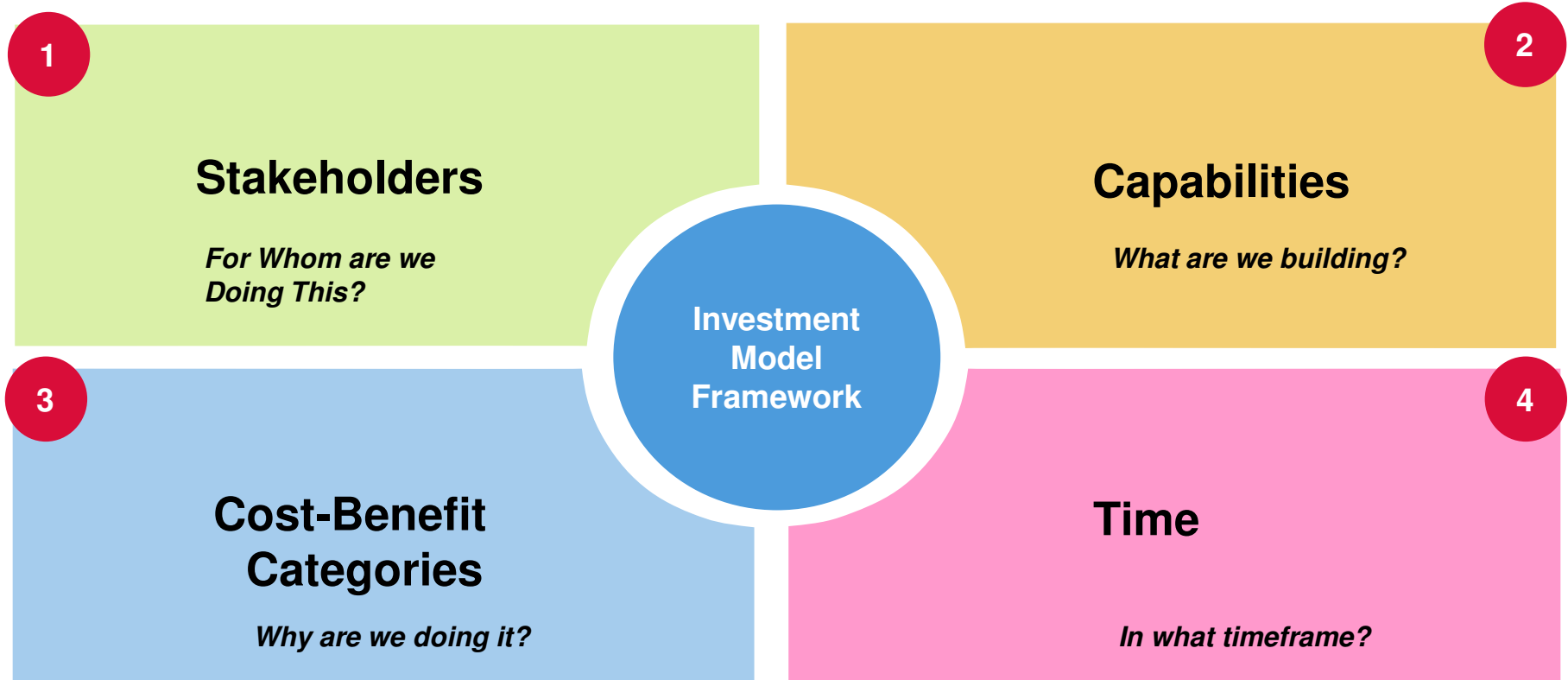
These engagements have allowed Booz & Company to develop a national EHR cost-benefit model to a level of maturity

Evolution of Booz & Company Investment Strategy Expertise for National HIT Programs



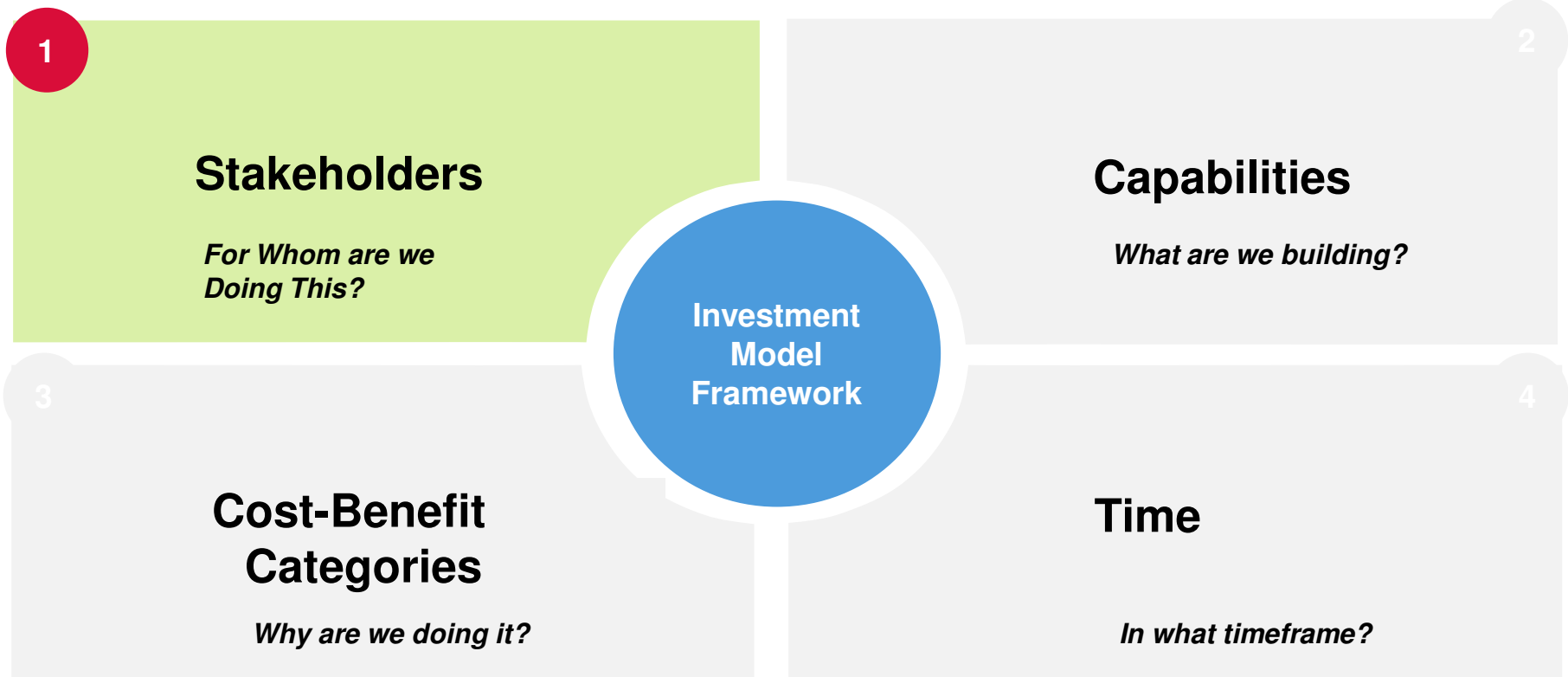
Building on this, we have developed an investment strategy for Singapore's national EHR that consists of 4 major building blocks

Four Dimensions of the Singapore EHR Financial Model Framework



The first dimension of the model focuses on the stakeholders for whom the system will be designed

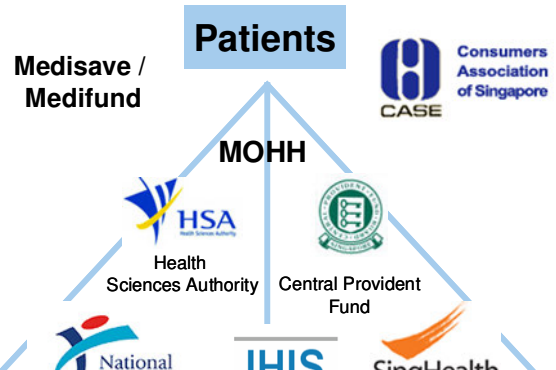
Four Dimensions of the Singapore EHR Financial Model Framework



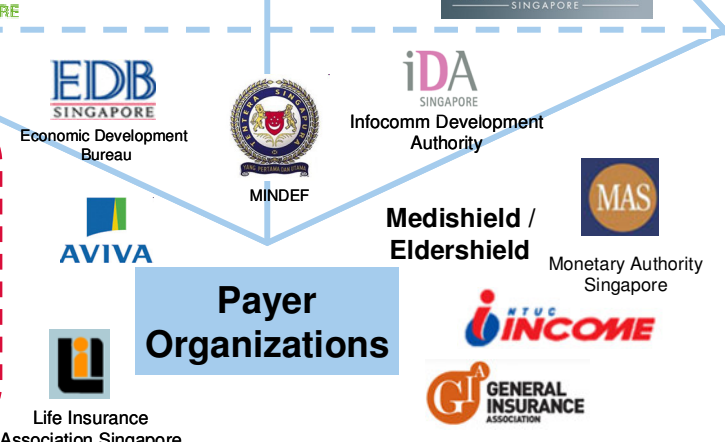
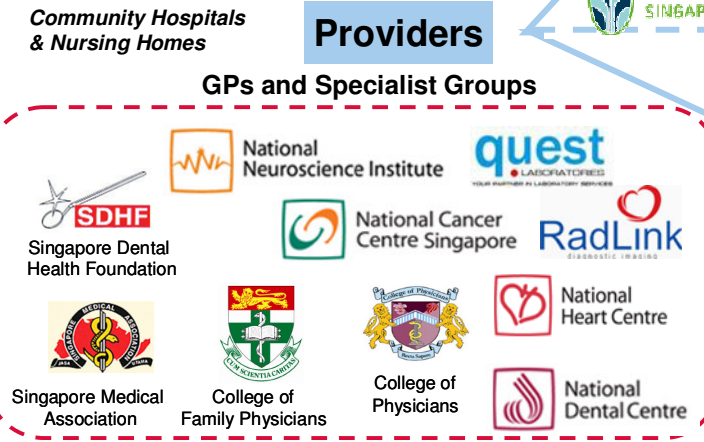


Considering the full spectrum of healthcare clinical, industry & policy stakeholders across Singapore – including the patients...

