Digitalisation and Value Chain Collaboration

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lendlease

“The industry will need to make radical changes to the processes through which it delivers its projects… The industry should create an **integrated project process** around the four key elements of **product development, project implementation, partnering the supply chain** and **production of components**. Sustained improvement should then be delivered through use of techniques for eliminating waste and increasing value for the customer.”

- Sir John Eagan, Rethinking Construction, 1998

The World's Largest Industry Underperforms

Lagging productivity growth

Less than **1.0%** per year for the industry over the past 20 years, versus **2.8%** percent for the total global economy.

Singapore's construction industry relies heavily on foreign labour and existing methods are not sustainable. Singapore set national targets to achieve **70% DfMA adoption rate** (by GFA) by 2025 under the Construction Industry Transformation Map.

Regular time and budget overruns

Schedules and budgets can often be set wrongly from inaccurate estimates. Just **31%** of all projects came within **10%** of the budget. This can lead to disputes and litigation between stakeholders.

Fragmented and Project-based Building Approach

Each design & construction process is highly project based – developed from unique specifications, using designs planned from scratch, with limited degree of repetition and reusability of previous designs.

Rework and waste

Inadequate communication and collaboration between stakeholders. Non-connected tools and processes increase risk of error and rework. Design errors accounted for **38%** of construction disputes

Complex regulation and tight compliance

The industry is subjected to a wide range of regulations, which can be complex and time-consuming to navigate and comply. This is accentuated in Singapore with strict building codes and regulations.

Increasing demand for sustainable buildings

The built environment contributes around **40%** of the world's carbon emissions. Singapore has committed to be **net-zero by 2050**, with government bodies to report their emissions annually and pushing for reduction of a building's carbon footprint over its entire lifecycle via Green Mark.

1997
SGD $22,000

2023
SGD $600

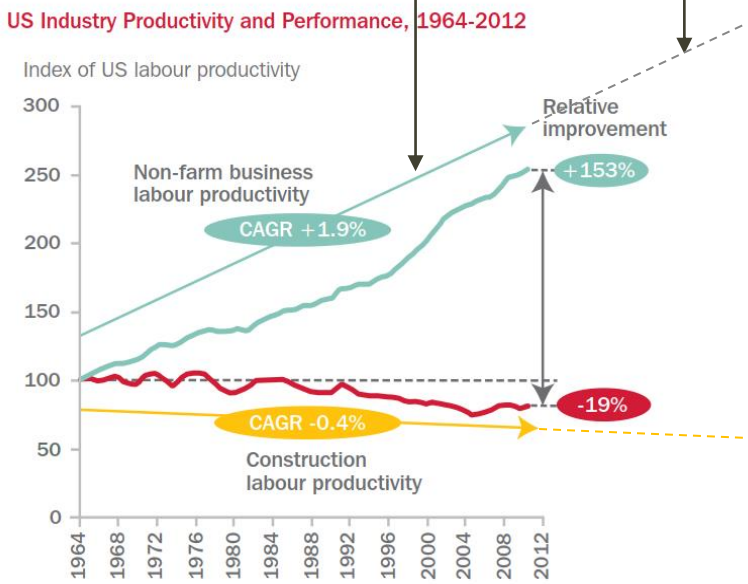
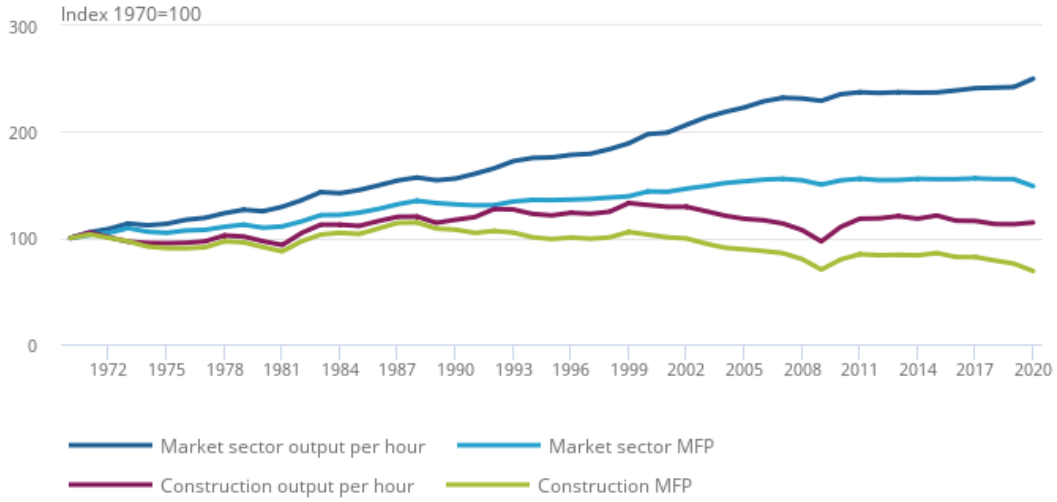


