COVID-19 Vaccination Protocol for India

A 360° PERSPECTIVE

It's no longer about the vaccine,
but about vaccination.

fractal
INTELLIGENCE FOR IMAGINATION

Contents

fractal

The Vaccination Challenge

While viable options for the Covid-19 vaccine have been developed, what starts is perhaps the most daunting challenge that governments across the world would have ever faced in - one of vaccinating 7.8 Bn people, **some desperate, some willing, some hesitant and some resistant**.

What will be at display is an unprecedented mobilisation and synchronisation of administrative machinery, healthcare delivery systems, logistics and supply chain experts, technology platforms and frontline workers, operating in tandem to vaccinate the world in a fair and efficient way.

As The Economist says – *"The Scientists have done their job, now it is time for the Society to take over."*

This document is an informed perspective borne out of our experiences of:
- working with government bodies towards the COVID-19 response in India
- in containing HIV across several African nations
- designing various aspects of the reproductive, maternal, newborn and child health (RMNCH) programs focused on ASHA workers

The document provides our perspective on two critical areas:

A) The **Program Delivery Priorities** for a staggered yet complete administration of two doses of the Covid-19 vaccine to 65%+ of the population in India

B) Propose a **Program Architecture** for Institutional Delivery that integrates the lenses of **Behaviour Change × Enabling Technology**

fractal

Program Delivery Priorities

Notwithstanding the infrastructural, logistics and technological challenges, it's evident that a program of this magnitude and importance will be scrutinised by administration and society at large through the prism of **transparency, efficiency and effectiveness,** each of which impacts the other. To recognise and optimise the trade-offs between these priorities across phases of delivery will be a crucial balancing act.

	TRANSPARENCY	**EFFICIENCY**	**EFFECTIVENESS**
BEHAVIOUR CHANGE	Incentivising **accuracy of data reporting** to enable decision integrity through the process	Designing digital applications that address digital-literacy challenges and **increase ease of adherence** to the process	Behavioural Segmentation of beneficiaries to **better prioritise** within allocated groups and **target messaging**
INSTITUTIONAL DELIVERY	**Creating visibility of the right data** for key stakeholders to help drive accountability	High-frequency validation of data and changing needs to help **align efforts between governing teams and frontline workers**	Data + Behaviour Science driven recommendations to help Governing teams **anticipate and plan for edge cases and latent scenarios**
ENABLING TECHNOLOGY	Instituting technological and process-related checks and balances to **strengthen data privacy and security**	Creating 'insights dashboards' to enable governing teams to **course-correct in time**	Systems and applications engineered to **handle high volumes of data** usage, ingestion and processing

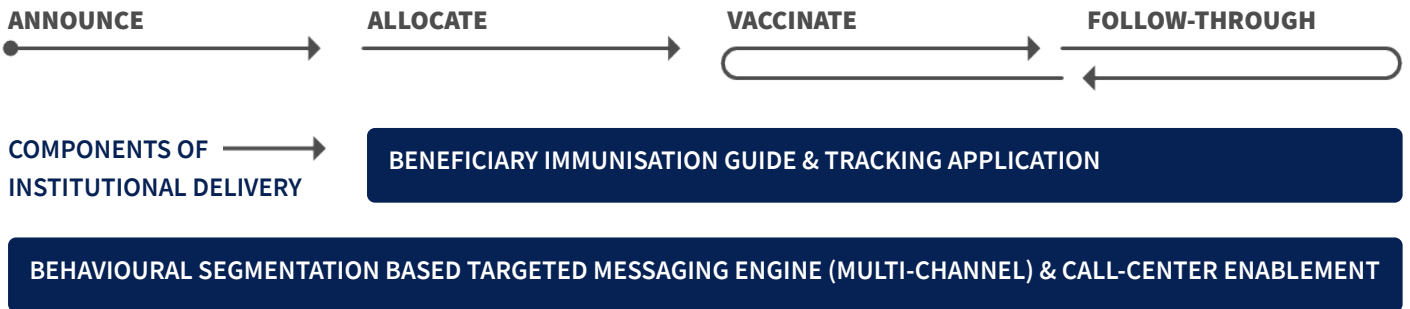fractal

A 360° Program Architecture

The program architecture provides a holistic perspective for operationalising vaccination across four distinct phases while optimising for transparency, efficiency and effectiveness.