Clinical Advisory Groups

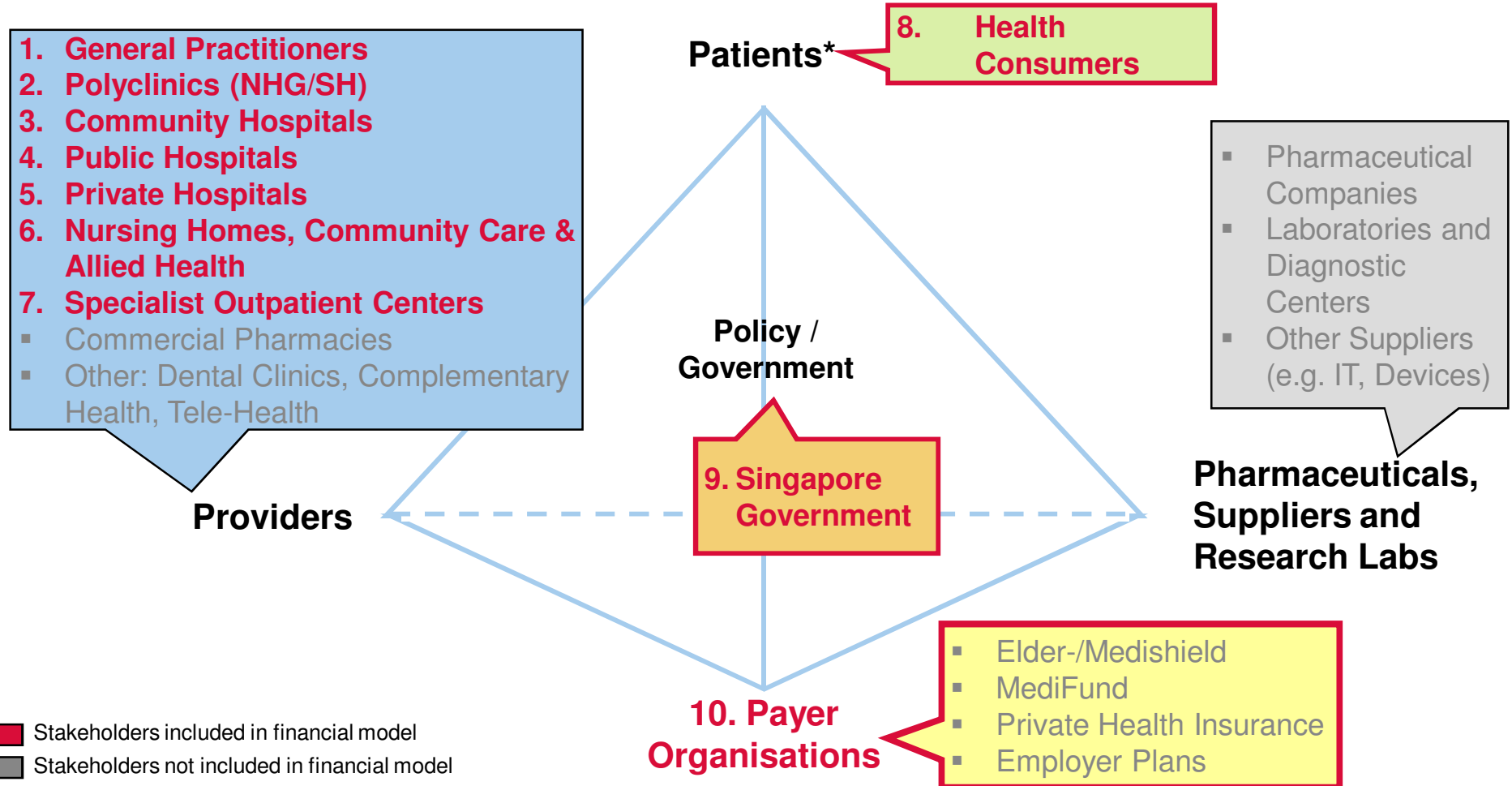


Providers





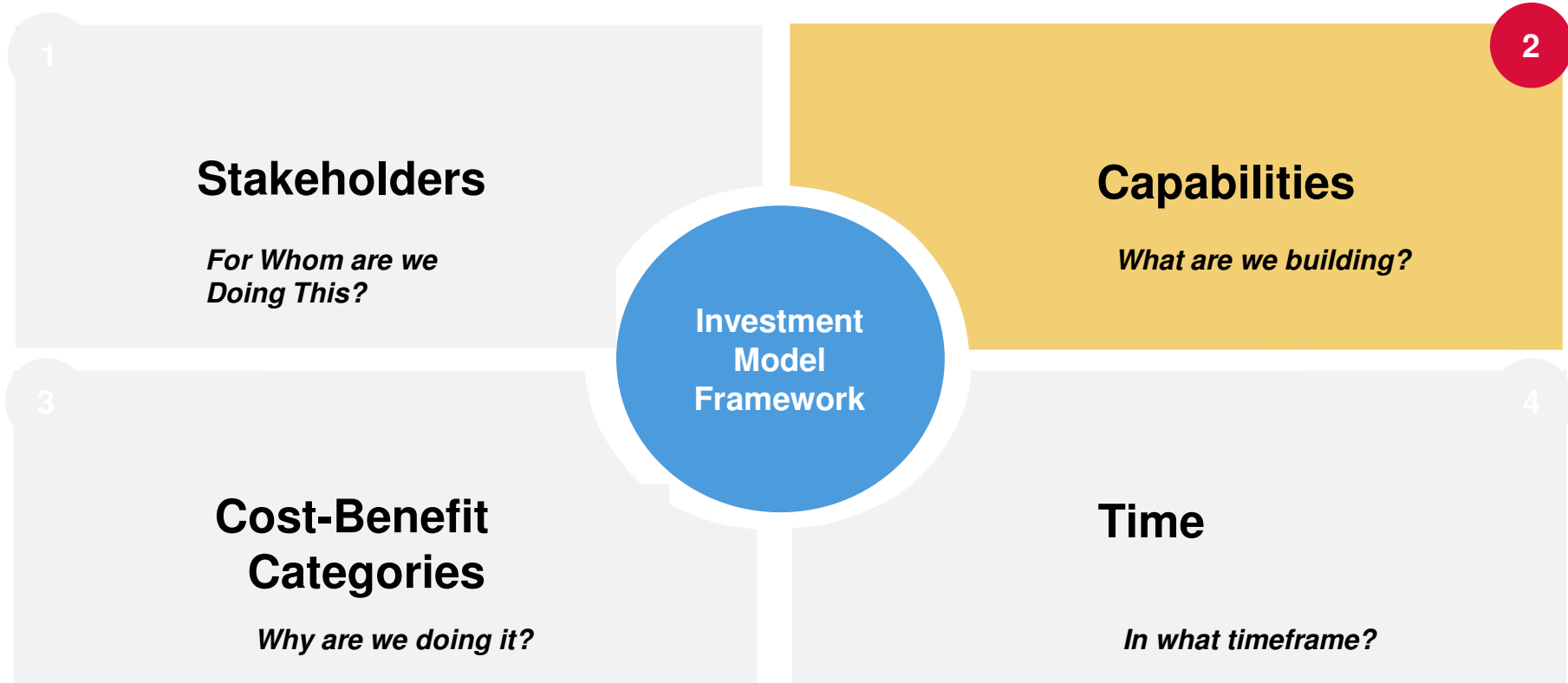
... we prioritized ten key stakeholder groups (in red) for analysis within the EHR investment model



* Patient stakeholder includes out-of-pocket and their personal MediSave accounts