Figure 1: Productivity has changed little in the construction industry in the past 50 years

Output per hour worked and multi-factor productivity, construction industry and market sector, UK, 1970 to 2020



Source: Office for National Statistics – Labour productivity and multi-factor productivity

Transformation in design & delivery: What we need to achieve

Design

- Maximum functionality for the minimum lifecycle cost
- Standardized, repeatable design solutions
- enhance quality
- ensure predictability

Create an environment where suppliers can thrive

- Refine their processes and offerings to deliver better value
- Engage manufacturer knowledge to add value to projects
- Recognize the importance of supplier profitability and overhead

Automate repetitive work, focus on value creation

- Automate the production of repetitive information, which can be resource-intensive
- Focus the time and effort of designers on the bespoke elements of projects
- Reduce re-work and duplication of effort.
- Enable redistribution of development costs, design fees, cost of sale, contingencies

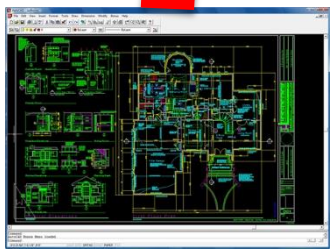
Minimise waste and risk

- Reduce the proportion of the construction cost and programme that is related to risk, rework, and waste
- Reduce waste by using collaborative procurement approaches that incorporate standardized components, materials, and construction methods