The architecture accounts for:
1. Stakeholders: beneficiaries, frontline workers & governing bodies
2. Anticipated behavioural challenges and interventions
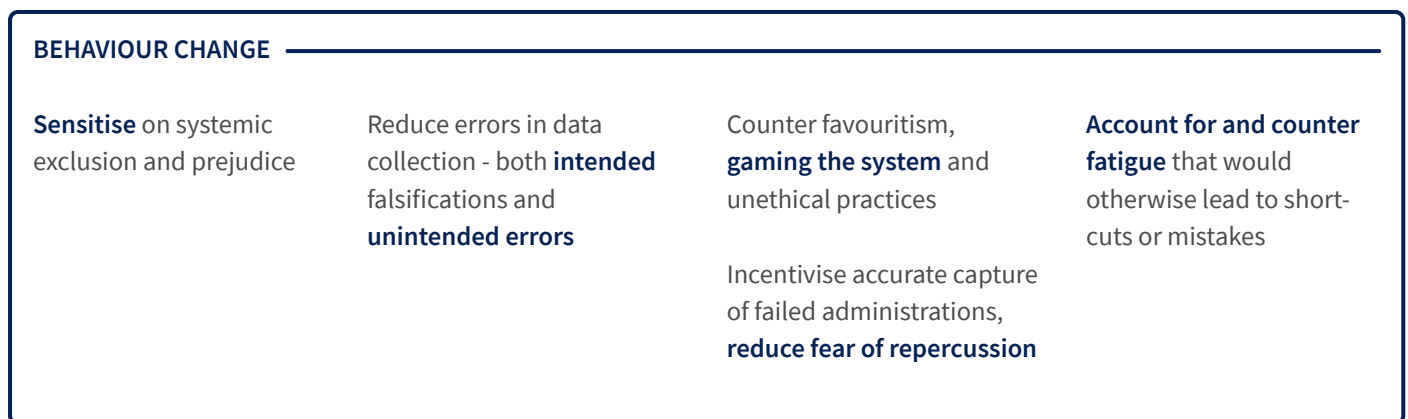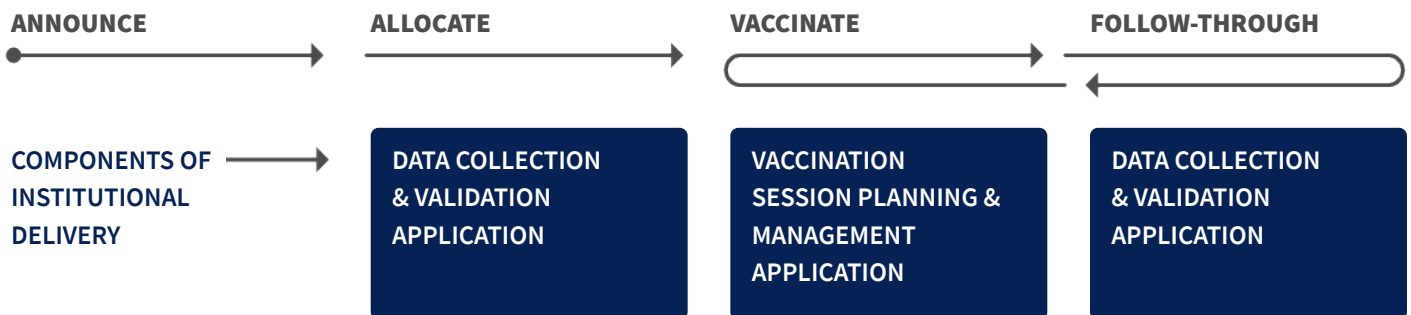3. Enabling technologies

3.1 Beneficiaries

For sustained co-operation throughout the immunisation journey, different beneficiary segments will need to be engaged, with customised messaging and relevant information.