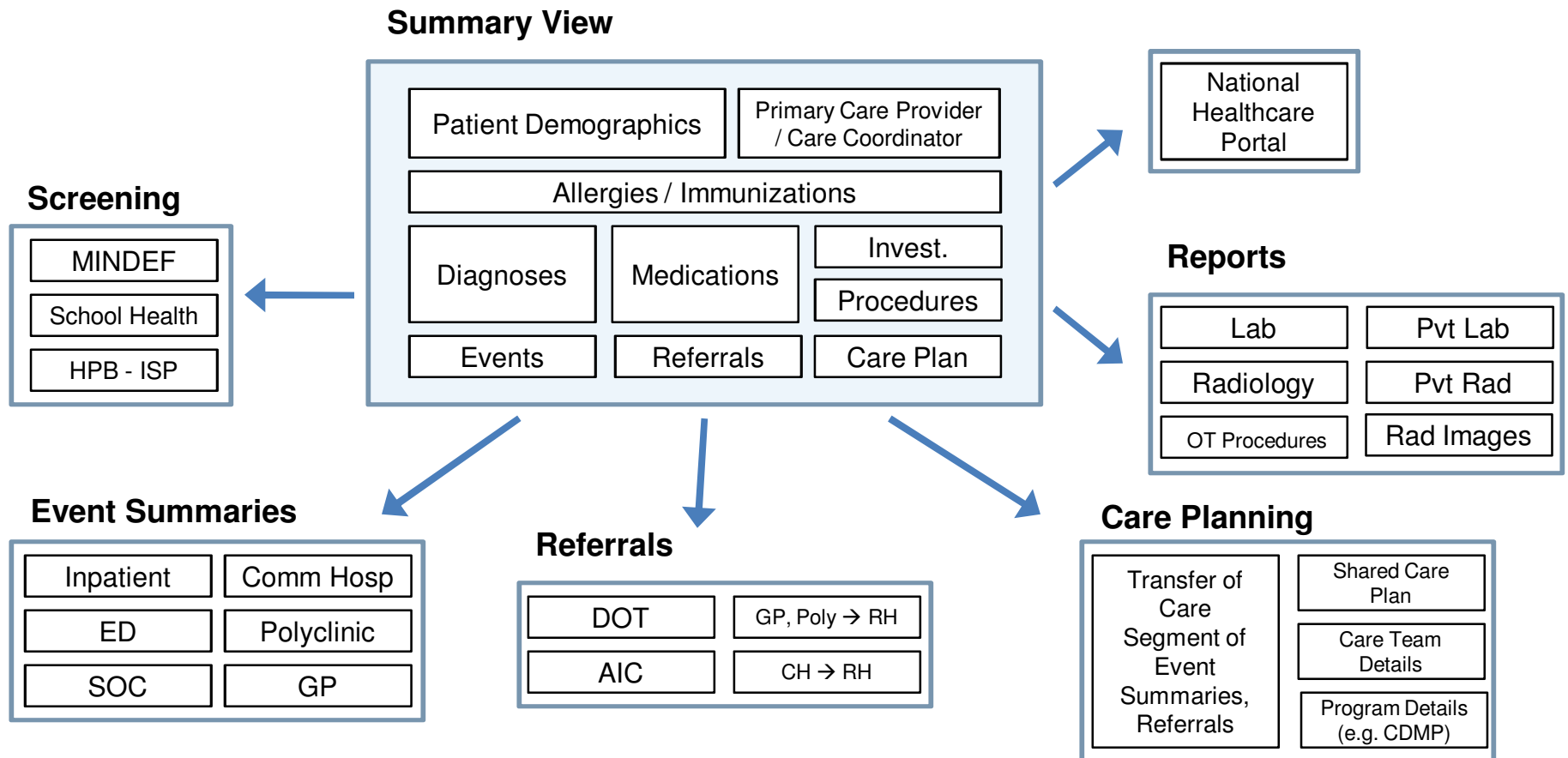
The second dimension of the model focuses on the IT capabilities which will be built

Four Dimensions of the Singapore EHR Financial Model Framework



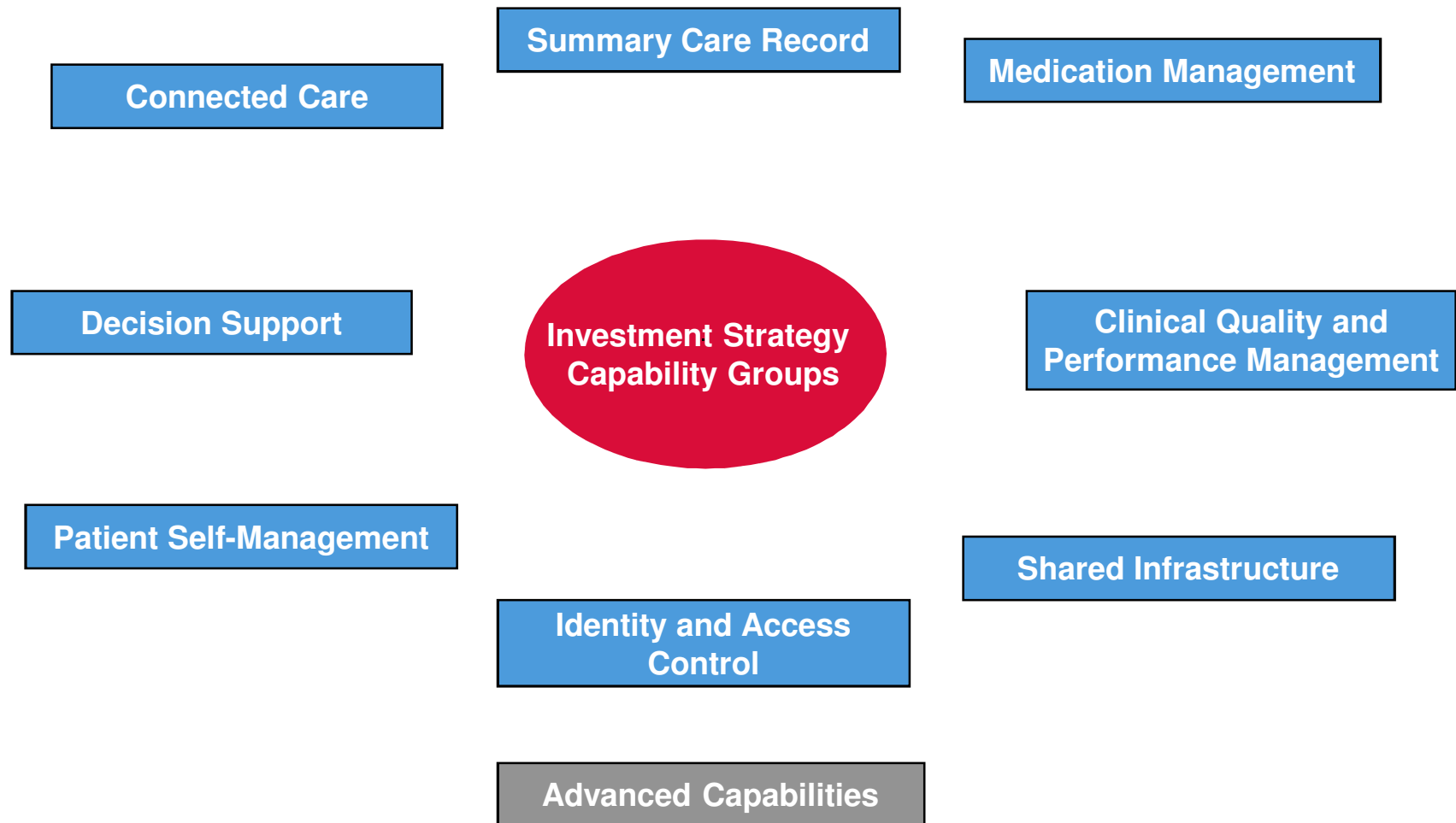


Similar to the stakeholder spectrum, the various functionalities defined so far in the scope of the EHR Program...