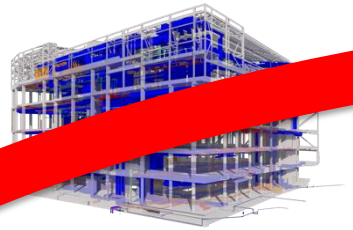
19th Century
- Paper drawing

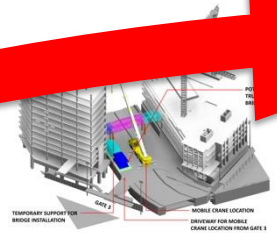
1957
- CAM

1975
- BIM v1
- Eastman – parametric design



2
CAD





2007
- BIM v2

Fast Track

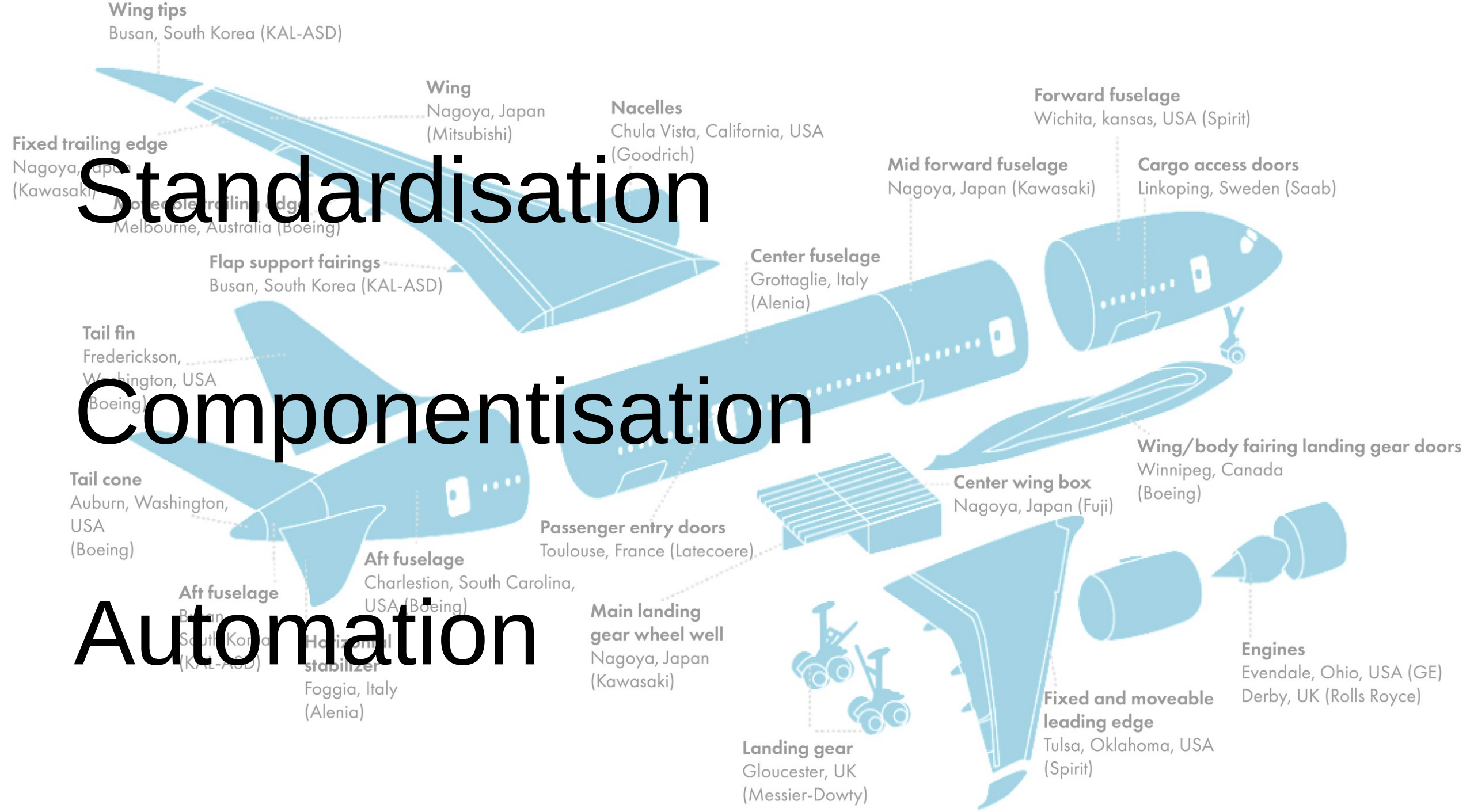
2017
- VDC

2018
- IDD

40yrs on, this is still the predominant toolset

2022
Revised CITM
- IPD
- Advanced Manufacturing
- Sustainable Urban Systems
- Industry leadership

How do we scale this effort?



Standardisation

Componentisation

Automation

Ways of Design must change

- In-situ
- Bespoke
- Labour Intensive

Conventional Construction

- Products
- Process (repeatable)
- Production System
- Volume Tooling
- Efficient Labour

Basic Manufacturing

- Robotics
- Autonomous Production Systems
- Low Labour

Autonomous Manufacturing

Off-Site Fabrication

- Construction in a shed
- Panelised
- Volumetric / Modular
- Logistics Equipment
- Conventional Tools
- Labour Intensive

Advanced Manufacturing

- Equipment Automation
- Digital Control of Tooling
- Digital Production System
- Reduced Labour