ANNOUNCE → **ALLOCATE** → **VACCINATE** → **FOLLOW-THROUGH**

COMPONENTS OF INSTITUTIONAL DELIVERY →

BENEFICIARY IMMUNISATION GUIDE & TRACKING APPLICATION

BEHAVIOURAL SEGMENTATION BASED TARGETED MESSAGING ENGINE (MULTI-CHANNEL) & CALL-CENTER ENABLEMENT

BEHAVIOUR CHANGE

Manage perceptions of injustice, inequality and inaccess

Manage **distrust and irritation** towards Frontline workers

Managing unfavourable personal circumstances and **forgetfulness**

Counter pain anticipation and **fear of Infection/AEFI**

Managing crowds at vaccination sites

Counter false sense of safety and **lowered risk perception** in those that have received 1st dose

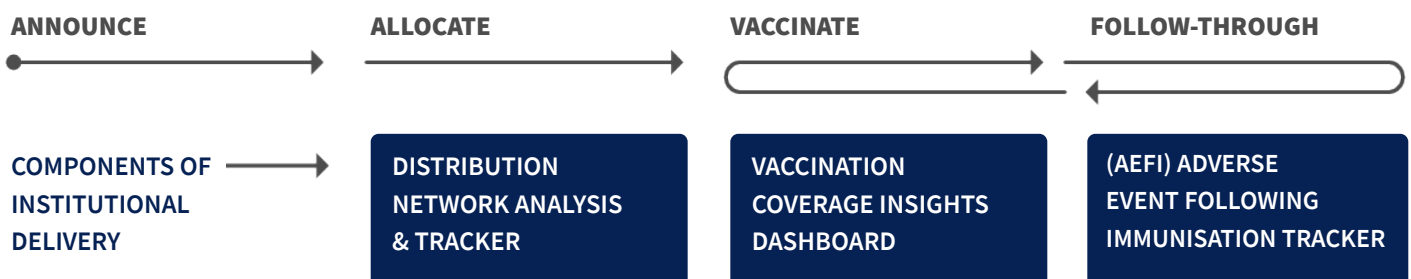Managing **spread of negative information** and detractors

fractal

3.2 Frontline Workers

Frontline workers need to be equipped with digital applications that are designed for accuracy of data input and ease of adherence to protocols.

ANNOUNCE   **ALLOCATE**   **VACCINATE**   **FOLLOW-THROUGH**

COMPONENTS OF INSTITUTIONAL DELIVERY

| DATA COLLECTION & VALIDATION APPLICATION | VACCINATION SESSION PLANNING & MANAGEMENT APPLICATION | DATA COLLECTION & VALIDATION APPLICATION |

BEHAVIOUR CHANGE

Sensitise on systemic exclusion and prejudice

Reduce errors in data collection - both **intended** falsifications and **unintended errors**

Counter favouritism, **gaming the system** and unethical practices

Incentivise accurate capture of failed administrations, **reduce fear of repercussion**

Account for and counter fatigue that would otherwise lead to short-cuts or mistakes

3.3 Governing Teams

Governing teams need to be equipped with digital tools to anticipate, plan and course correct for non-linearities and evolving scenarios on the ground.

ANNOUNCE   **ALLOCATE**   **VACCINATE**   **FOLLOW-THROUGH**

COMPONENTS OF INSTITUTIONAL DELIVERY

| DISTRIBUTION NETWORK ANALYSIS & TRACKER | VACCINATION COVERAGE INSIGHTS DASHBOARD | (AEFI) ADVERSE EVENT FOLLOWING IMMUNISATION TRACKER |

