Global Risk & Sustainable Finance

Framework for Next Generation Counterparty Risk

Integration of Green Ratings with Credit Ratings

Solving for:
/ Board-level Risk Appetite Mapping by the ExCo to the Business
/ Capital Allocation Process
/ Capital Pricing Process
/ "Internal Green Ratings" plus "Internal Credit Ratings" for "New Counterparty Risk Models"
/ Granular Green Limits and Credit Limits for Spot and Transition Horizon

Author: Johnny Mattimore
Date: 05-Dec-2022 (v2.1)

F**I**RST DER**I**VAT**I**VE

Objectives

To demonstrate the following:

/ How EBA Pillar 3 data provides the foundations for Capital Management

/ How to integrate Green Ratings with Credit Ratings for Internal Models

/ How to use this for mapping Risk Appetite to Capital Management

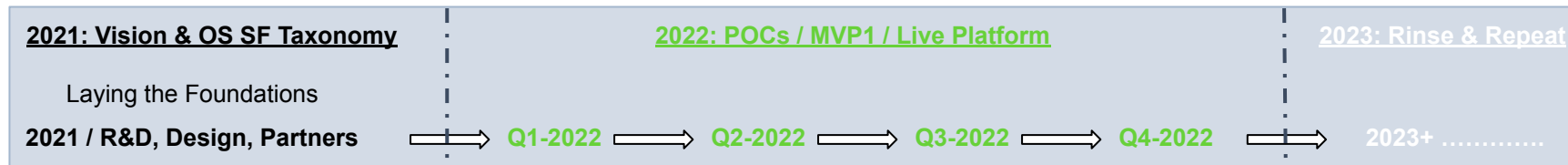# 1. EBA Pillar 3 Data
provides the foundations for future
Capital Management

1.1. **What have we been doing?**
Vision of data evolution for SF

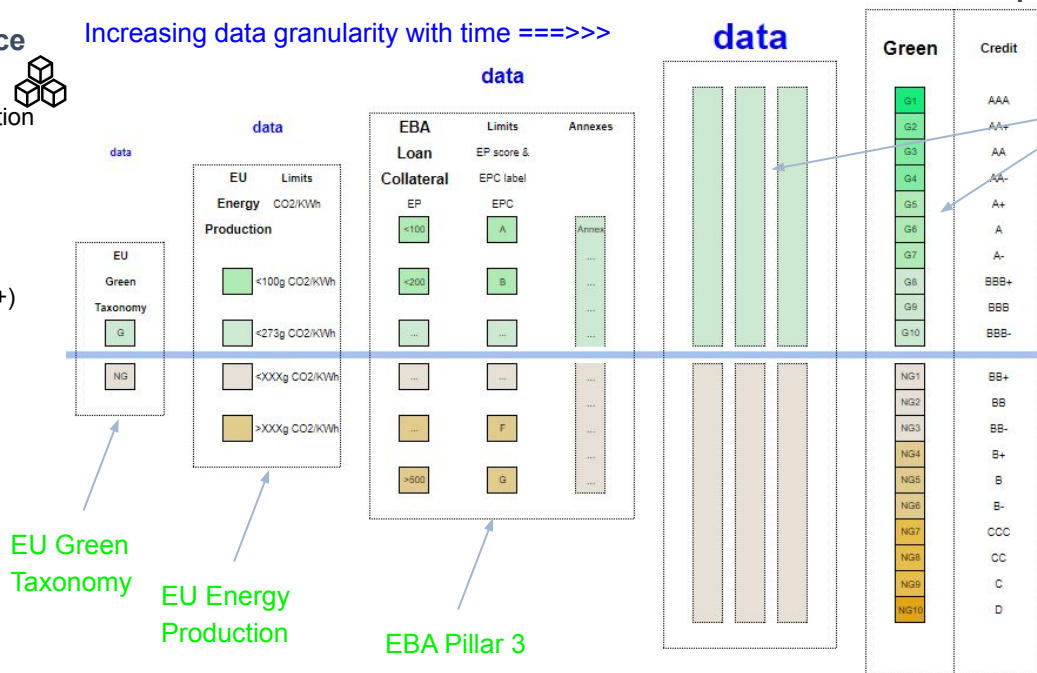| 2021: Vision & OS SF Taxonomy	2022: POCs / MVP1 / Live Platform			2023: Rinse & Repeat
Laying the Foundations				
2021 / R&D, Design, Partners	Q1-2022 Q2-2022	Q3-2022	Q4-2022	2023+ …………