Site Robotics

- Logistic Robotics
- Assembly Robotics
- Ground Works Robotics
- Remote Production System

Traditional Design

Design for Manufacture & Assembly (DfMA)

+

UBER

Driver → Find passengers, Revenue

Win / Win

Passenger → Transport A to B, Affordability

+

Grab Food

+

Grab Food

Restaurant → Find diners, Revenue

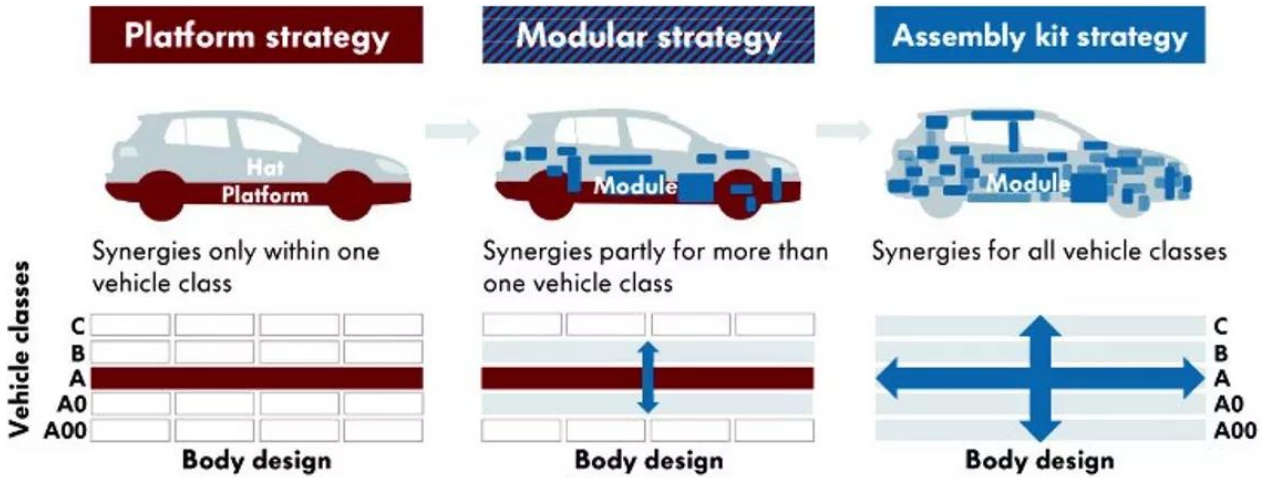
Win / Win

Rider → Get delivery jobs, Revenue

Win / Win

Diner → Find food, Convenience

The modular assembly kit evolution



» Based on the platform strategy, Volkswagen has developed the modular assembly strategy.

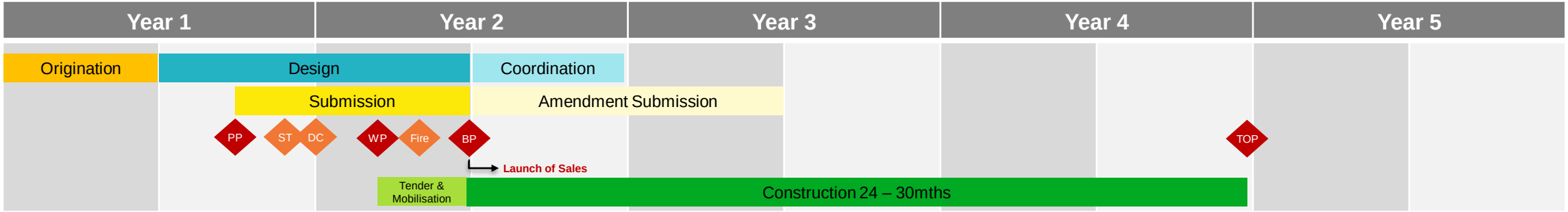
Technology on its own cannot provide the answer to the need for greater efficiency and quality in construction. There have been celebrated examples of new technology being used to reinforce outdated and wasteful processes and it does not work.