VACCINATION PROGRAM PLANNING PLAYBOOKS, TOOLKITS & QUALITY CHECK PROTOCOLS

BENEFICIARY ENGAGEMENT INDICATOR

fractal

3.4 Phase-wise Prioritisation

ANNOUNCE	ALLOCATE	VACCINATE	FOLLOW-THROUGH

TRANSPARENCY

EFFICIENCY

EFFECTIVENESS

TRANSPARENCY

EFFICIENCY

EFFECTIVENESS

TRANSPARENCY

EFFICIENCY

EFFECTIVENESS

TRANSPARENCY

EFFICIENCY
EFFECTIVENESS
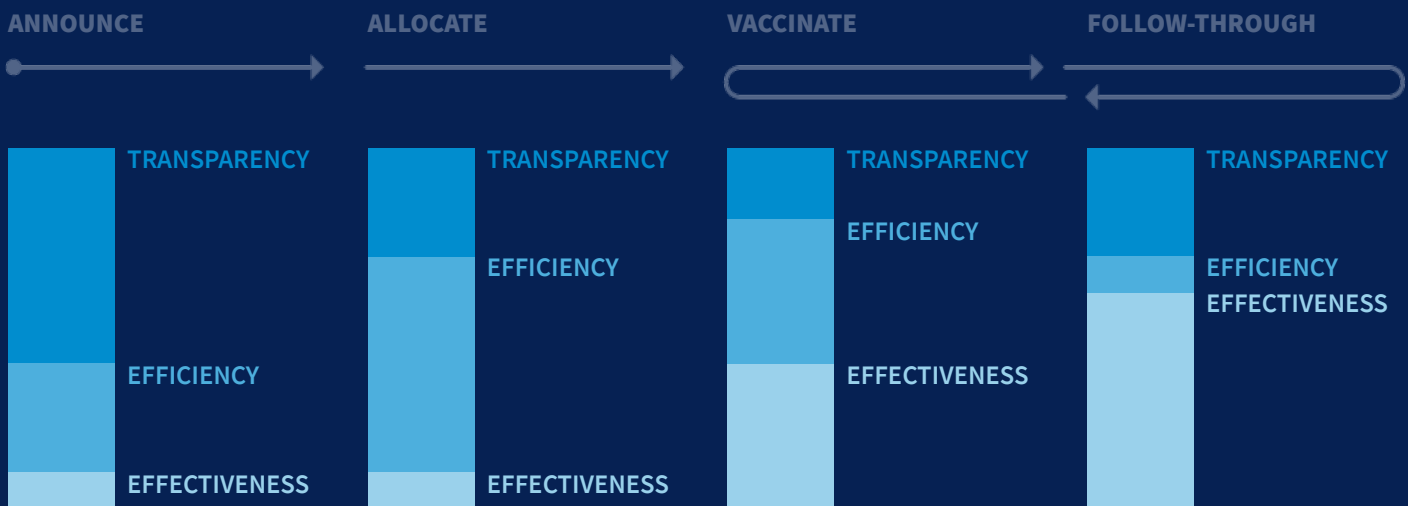
In different phases of the vaccination journey: Announce, Allocate, Vaccinate, Follow-Through; the system would need to trade-off amongst program priorities. Attempting to optimise for all three at all times is likely to lead to diluted results.

While the journey is laid out linearly, several overlapping cycles are to be expected. The staggered vaccine administration roadmap will increase in scale and complexity. Through subsequent cycles of administration, systems need to leverage past learnings to refine the delivery process further.

fractal

Program Components

4.1 Behavioural Gaps

The complexity, scale and associated uncertainties with the vaccination program suggests that there might be several behavioural challenges that may emerge and would require anticipation and management across beneficiaries and the people delivering it.

The core themes of these gaps are:

a. **Intent-Action Gaps** where one might witness high belief and intent, but lack corresponding action towards the vaccination program.

b. **Hesitancy towards vaccination** due to with evolving news, inconsistent communication, counterfactuals and sporadic adverse events.

c. **Access Gaps** driven by media darkness, poor quality of information or self-appointed community gate-keepers; leading to suboptimal engagement on the part of the beneficiaries and frontline workers. At the same time, there could be a few that attempt to game the system to gain access without meeting the criteria or allocation.

d. **Poor adherence** to protocols on the part of beneficiaries and providers driven by decision biases like poor risk-availability and overconfidence.

Long Road to Herd Immunity

While there are no estimates for when herd immunity might be achieved in India, there is a likelihood that this may not happen in 2021 at all. A prolonged vaccination campaign will pose a new set of challenges:

a. **Frustration**, impatience and feelings of unfairness due to inability to get vaccinated despite intent and willingness to pay

b. **Lowered risk perception** regarding COVID and more risk-taking due to uninformed beliefs about vaccine efficacy and herd immunity

c. **Lower adherence** to safety measures due to fatigue and signals from other countries where herd immunity is achieved earlier

d. **Black and grey markets** may develop to cater to the unmet demand for vaccine