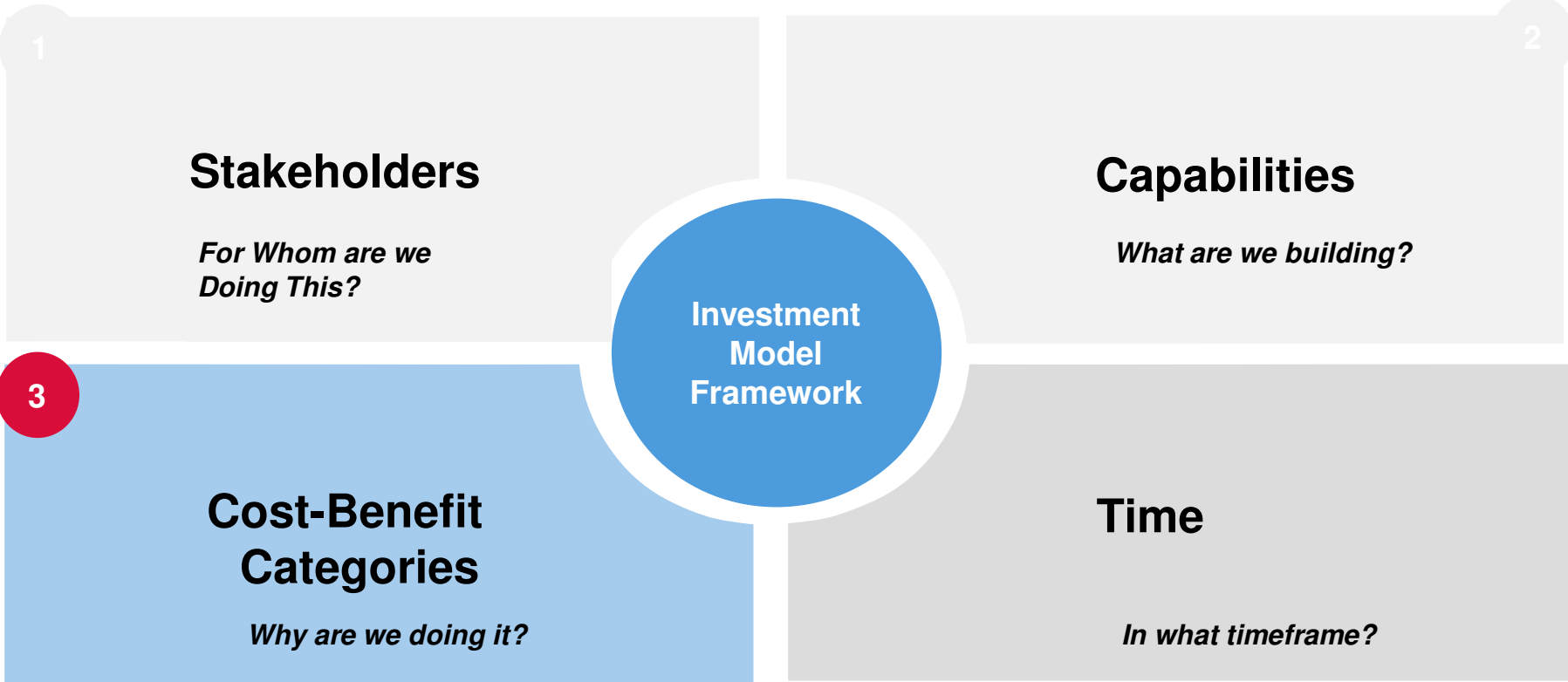


... were grouped into defined categories to facilitate analysis



The third dimension of the model focuses on the cost-benefit categories

Four Dimensions of the Singapore EHR Financial Model Framework





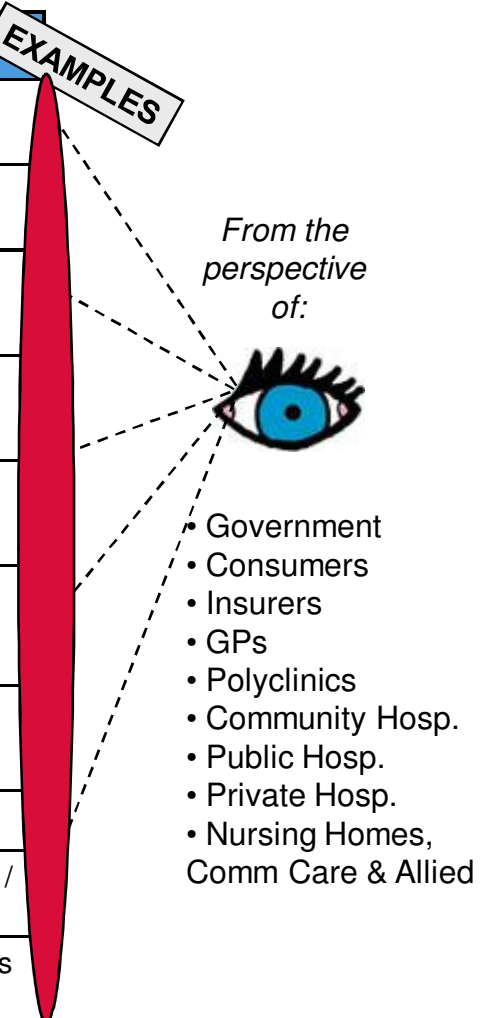
Costs and benefits are the basis for a business case and can be estimated with stakeholder and capability information

With the list of stakeholders and capabilities, we were able to develop

- **Estimates of the costs** to implement the EHR in individual **care settings**
- **Hypotheses on the types and magnitude of benefits** from implementing the EHR



Stakeholder group costs were estimated based on standard types of one-off and operating costs - including training & change mgmt

	One-Off Investment Costs	Ongoing Operational Costs	EXAMPLES
Personnel	<ul style="list-style-type: none"> Project management, coordinators, architects, analysts, consultants 	<ul style="list-style-type: none"> Call centres, support teams, contract management, program mgt office 	 <p>From the perspective of:</p> <ul style="list-style-type: none"> • Government • Consumers • Insurers • GPs • Polyclinics • Community Hosp. • Public Hosp. • Private Hosp. • Nursing Homes, Comm Care & Allied
Business Process	<ul style="list-style-type: none"> Downtime revenue loss from introducing new system 	<ul style="list-style-type: none"> Ongoing costs introduced to existing processes 	
Software Development	<ul style="list-style-type: none"> Design, build / upgrade, configuration, data migration, standards, testing 	<ul style="list-style-type: none"> Minor projects and service requests 	
Implementation	<ul style="list-style-type: none"> Pilot testing, training, PR and change management 	<ul style="list-style-type: none"> Support for ongoing, minor upgrades 	
COTS Software	<ul style="list-style-type: none"> initial license fees and product customisation 	<ul style="list-style-type: none"> Maintenance fees, upgrades 	
Security / Identification	<ul style="list-style-type: none"> POC/POS terminals, cards, identification, certification, registration, biometrics 	<ul style="list-style-type: none"> Service & maintenance, upgrades 	
User Hardware	<ul style="list-style-type: none"> PC's, terminals, devices, consumer kiosks 	<ul style="list-style-type: none"> Service & maintenance, upgrades 	
Server	<ul style="list-style-type: none"> UNIX, Wintel, OS software, storage, DR 	<ul style="list-style-type: none"> Service & maintenance, upgrades 	
Network	<ul style="list-style-type: none"> Cables, switches, routers, firewalls, DR 	<ul style="list-style-type: none"> Service & maintenance, upgrades, traffic / usage 	
Facilities	<ul style="list-style-type: none"> Data centre construction, infrastructure relocation, DR, building construction 	<ul style="list-style-type: none"> Data centre hosting, office rental, facilities management 	



Benefits hypotheses were more complex to develop and followed a multi-step process with extensive verification

Steps to identify and verify the benefits

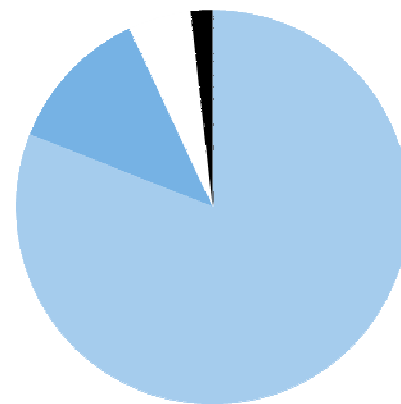
1. **Literature review:** Defining the possible benefits categories and range of impacts based on evidence from peer-reviewed clinical studies
2. **Extrapolating findings to Singapore context:** Based on local population, financing and service statistics
3. **Verifying the initial hypotheses:** with local clinical subject matter experts
4. **Validating the hypotheses and calculations** with MOH and an international expert panel (in progress)



Although Health Informatics is still a relatively young discipline the body of available solid evidence is rapidly growing

- Out of ~2700 papers screened, we were able to **shortlist 400+** for review
- The shortlisted studies focused on both specific and general clinical studies
 - **specific studies on EHR** and/or Information Exchange
 - **general clinical studies** applicable to each benefits hypothesis (e.g. prevalence of ADEs in community)

Articles Reviewed



- 1- to 1++
- 2+ to 2++
- 3 to 2-
- 4

- 1- Randomized Control Trial
- 2 - Cohort Study
- 3 - Case series
- 4 - Expert Opinion

The Evidence: Information & Communication Gaps

JAMA 2005 - Missing clinical information during primary care visits

Smith PC, Araya-Guerra R, Bublitz C, Parnes B, Dickinson LM, Van Vorst R, Westfall JM, Pace WD.

Cross-sectional survey conducted in 32 primary care clinics within State Networks of Colorado Ambulatory Practices and Partners (SNOCAP). 253 clinicians were surveyed about 1614 patient visits.

Clinicians reported missing clinical information in 13.6% of visits; Missing clinical information was frequently reported to be located outside their clinical system but within the United States

JAMA 2007 - Deficits in communication and information transfer between hospital-based and primary care physicians: implications for patient safety and continuity of care. Kripalani S, LeFevre F, Phillips CO, Williams MV, Basaviah P, Baker DW.

Deficits in communication and information transfer at hospital discharge are common and may adversely affect patient care.

Interventions such as computer-generated summaries and standardized formats may facilitate more timely transfer of pertinent patient information to primary care physicians and make discharge summaries more consistently available during follow-up care

The Evidence: Medication Management & Safety

Ann Acad Med Singapore 2004 - Polypharmacy and inappropriate medication use in Singapore nursing homes

Mamun K, Lien CT, Goh-Tan CY, Ang WS.