Building Blocks are in Place
- 2 years of research preparation
- 1.5 years of fintech partner selection
- 1.5 years of client research
- 1 year of SFI partner work
- 1 year of design research
- 6 months of taxonomy research
- large scale hire & train plan (500+)
- relationship building:
  - Domestic Banks
  - International Banks
  - International Funds
  - SFI, SF COE, CBI, DoF
  - Skillnet
  - BPFI/FPAI
  - Irish Funds
  - Insurance Ireland
  - Academia

Increasing data granularity with time ===>>>

data

data

data

EU	Limits
Energy	CO2/KWh
Production	

EU Green Taxonomy

G

NG

EU Green Taxonomy	
<100g CO2/KWh	
<273g CO2/KWh	
<XXXg CO2/KWh	
>XXXg CO2/KWh	

data

EBA Loan Collateral	Limits EP score & EPC label	Annexes
EP	EPC	
<100	A	Annex
<200	B	…
…	…	
…	…	
…	F	
>500	G	

data

Green	Credit
G1	AAA
G2	AA+
G3	AA
G4	AA-
G5	A+
G6	A
G7	A-
G8	BBB+
G9	BBB
G10	BBB-
NG1	BB+
NG2	BB
NG3	BB-
NG4	B+
NG5	B
NG6	B-
NG7	CCC
NG8	CC
NG9	C
NG10	D

EU Green Taxonomy

EU Energy Production

EBA Pillar 3

Evolution of Complex Data Requirements
- Green Ratings
- Green Data Sets
- Green Risk Metrics

For example on EBA
- GAR from Dec-2023
- BTAR from Jun-2024

For example on SFDR
- Article 8/9
- Timeline obligations

1.2. **Combining Green & Credit Ratings**
From Single Ratings to a Grid of Ratings

Illustrating Size of Data Metrics Architecture

Credit Ratings: 20 grades
Credit Rating Migration 1 year forward: 20x20 = **400 outcomes**

Combining Credit & Green Ratings:20x20 = 400 grades
Credit & Green Ratings Migration 1 year forward: 20x20x20 = **8,000 outcomes**

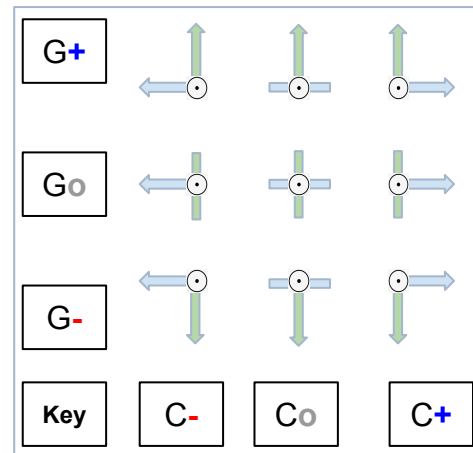**Adding State of an Asset** (3 modified states for each rating: +ve, stable, -ve)
Combining Credit & Green Ratings:60x60 = 3,600 grades
Credit & Green Ratings Migration 1 year forward: 60x60x60 = **216,000 outcomes**

Climate Models 80 years (2100) data grows (80 x 60^3) = **17,280,000 outcomes**
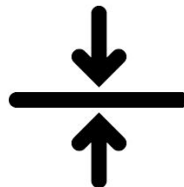
State of Asset "Modifiers"

1.3. **Data Foundations for Green Ratings**

Beyond EBA Pillar 3 Carbon Emissions Reporting

Data sources maturing over time

Baseline using EBA PIllar 3 449a CRR reporting
- / Internal sources
- / External sources
- / Proxy methods