fractal

Table - Summary of Behavioural Gaps Anticipated

Intent-Action Gaps	Vaccine Hesitancy	Access Gaps	Adherence Gaps
Logistical barriers – time, money, means, ability, opportunity costs	Low risk perception regarding COVID-19 – social sentiment, personal experience or beliefs	Media and digital dark spots - communities, households, individuals	Reducing risk compensation for adopting mitigation measures (Eg. reducing personal safety measures once vaccinated)
Social signals/ norms counter to vaccination	AEFI - Adverse events following immunisation	Resistance to engaging with Frontline workers	Efficacy misperceptions (Eg. One shot is sufficient)
Procrastination, de-prioritisation or forgetting	Mistrust of government/ misinformation	Errors in reporting health condition/ health information	AEFI – Adverse events following immunisation
Perceived unfairness regarding prioritisation criteria or lack of agency	Intimidation due to novelty/ unfamiliarity	Intra-household access disparity	Perceived gap between benefits and risk (Eg. sensationalised negative stories)
Pain anticipation due to delivery format, fear of side-effects	Lack of perceived rewards	Interference of community gatekeepers	
		Attempts to game the system of allocation and expedite one's turn	
		Misreporting of health condition/health information	

fractal

4.1.1 Interventions to Drive Vaccine Uptake

World Health Organization released a report on 'Behavioural considerations for acceptance and uptake of COVID-19 vaccines' in which three categories of drivers of vaccine uptake were identified:
a. an enabling environment
b. Social influences
c. motivation.

A number of academics and practitioners have also put forth their ideas for reducing vaccine hesitancy and driving uptake of the COVID vaccines. Some key ideas are as follows:

a. **Social proof** – social signals like stickers, digital badges to make vaccinated population visible and drive a supportive social norm

b. **Social responsibility framing** – 'help save lives of other (more vulnerable) by getting vaccinated' to target population who do not feel at risk

c. **Optimistic, hopeful framing** of public awareness campaign with a clear and catchy call to action for vaccination, similar to 'yes we can'

d. **Publicized vaccination** of influencers and authority figures

e. **Charity auction** for limited early volumes of vaccines
•   Welfare redistribution – raise money to support vaccination of vulnerable or hard to reach population
•   Check black markets – meet some of the demand through auctions
•   Signaling – publicize willingness of the rich and elite population to get vaccinated

f. **Incentives and perks** - a vaccine ID that can be used to offer special perks and access to public spaces to the vaccinated individuals

g. **Social media** - control spread of misinformation and promote trusted sources on vaccination

h. **Default with opt-out**s – automatic scheduling of vaccination with easy option to opt-out

i. **Directly addressing fears about AEFI**
•   Citizen engagement to listen to and understand fears and hesitancy about vaccines
•   Easily understood non-medical communication about side-effects and efficacy

4.2 Technology Blueprint

What is needed is a dynamic architecture that provides seamless access to beneficiaries, frontline workers and governing teams to interact with the systems, enable information delivery and input data capture.

The aim would be to increase **transparency** in the system by baking in quality validation mechanisms that ensure data sanctity as well as **improving quality** (deduplication etc.); making the stored data extremely **resilient** against unauthorised tampering.

The system ought to be **scalable and nimble** to support ingesting and processing a variety of data sources/ types by way of a cloud-based solution architecture. This also grants the required **elasticity** to scale up and down as needed. The solution must have industry standard **security** protocols like encryption, data security as well as Role Bases Access Controls.

Lastly, the system must communicate with what's already implemented in development platforms by exposing secure API endpoints to share and ingest data from parallel platforms and systems.

The following page illustrates technology architecture approaches based on AWS & Azure. In both cases, while there is an optimazation for speed, there's also provision for systems that ensure validation and quality assurance of data - engineering the right trade-off here is key to create a program that is ready for scale.

Note that the data sources illutrated are meant to point out the most relevant ones and aren't exhausitve. For example there is an opportunity to leverage public social media chatter, so communication strategies can be responsive to macro trends in public sentiment.