- Sir John Eagan, Rethinking Construction, 1998

Impact from Future Regulatory Approval Process via Corenet X

A Typical Private Condominium Development- Traditional Lump Sum Contract (Design-Bid-Build)

As-is Condition with Corenet 2



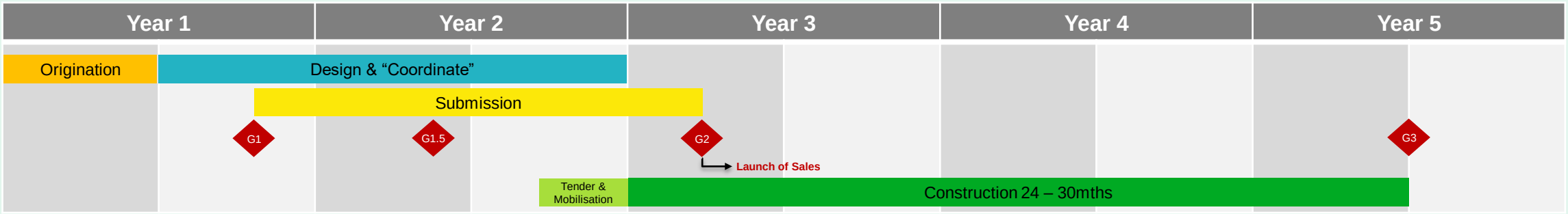
New Process

- Streamlines multiple touchpoints into 3 key submission gateways
- Upfront coordination, single all agency submission
- Coordinated single response from all agencies

Possible Implications

- Less flexibility in managing submissions as no concurrent submissions can be made
- Workload has been shifted to upfront, design timeline needs to be shortened to prevent long development timeline. Key design parameters must be locked in and decisions need to be made faster and earlier

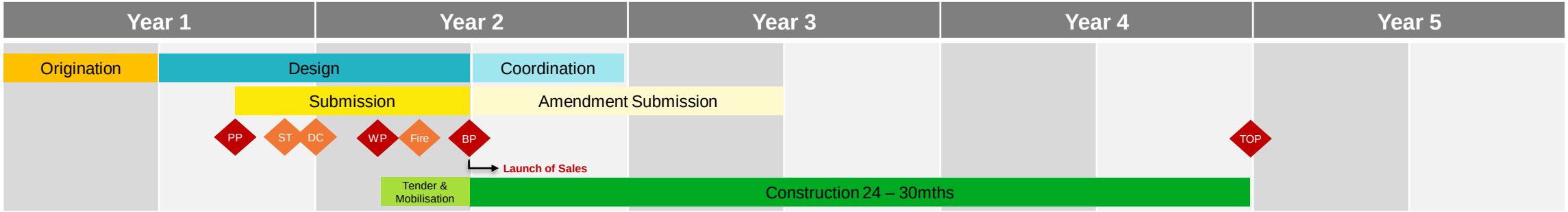
Corenet X – Worst case scenario



Future Regulatory Approval Process via Corenet X

A Typical Private Condominium Development- Traditional Lump Sum Contract (Design-Bid-Build)

As-is Condition with Corenet 2

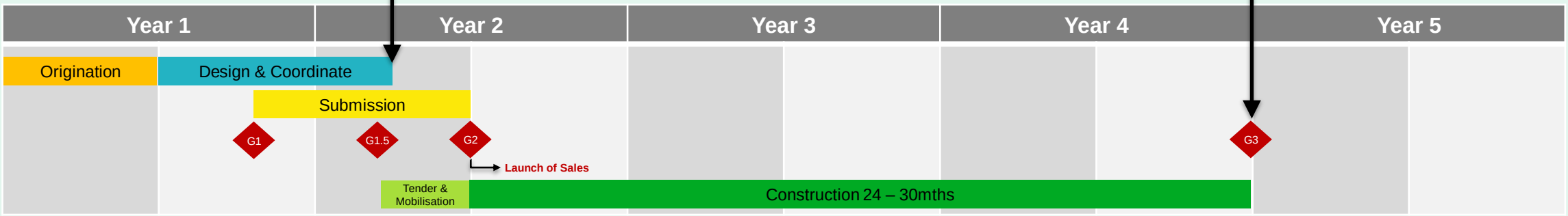


- How do we commit the design in a shorter time frame?
- We need to fully coordinate the design before G2.
- What process change is needed to document design for G2?