Add existing green data outside scope of EBA reporting
- / Real estate EPC/BER data
- / Natural Hazard risk data (e.g. flood risk)
- / Third party ESG data
- / Internal proprietary research

Expand using new sources as they emerge
- / TCFD enhanced/improved reporting extends "E" (environmental metrics) for GHG Emissions
- / TNFD new reporting extends "E" data for Nature Impact
- / Extend sources for "S" (societal metrics) as EU Societal taxonomy evolves
- / Extend sources for "G" (governance metrics) as market sources evolve
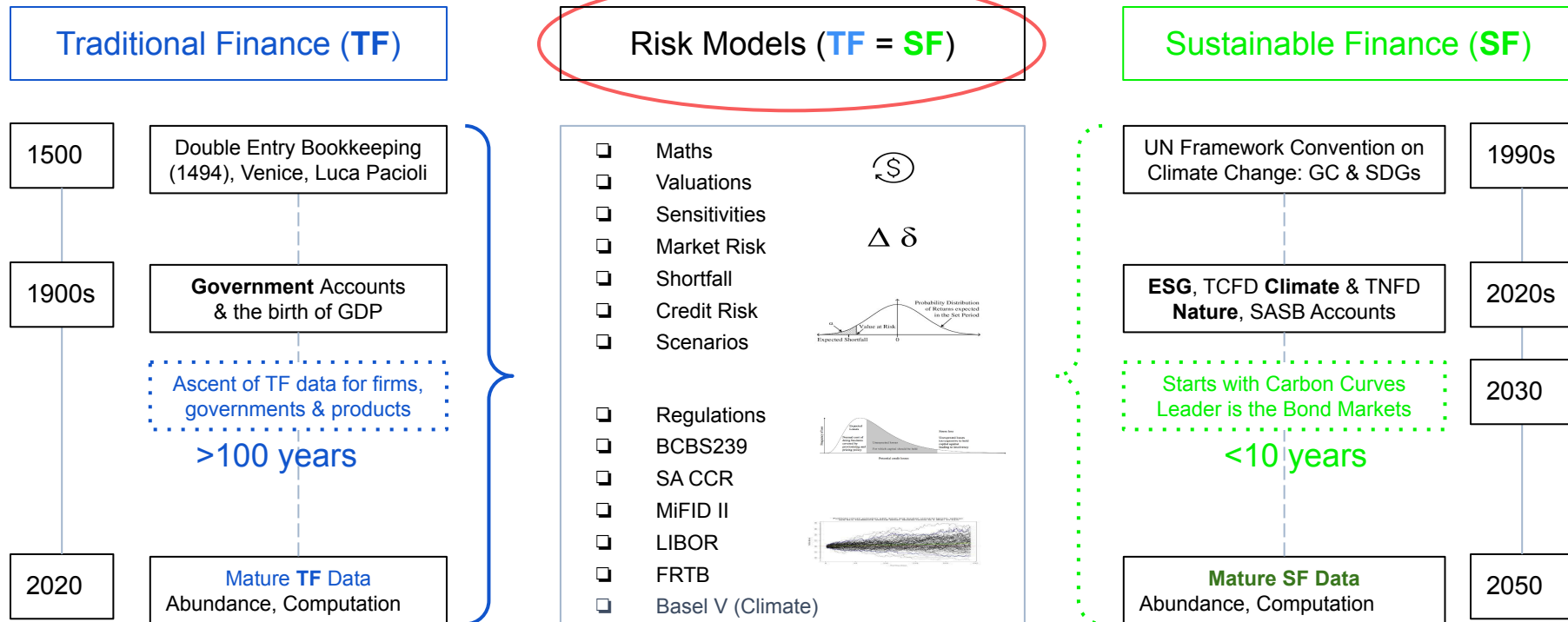- / Then refine over time - internal/external/proxy
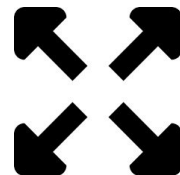
2. Green Ratings & Credit Ratings integration defines the future of Internal Models