454 residents involved in study. *Polypharmacy and issues with medication use were seen in 266 (58.6%) and 318 (70.0%) residents, respectively.* Most common medication-related problems were the use of medication without proper indication (n = 302), significant potential for adverse drug reactions (n = 281) and drug interactions (n = 141, 30%).

Pharm World Sci. 2003 - Koh Y, Fatimah BM, Li SC.

The study population consisted of 347 patients (aged 16-97) on a mean of 7.4 +/- 2.1 medications.

10.8% of the study population had DRPs on admission: 71.9% of which were dominant reasons for admission, and DRPs contributed partly in the remaining cases.

These DRPs were mostly avoidable, and can be broadly classified into non-compliance, adverse drug reactions, require synergistic therapy, inappropriate dose and untreated condition. 52% of these cases were made up of geriatric patients.

The Evidence: Medication Management & Safety

J Emerg Med. 2000 - Emergency department patient knowledge of medications

Vilke GM, Marino A, Iskander J, Chan TC

Therapeutic decisions made by Emergency Physicians are often influenced by which prescribed medications are being taken by patients.

Only 48% of patients could recall or produce a list or the actual bottles of all of their medications, 39% knew the times they take their medications, and only 24% knew all the dosages. Although knowledge of medications is often critical for decision making in the ED, a significant number of patients are unable to provide this information.

JAMA 1997 - Factors related to errors in medication prescribing

Lesar TS, Briceland L, Stein DS.

The most common groups of factors associated with errors were those related to knowledge and the application of knowledge regarding drug therapy (209 errors, 30%); knowledge and use of knowledge regarding patient factors that affect drug therapy (203 errors, 29.2%); use of calculations, decimal points, or unit and rate expression factors (122 errors, 17.5%); and nomenclature factors (incorrect drug name, dosage form, or abbreviation) (93 errors, 13.4%).

The Evidence: Medication Management & Safety

Systems analysis of adverse drug events. ADE Prevention Study Group.

JAMA. 1995 Jul 5;274(1):35-43; Leape LL, Bates DW, et al

- 334 errors were detected as the causes of 264 preventable ADEs and potential ADEs.
- **Sixteen major systems failures were identified as the underlying causes of the errors.**
- The most common systems failure was in the dissemination of drug knowledge, particularly to physicians, accounting for 29% of the 334 errors.
- Inadequate availability of patient information, such as the results of laboratory tests, was associated with 18% of errors.
- **Seven systems failures accounted for 78% of the errors; all could be improved by better information systems.**

The Evidence: Supporting Good Clinical Practice

Diabetes Care 2007 - Benefits of Information Technology–Enabled Diabetes Management

Bu D, Pan E, Walker J, Adler-Milstein J, Kendrick D, Hook JM, Cusack CM, Bates DW, Middleton B.

All forms of IT-enabled disease management improved the health of patients with diabetes and reduced health care expenditures. Authors calculated for the US **over 10 years a potential 15% savings of medical/hospital costs through a mix of IT initiatives** including: integrated provider & patient systems, decision support, registries and IT-enabled self management

Health Affairs 2005 - Can electronic medical record systems transform health care? Potential health benefits, savings, and costs.

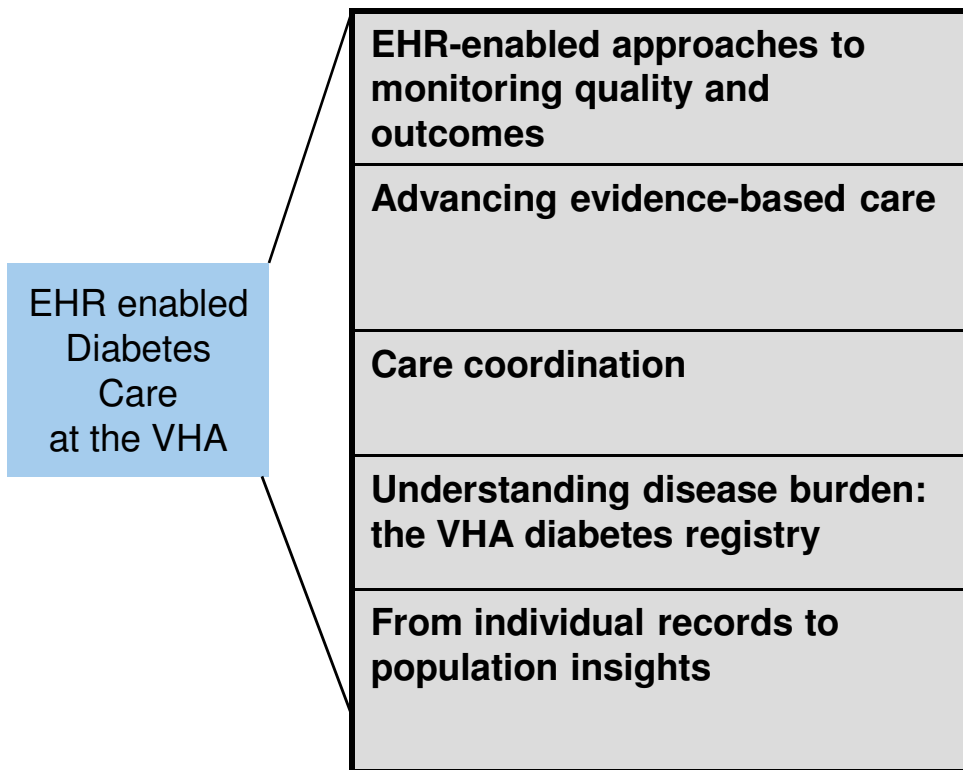
Hillestad R, Bigelow J, Bower A, Girosi F, Meili R, Scoville R, Taylor R.

Examined disease management programs for four conditions: asthma, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), and diabetes and estimated the effects of 100 percent participation of people eligible for each program.

The adoption of interoperable **EMR systems could produce efficiency and safety savings amounting to 4% of total hospital spending through promoting best practice**. By greatly reducing hospital use (-4% of total hospital spending [-30b out of 700bUS\$ p.a.] at the cost of increased physician office visits and use of prescription drugs (+0,8% of prescription drug spending [+1,9b US\$ of 230bUS\$ in total].)

The Evidence: Supporting Good Clinical Practice

How the Veterans Health Administration is using its EHR-system to improve health outcomes Advancing Evidence-Based Care For Diabetes: Lessons From The Veterans Health Administration - Health Affairs 2007, Kupersmith et al.



*Since 1995, the Veterans Health Administration (VHA) has had an ongoing process of systems improvement that has led to dramatic improvement in the quality of care delivered, **VHA has been able to increase its productivity by nearly 6 % per year***

The Evidence: Duplication of Tests

Ann Intern Med 1987 - Computerized display of past test results. Effect on outpatient testing - Tierney WM, McDonald et al

Presenting physicians with previous test results reduced the ordering of those tests. The actual effect may have been greater than 13%

Ann Emerg Med. 2002 - A randomized, controlled trial of clinical information shared from another institution

Overhage JM, Dexter PR, Perkins SM, Cordell WH, et al

Authors observed a trend towards cost savings

J Emerg Med. 1998 - Reduction of redundant laboratory orders by access to computerized patient records. Stair TO

Overall savings in tests, prescriptions, admissions, and errors were estimated at about \$5 per visit. (20% of visit costs)

The Evidence: New Models of Patient-Provider interaction

Health Affairs 2009 - The Kaiser Permanente Electronic Health Record: transforming and streamlining modalities of care.

Chen C, Garrido T, Chock D, Okawa G, Liang L

Examined the impact of implementing a comprehensive electronic health record (EHR) system on ambulatory care use in an integrated health care delivery system with more than 225,000 members.

Between 2004 and 2007, the annual age/sex-adjusted **total office visit rate decreased 26.2 percent**, the adjusted primary care office visit rate decreased 25.3 percent, and the adjusted specialty care office visit rate decreased 21.5 percent.