fractal

4.2 Technology Blueprint

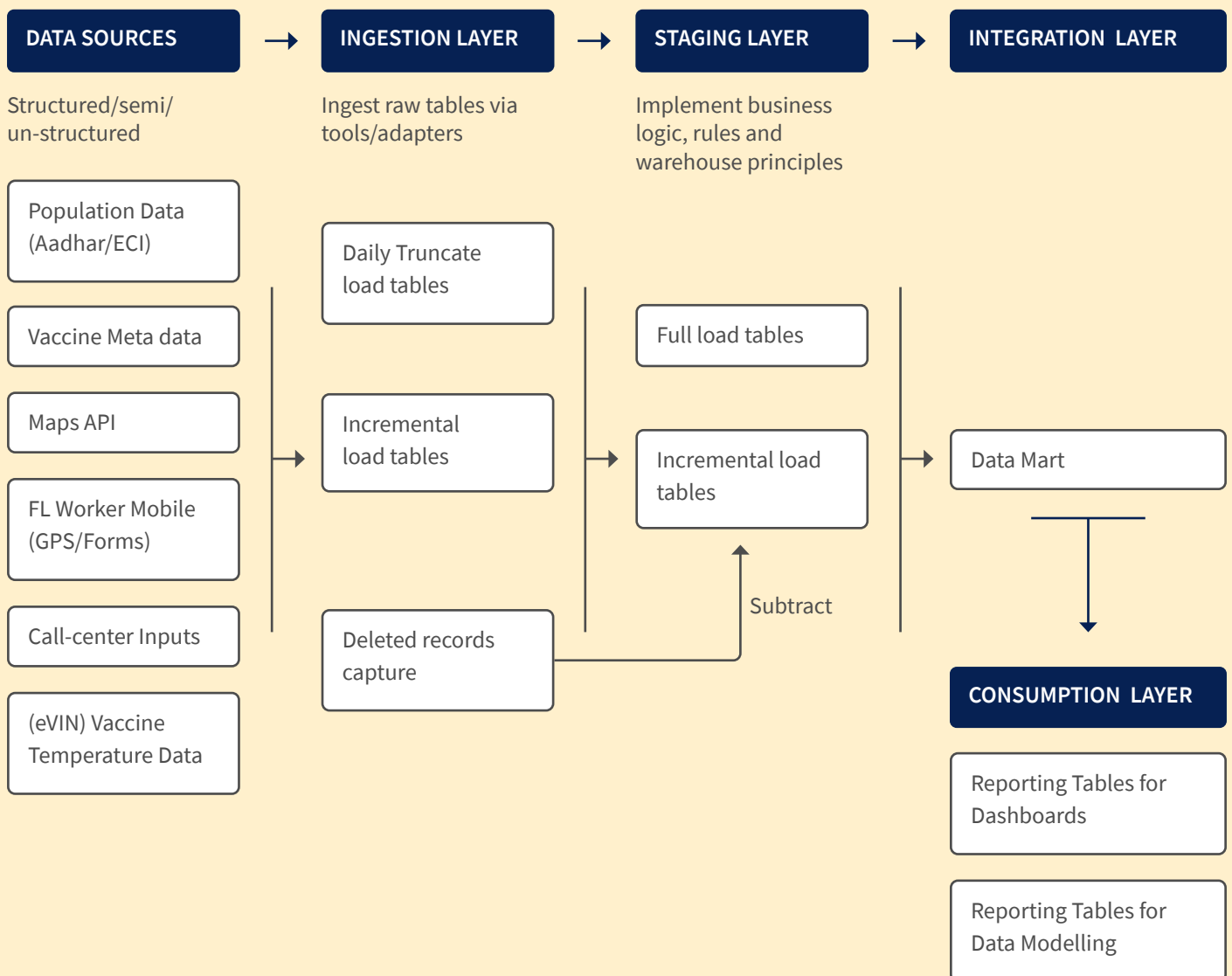## Diagram - Illustrative AWS based Architecture