2.1. **TF meets SF**
Risk in Financial Services

It's all about making information "**economic ready**" - a **data problem** - but **risk models are the same**

Traditional Finance (**TF**)	Risk Models (**TF** = **SF**)	Sustainable Finance (**SF**)

1500	Double Entry Bookkeeping (1494), Venice, Luca Pacioli	❑ Maths	UN Framework Convention on Climate Change: GC & SDGs	1990s
1900s	**Government** Accounts & the birth of GDP	❑ Valuations ❑ Sensitivities ❑ Market Risk ❑ Shortfall ❑ Credit Risk ❑ Scenarios	**ESG**, TCFD **Climate** & TNFD **Nature**, SASB Accounts	2020s
	Ascent of TF data for firms, governments & products >100 years		Starts with Carbon Curves Leader is the Bond Markets <10 years	2030
2020	Mature **TF** Data Abundance, Computation	❑ Regulations ❑ BCBS239 ❑ SA CCR ❑ MiFID II ❑ LIBOR ❑ FRTB ❑ Basel V (Climate)	**Mature SF Data** Abundance, Computation	2050

$\Delta \ \delta$

Probability Distribution of Returns expected in the Set Period

Value at Risk

Expected Shortfall

2.2. **Modeling for Green & Credit Ratings**

F/RST DER/VAT/VE

Maths: data store & compute gets large, quickly

Task
Create CREDIT Vectors (Extant)

Effort & Output
Credit Rating (CR) Vector
IG = {AAA, ..., BBB-}
Non-IG = {BB+, ..., B-, CCC,CC,C,D}
IG set size = 10
Non-IG set size = 10
CR-Vect = 1x20
Set size = 20
Modifiers
CR-Mod = {+,=,-}
{+} = improving
{=} = stable
{-} = deteriorating
Modified Credit Rating Vector
IG-Mod set size = 10x3 = 30
Non-IG-Mod set size = 30
CR-Vect-Mod = 1x60
Set size = 60
Ex-Mod Data Set Sizes
Spot = 1x20 = 20
Forwards = 20x20 = 400
80 years forward = 80 x 400 = 32,000
Cum-Mod Data Set Sizes
Spot = 1x60 = 60
Forwards = 60x60 = 3,600
80 years forward = 80 x 3,600 = 288,000

Task
Create GREEN Vectors (New)

Effort & Output
Green Rating (GR) Vector
Green Grade = GG = {G1,...,G10}
Non-GG = {G11,...,G20}
GG set size = 10
Non-GG set size = 10
GR-Vect = 1x20
Set size = 20
Modifiers (Mod)
GR-Mod = {+,=,-}
{+} = improving
{=} = stable
{-} = deteriorating
Modified Green Rating Vector
GG-Mod set size = 10x3 = 30
Non-GG-Mod set size = 30
GR-Vect-Mod = 1x60
Set size = 60
Ex-Mod Data Set Sizes
Spot = 1x20 = 20
Forwards = 20x20 = 400
80 years forward = 80 x 400 = 32,000
Cum-Mod Data Set Sizes
Spot = 1x60 = 60
Forwards = 60x60 = 3,600
80 years forward = 80 x 3,600 = 288,000