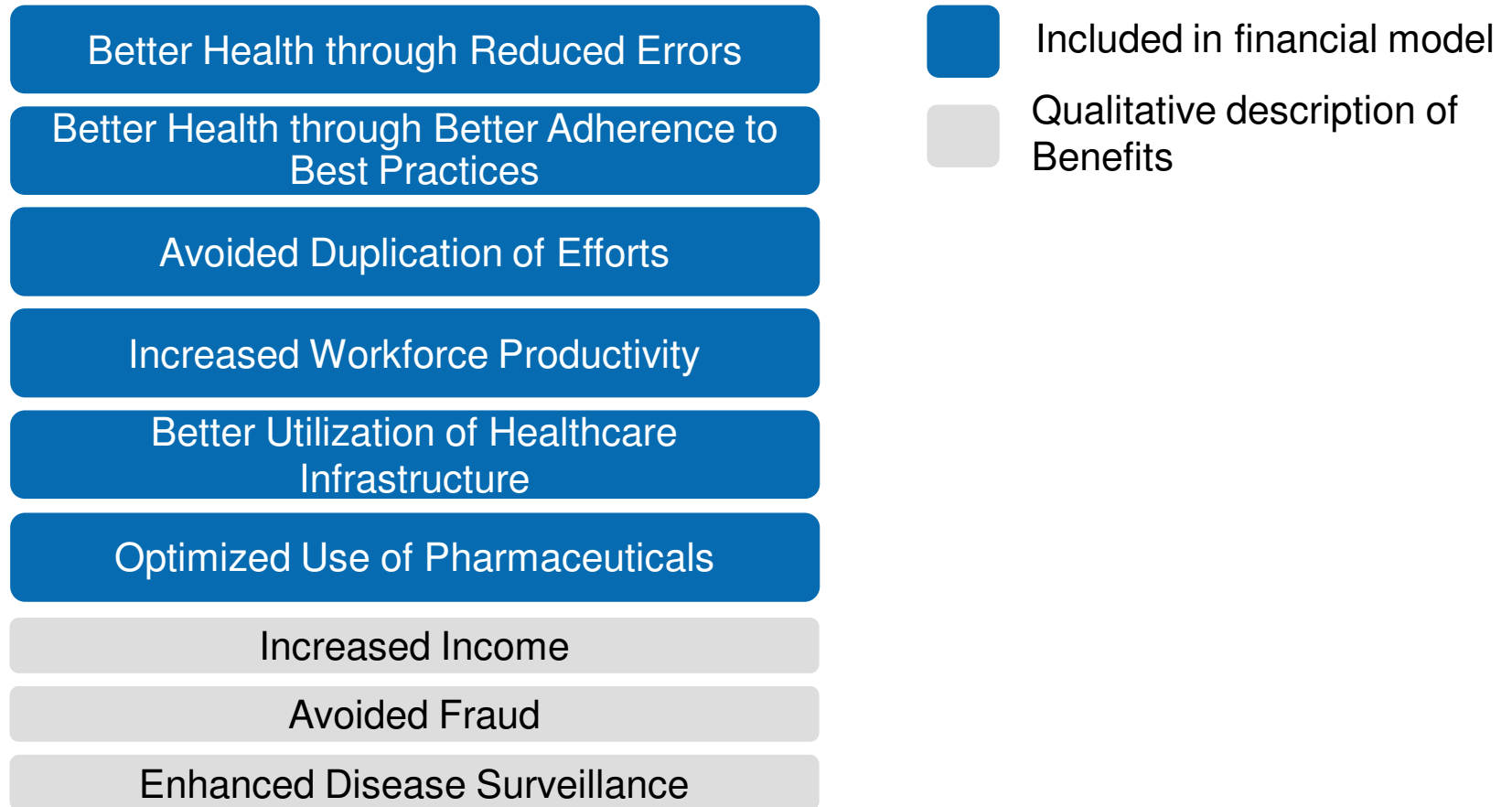
Scheduled telephone visits increased more than eightfold, and secure e-mail messaging, which began in late 2005, increased nearly sixfold by 2007.

Introducing an EHR creates operational efficiencies by offering nontraditional, patient-centered ways of providing care.



Based on the available literature, the team was able to outline a mix of quantifiable and qualitative benefits categories

Benefit Categories





However, care was taken to adopt the low-end (conservative) portion of the range for all benefits assumptions (1)...

Example Assumption:

Percentage of admissions caused by adverse drug reactions	Figure adopted 6%	11,3%	Drugs Aging Passarelli et al 2005
		10.8%	(Singapore) Pharm World Sci. 2003, Koh et al
		6,3%-10,7%	Ann Pharmacother 2008, Kongkaew et al
		7,2%	Eur J Clin Pharmacol 2000, Lagnaoui et al
		6%	Pharmacoepidemiol Drug Saf. 1997
		6,6%	Br J Clin Pharmacol 1998
		6,5%	BMJ 2004, Pirmohamed et al
		5,8%	BMC Clinical Pharmacology 2009,
		6%	Drug Saf Franceschi et al 2008
		4,3%	Pharmacoepidemiol Drug Saf. 2005,



However, care was taken to adopt the low-end (conservative) portion of the range for all benefits assumptions (2)...

Example Assumption:

ADE Hospitalization Cost
(per admission)

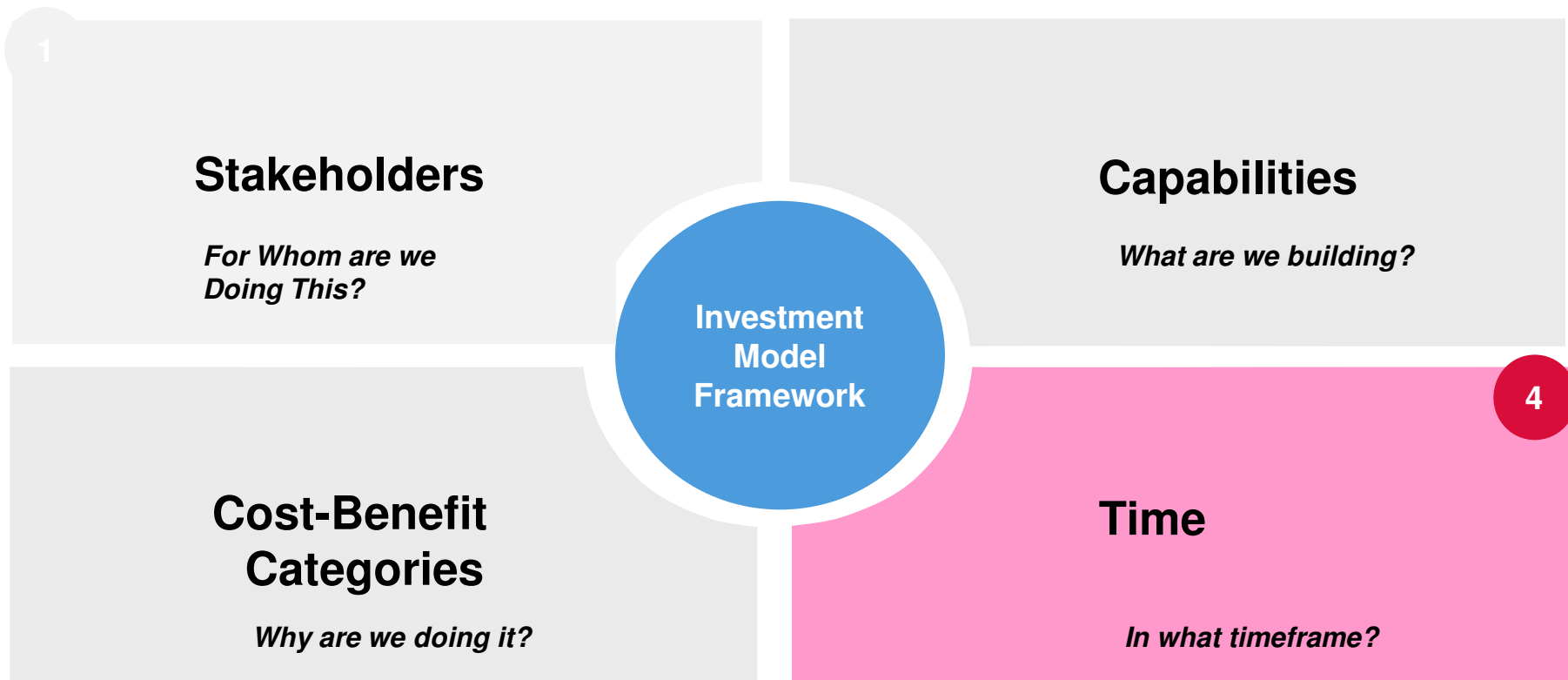
Low	Base	High
\$3,100 ¹	\$4,600³	\$6,200 ²