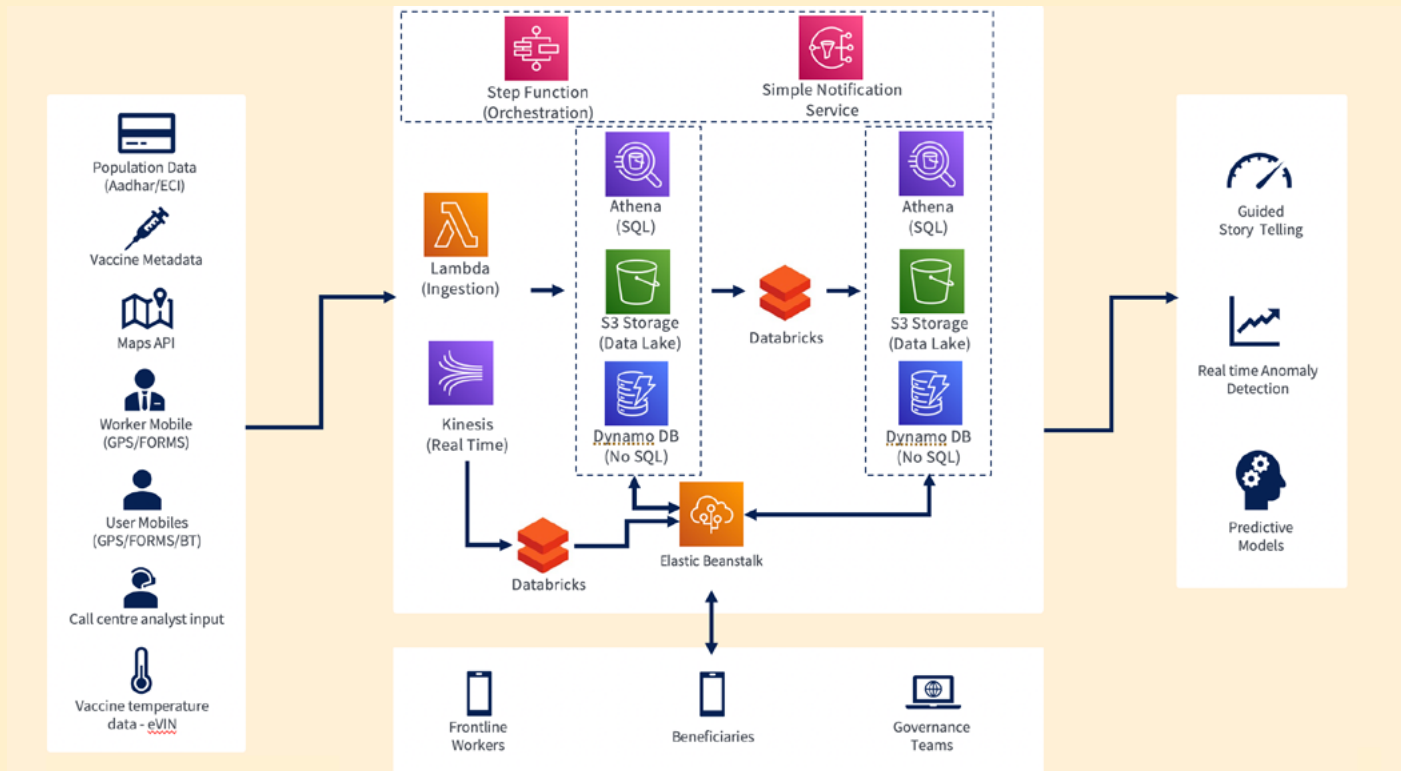
Diagram - Illustrative Azure based Architecture
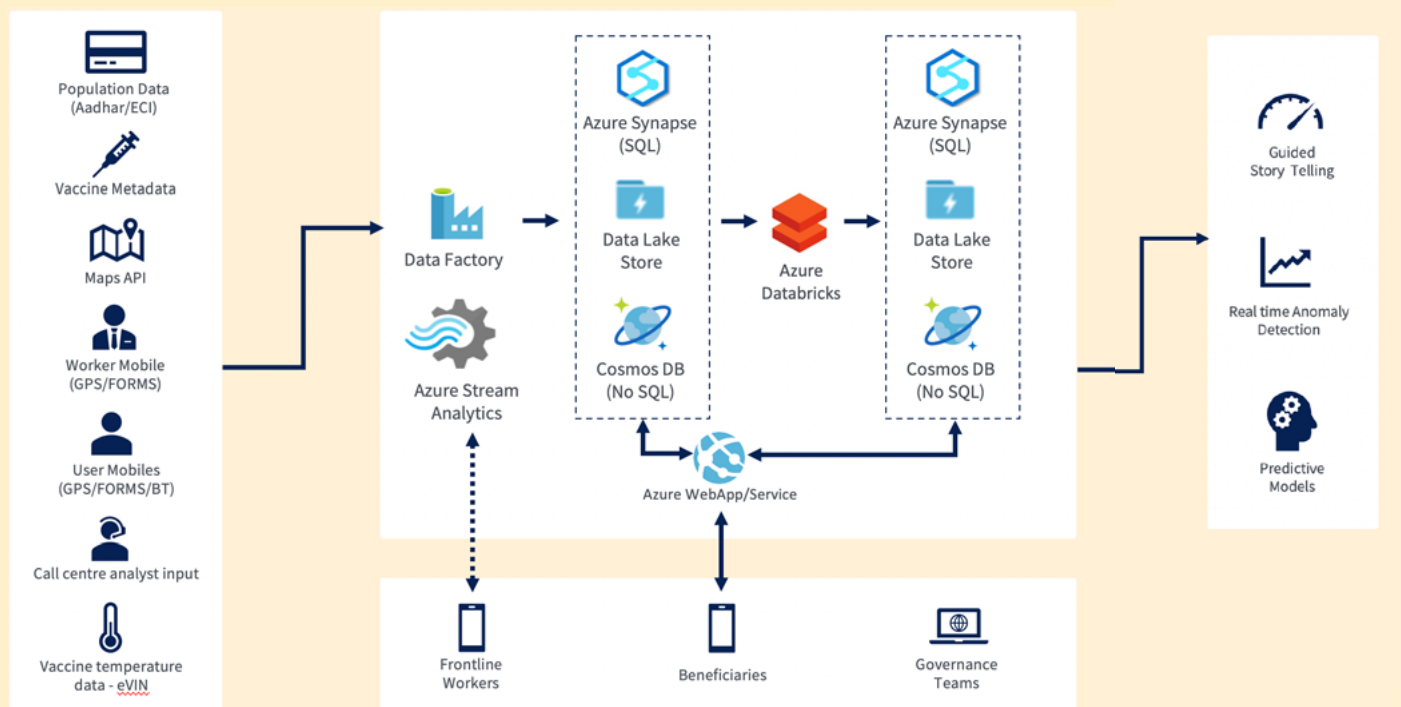
4.3 Managing Data Flow