Task
Create CRxGR Data Architecture

Effort & Output
Spot for CRxGR = Matrix (n^2)
CRxGR-C2-spot (t=0) = X x X = X^2
[Ex-Mod set size = 20x20 = 400]
[Cum-Mod set size = 60x60 = 3,600]
CRxGR Matrix Forwards = Cubes (n^3)
CRxGR Migration Cube (ex-Mod)
CRxGR-Mig-C3-01yr = 20x20x20 = 8,000
CRxGR-Mig-C3-02yr = 20x20x20 = 8,000
..., etc
[Ex-Mod = 20x20x20 = 8,000]
[Cum-Mod = 60x60x60 = 216,000]
Number of Years Forward (F x n^3)
Climate Forecasts out to the year 2100
Forwards are circa 80 years
[Ex-Mod = 80 x 8,000 = 640,000]
[Cum-Mod = 80 x 216,000 = 17,280,000]
...
Ex-Mod Data Set Sizes
Spot = 20x20 = 400
Forwards 20x20x20 = 8,000
80 years Forward = 80 x 8,000 = 640,000
Cum-Mod Data Set Sizes
Spot = 60x60 = 3,600
Forwards 60x60x60 = 216,000
80 years Forward = 80 x 216,000 =17,280,000

Size of Forward Cubes Outcomes (# of paths are larger)
- Quantity of Data Metrics 1 year out = 216,000
- For Climate Risk out 80 years = 17,280,000

Baseline: Sourcing Data
- Internal
- External
- Proxy

Baseline: Options for Filling Data Gaps
- Extending scope of sources
- Academic sources
- Academic proxy models

Baseline: Quality Assurance
- Build QA tests for switching existing sources
- Build QA test for finding new sources
- Preserve audit trail of data sources and switches
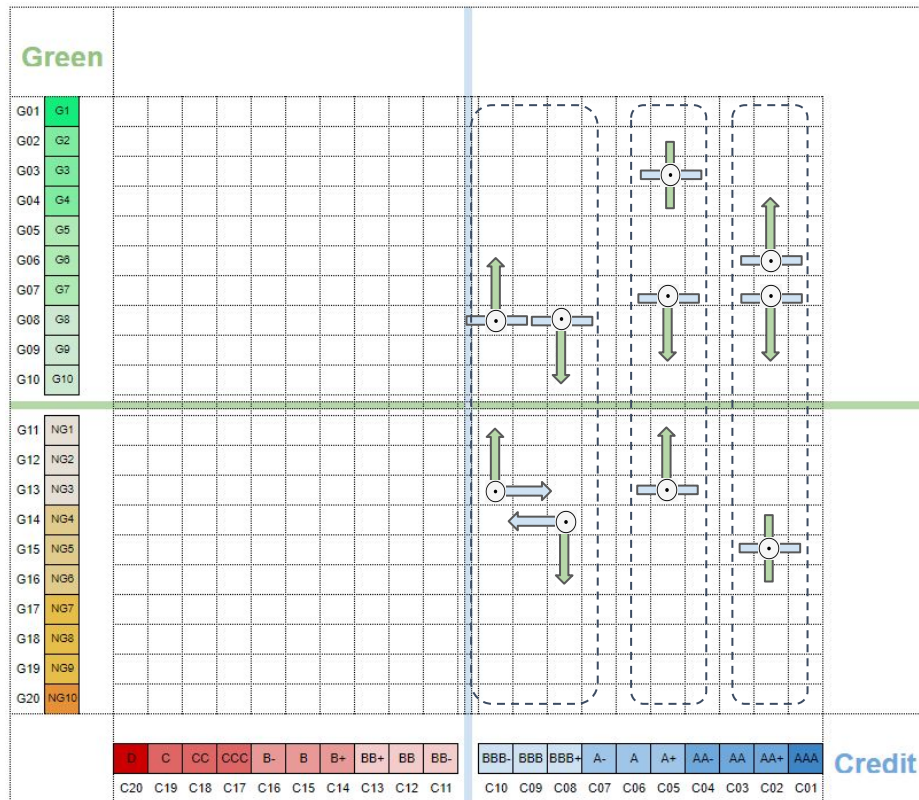
Ratings Migration Forward Data
- Primarily done using mathematical simulation models

Approach Re-uses existing sunk cost by extending
- Existing infrastructure
- Existing models
- Existing workflows
- Existing reporting

2.3. Reclassify Assets by Internal Model
Map, Analyse, Modify & Adjust

**Illustrating "Reclassification" of Assets/Collateral**

Map: map all Credit Rated Assets ⊙ to Credit-Green Rating Matrix

Analyse: identify anomalies - the good, bad and ugly of capital allocation & pricing