Cost of an ADE-related Inpatient admission



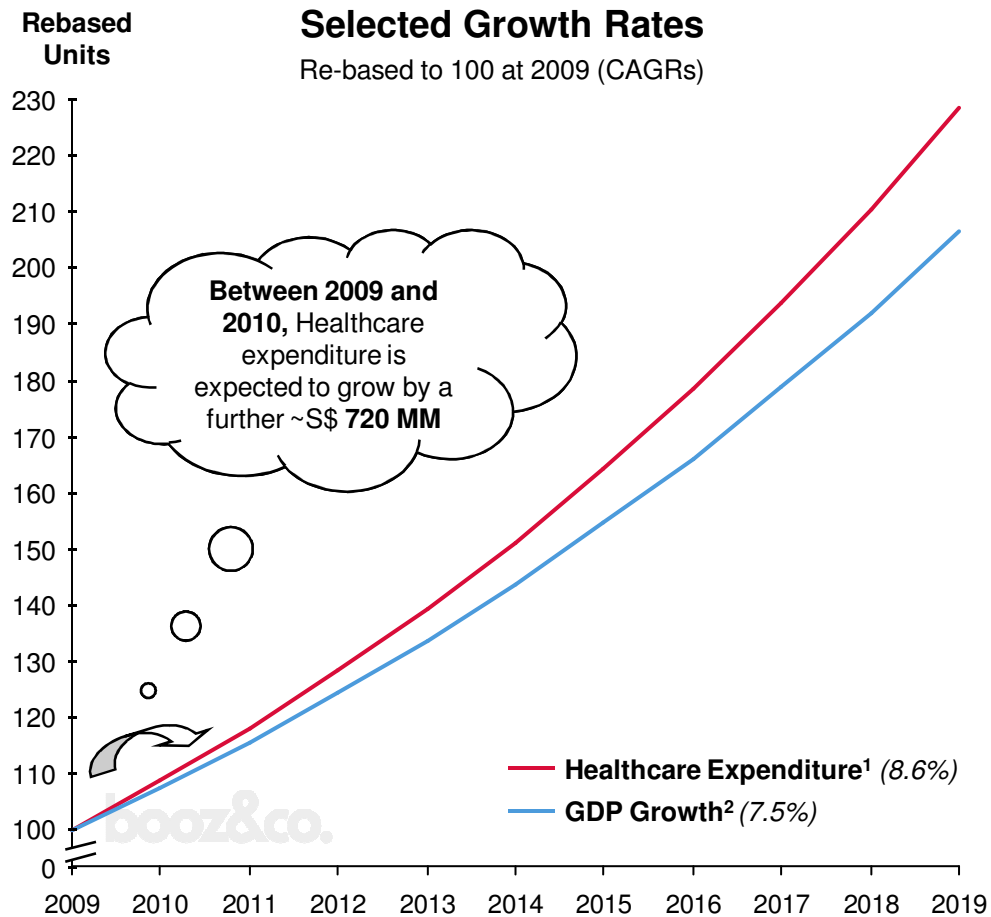
The fourth dimension of the model focuses on the impact of time

Four Dimensions of the Singapore EHR Financial Model Framework





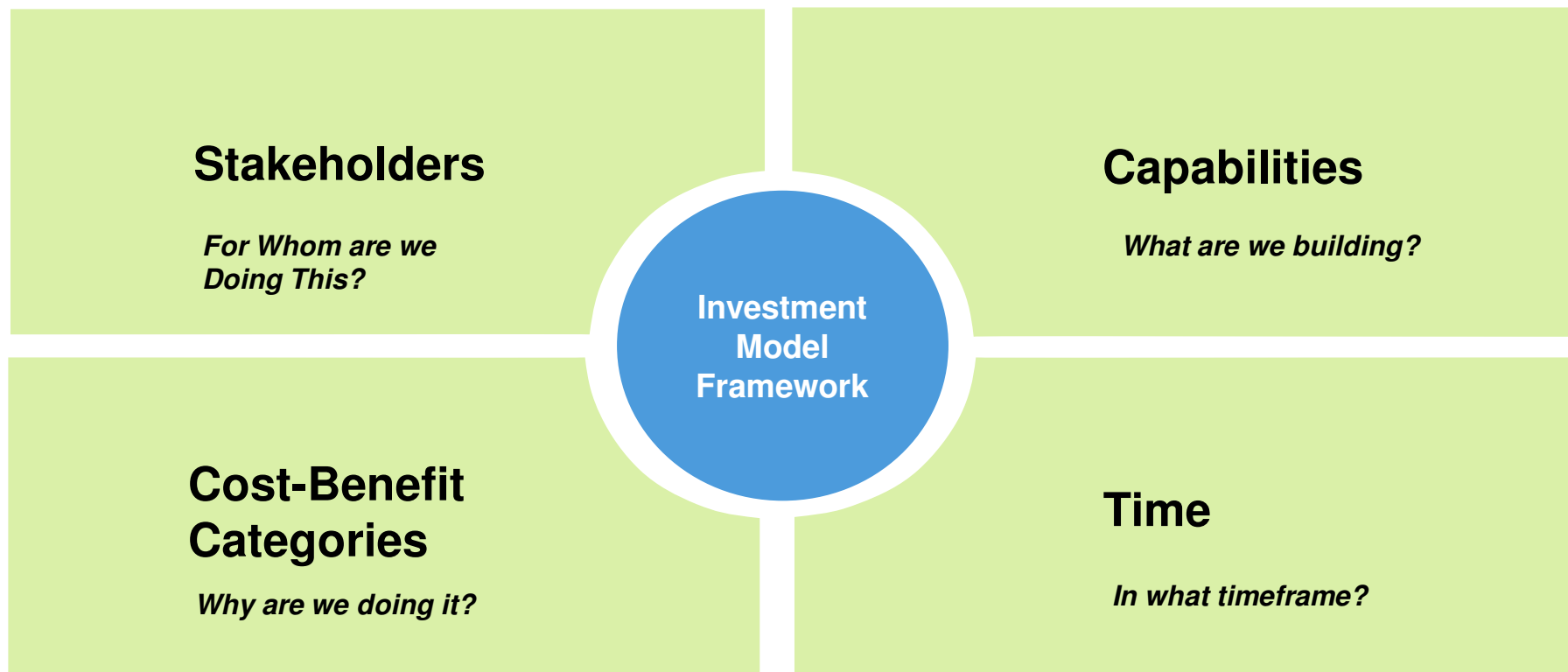
Inputs are combined with anticipated healthcare growth rates to derive the outputs of the investment strategy model



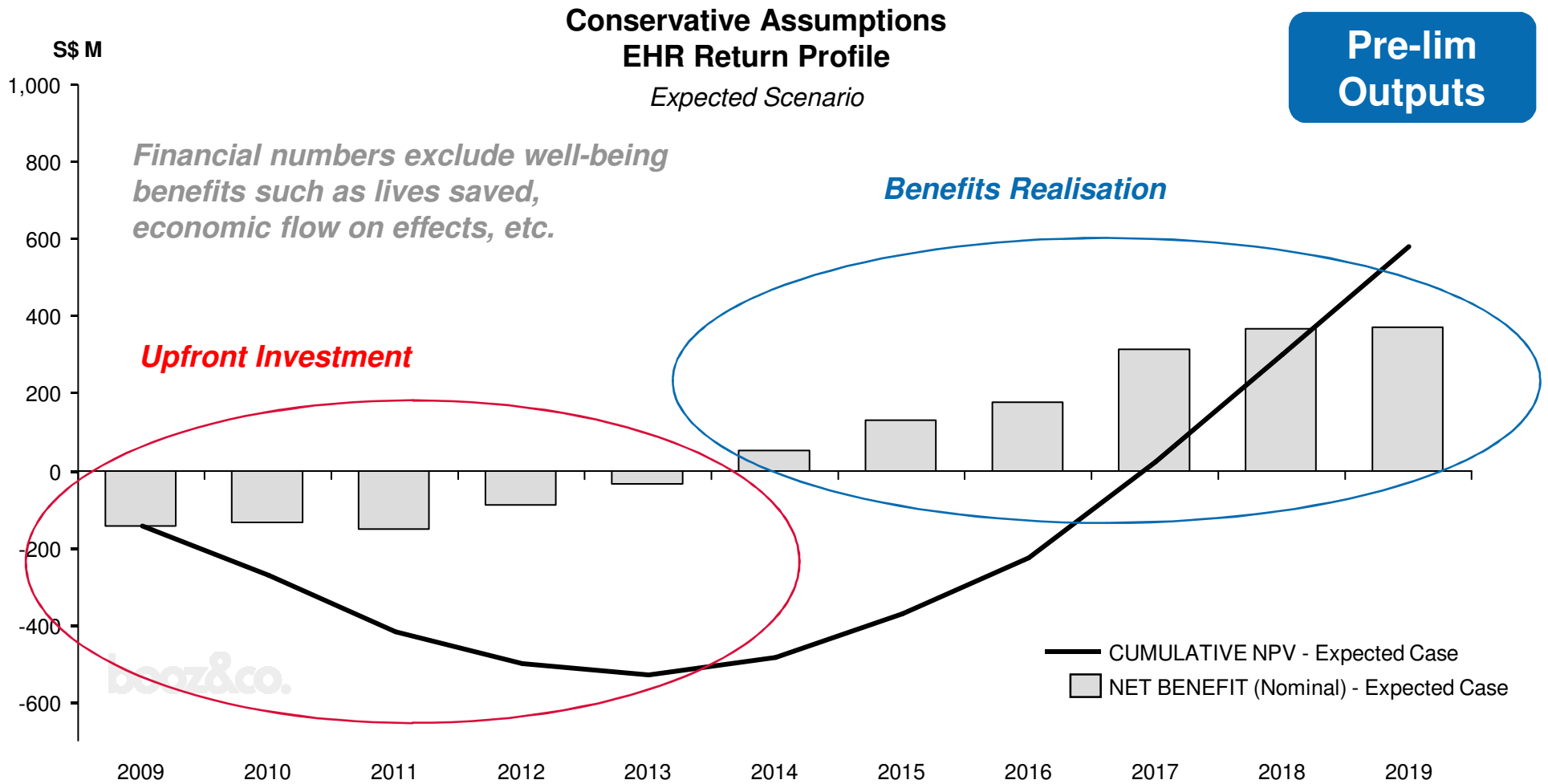


The four model dimensions have been combined to yield preliminary results

Four Dimensions of the Singapore EHR Financial Model Framework



Preliminary findings show that Singapore's EHR program will have a positive financial benefit over 10 years