How will the industry capture a win/ win benefit from Corenet X?

- Corenet X submission will not take any longer than the current system.
- But where is the benefit for industry?

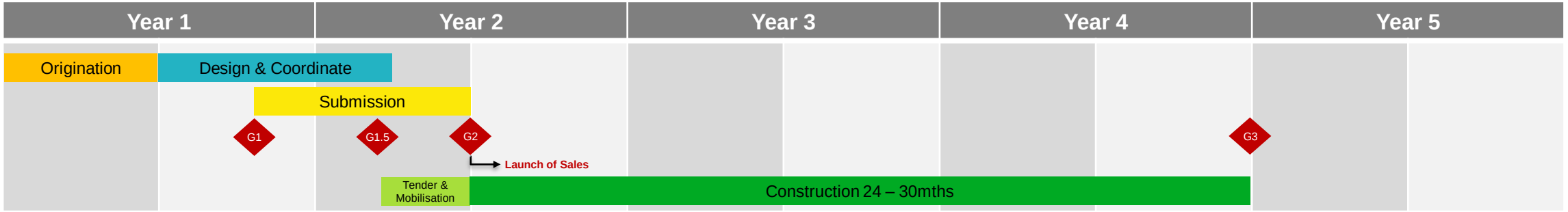
Corenet X – Baseline scenario



Benefit from Future Regulatory Approval Process via Corenet X

A Typical Private Condominium Development- Traditional Lump Sum Contract (Design-Bid-Build)

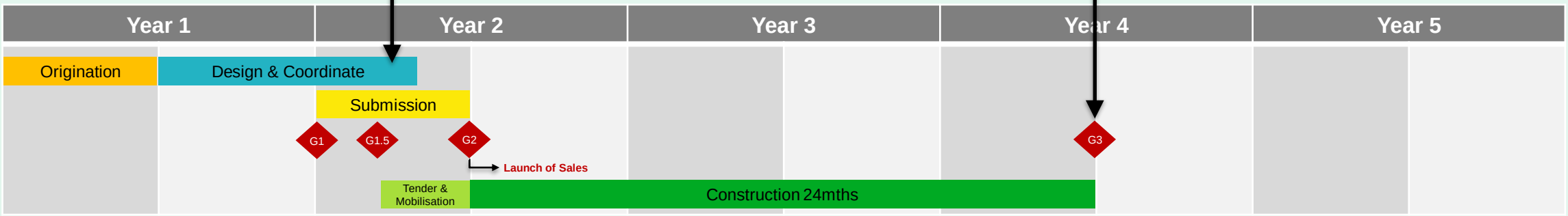
Corenet X – Baseline scenario



- Faster authority processing enables submission process to commence later.
- More time to design and coordinate.

- Complete design documentation, fully coordinated could reduce waste and re-work.
- Faster time to deliver using Modern Methods of Construction (DfMA).

Corenet X – Best case scenario ?