Mixing and matching all the available data sources will be a complex task and the system should be able to handle them seamlessly, as well as support plugging in any new and upcoming data sources. By following a layered-architecture data can be modelled in a robust manner to support varied use-cases and analysis in both batch and real time modes. The system must be able to churn out data to support dashboards, KPI derivation, visualisation and machine learning models by means of a flexible backend model.

| DATA SOURCES | → | INGESTION LAYER | → | STAGING LAYER | → | INTEGRATION LAYER |

Structured/semi/un-structured

Ingest raw tables via tools/adapters

Implement business logic, rules and warehouse principles

Population Data (Aadhar/ECI)

Vaccine Meta data

Maps API

FL Worker Mobile (GPS/Forms)

Call-center Inputs

(eVIN) Vaccine Temperature Data

Daily Truncate load tables

Incremental load tables

Deleted records capture

Full load tables

Incremental load tables

Subtract

Data Mart

CONSUMPTION LAYER

Reporting Tables for Dashboards

Reporting Tables for Data Modelling

fractal

Making investments sustainable

Unprecedented level of resources, both human and financial are being deployed to fight COVID-19. While the situation is dynamic, **there is a real opportunity to make the investments sustainable.** There are several healthcare and adjacent outcomes that can be improved by making these systems more durable.

Some of the obvious candidates are:

1. Immunisations in general
2. Seasonal flu vaccines
3. Managing outbreaks
4. Managing other deadly contagious diseases like TB

The insight and data systems, real time intelligence, technology platforms and rapid capacity building platforms need to be developed with a view of making them adaptable to these areas as well.

The process would entail mapping the mesh points, both at a data and personnel level and initiate pilot programs where these platforms are deployed simultaneously while vaccine deployment is in force.

fractal

AUTHORS

ANMOL KAUL
Associate Director - Big Data
& Data Engineering

ANURAG VAISH
Chief Practice Officer -
Behavioural Science & Design

DINESH NORY
Vice President - Analytics

KAUTUK TRIVEDI
Lead - Design Researcher
& Strategist

RAHUL DESAI
Vice President - Artificial
Intelligence

RAM PRASAD
Co-founder & CEO -
FinalMile Consulting

SARANSH SHARMA
Lead - Behavioural Strategist

SHIVANI GUPTA
Lead - Behaviour Architect

SRIKANTH VELAMAKANNI
Co-Founder, Group Chief
Executive & Executive Vice-
Chairman - Fractal.ai

For further clarifications and conversations, do reach out to us at **vaccination-program@fractal.ai**

fractal