1) Expected scenario assumes 100% of expected benefits are realized; includes cost contingencies of 20%; adoption at expected levels; and health finance reform occurs in 2014
 Note: Does not include terminal value

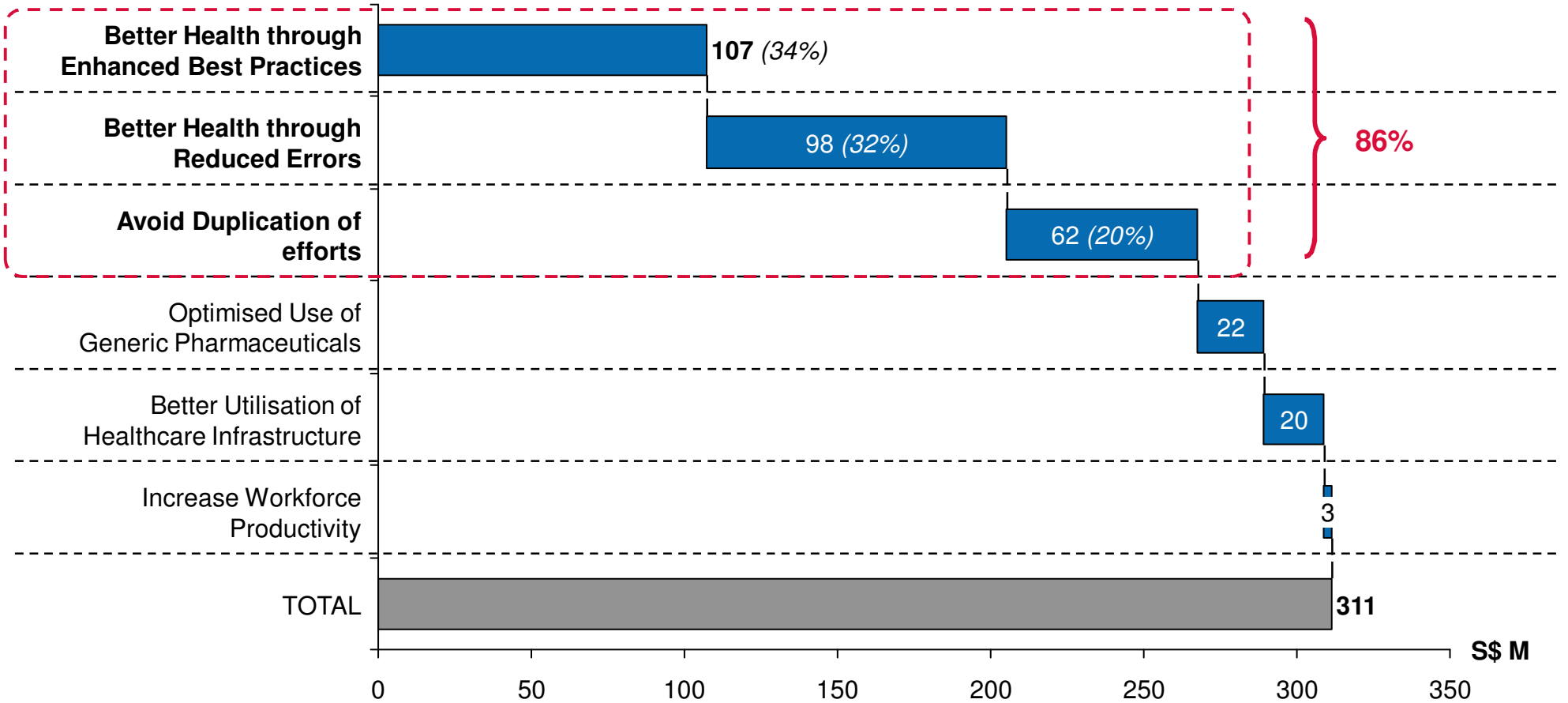


Model estimates show the greatest EHR potential in enhanced best practices, reduced errors and duplication of efforts

Annual EHR Benefit Value Breakdown

Total Potential¹ in 2009

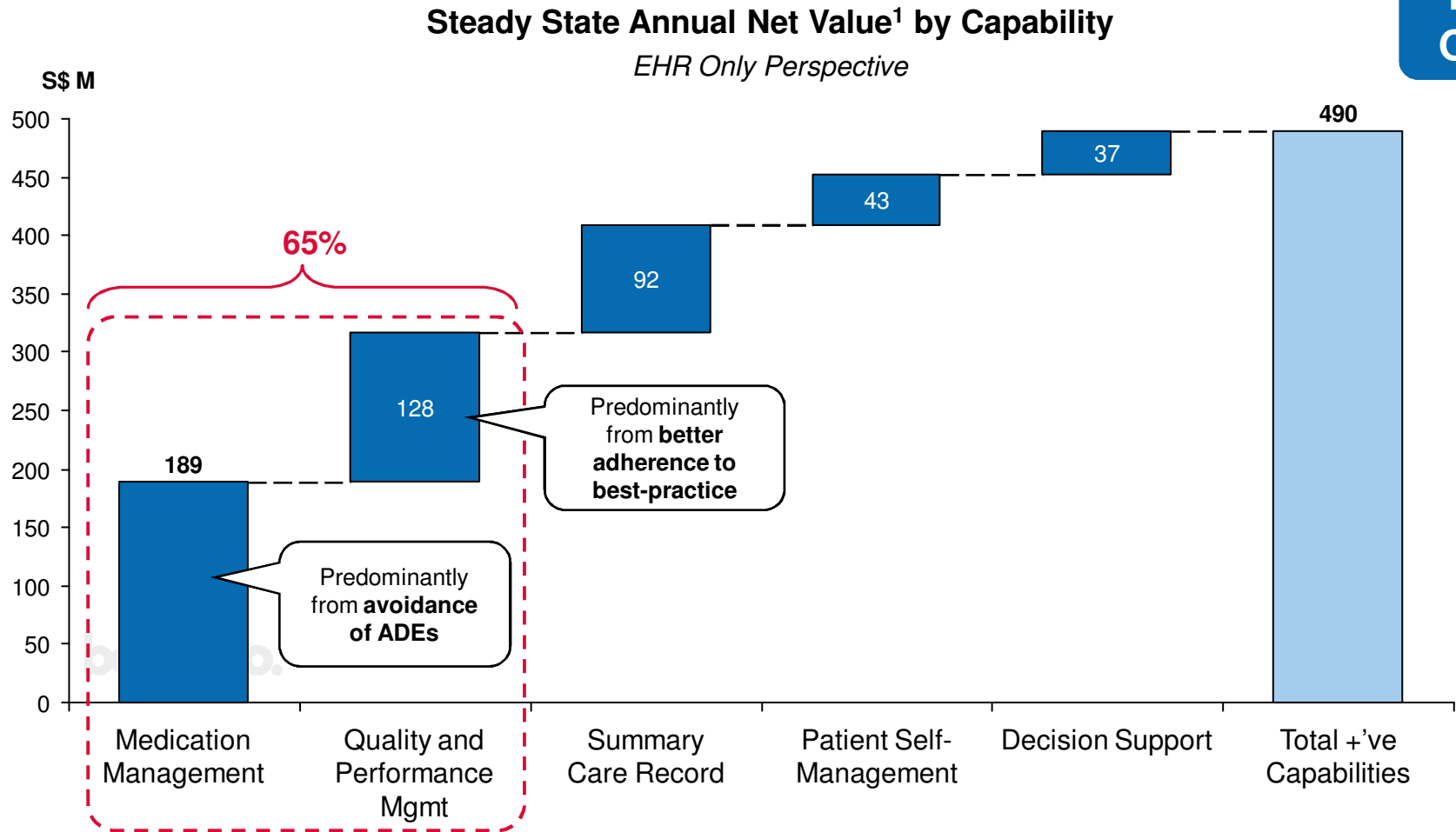
**Pre-lim
Outputs**



1) Assumes full deployment and adoption of systems in 2009

~65% of ongoing benefits are a result of proposed EHR IT capabilities in Medication Mgmt and Quality & Performance Mgmt

Pre-lim Outputs



1) Steady state refers to the value generated once the program has ramped up (i.e., in 2019), Annual net value considers ongoing benefits in 2019 less ongoing costs
 Note: Connected Care and Advanced Capabilities do not accrue any quantitatively sized steady state benefits / costs - hence are excluded from this figure

Summary of Key Messages - preliminary findings suggest Singapore's EHR program will have a net benefit over 10 years

- The goal of Singapore's EHR investment strategy is to **estimate the total national investment necessary** – across all key care settings and provider groups, and over a 10-year timeframe.
- An **evidence guided approach** to projecting benefits from the EHR and interoperability is possible, - based on the growing body of literature in this area.
- There will always be some uncertainty when making such projections, however these can be mitigated by **adopting conservative assumptions**, and the low end of any given range of anticipated impacts
- Even so, **preliminary findings suggest that Singapore's EHR program will have a net benefit over a 10-year timeframe.**
- Findings also suggest that **there are key benefit categories and IT capabilities that will deliver the majority of the benefits from the program**, - and these should be given due priority and resourcing.