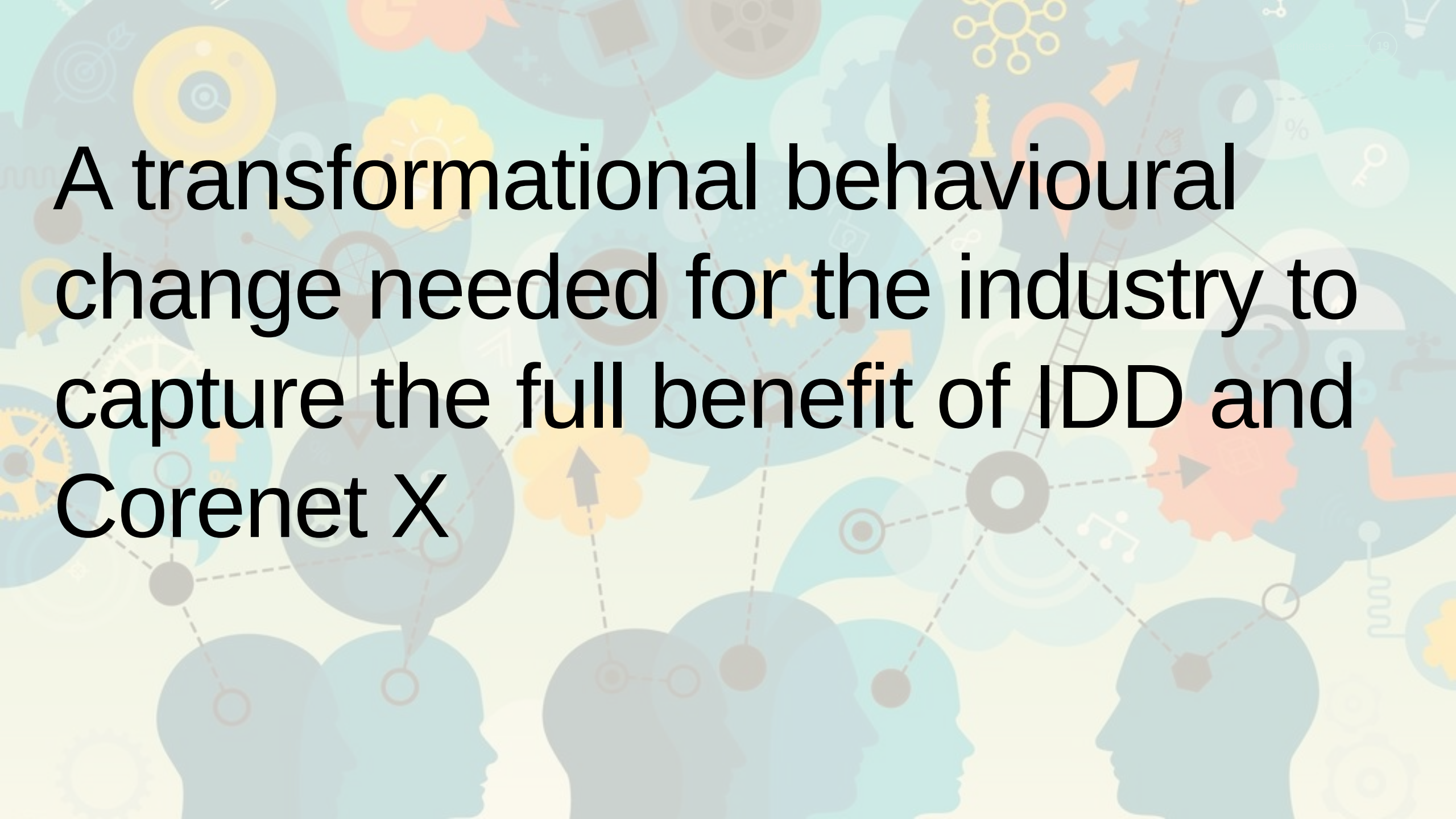


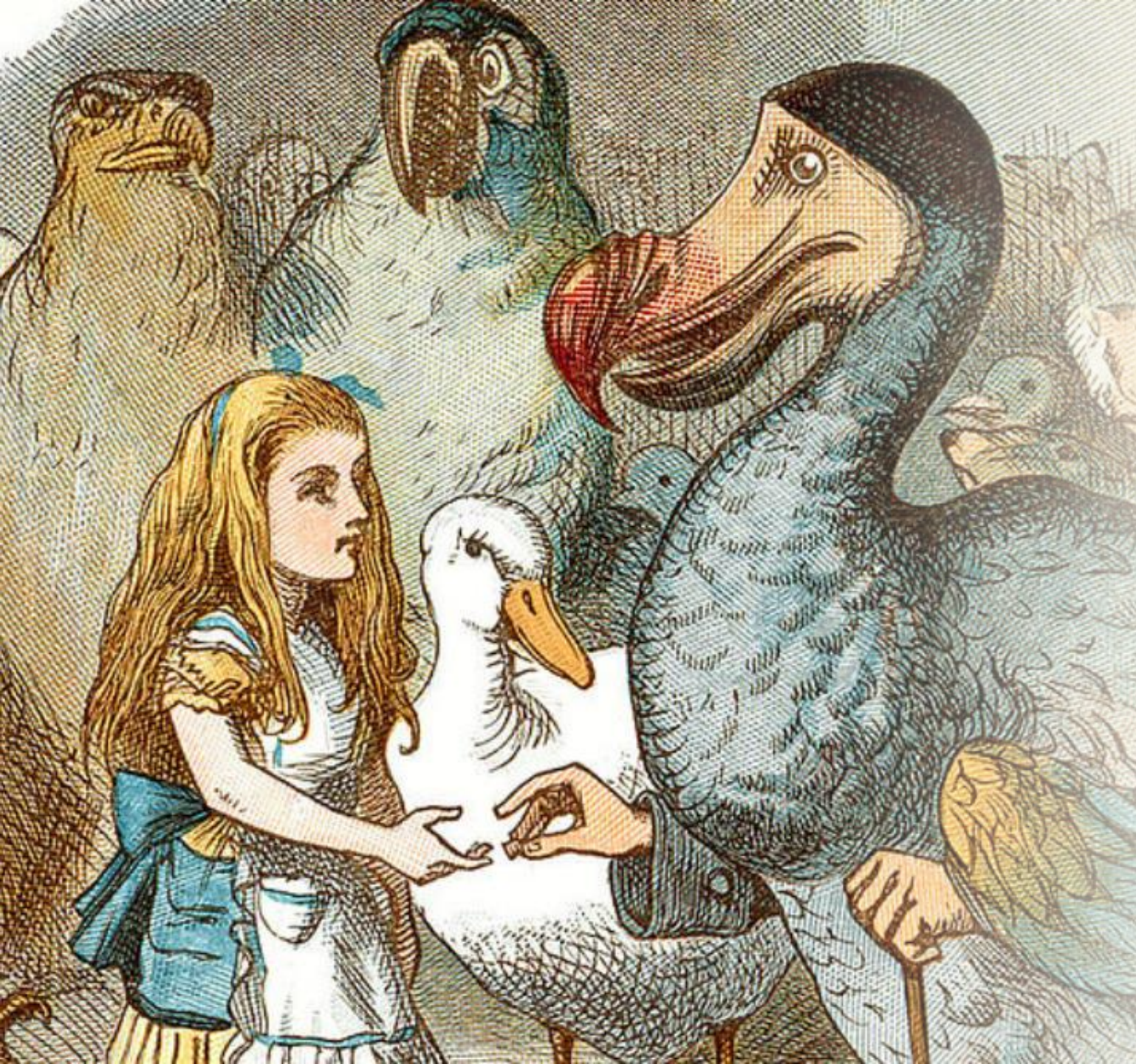
$115k of interest cost incurred for each day

based on 3.75% average overnight interest rate for a prime GLS site (Estimated project & land cost: $1.8b, 60% geared)

$3.4m of interest lost/saved per month

based on 3.75% average overnight interest rate for a prime GLS site (Estimated project & land cost: $1.8b, 60% geared)


A transformational behavioural change needed for the industry to capture the full benefit of IDD and Corenet X



“Everybody has won and all must have prizes”

- Dodo, Alice’s Adventures in Wonderland