Modify: apply modifiers for Green Rating trend and Credit Rating trend

Adjust: remediate classification for capital (risk) allocation and capital (risk) pricing
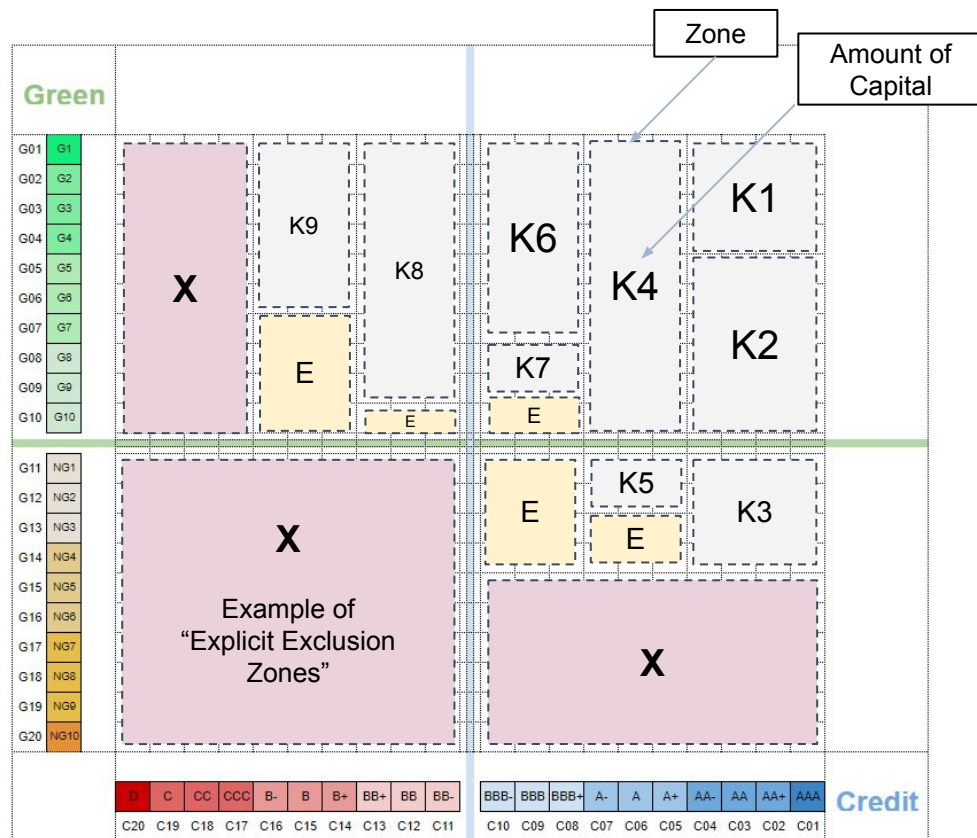
State of Asset "Modifiers"
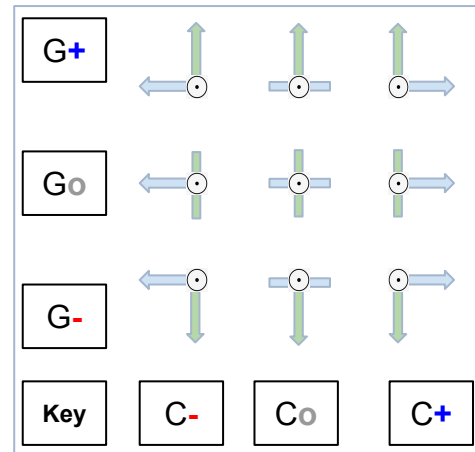
3. Mapping Risk Appetite
to Green & Credit Ratings for
Capital Allocation, Pricing & Limits

3.1. **Mapping Risk Appetite: K=Capital**
From "Single" Ratings to "Zones" of Ratings

Capital Allocations

K1 to K9: increasing risk appetite, sized by capital, applied to grade "zones"

Exceptions (E): capacity for exceptions

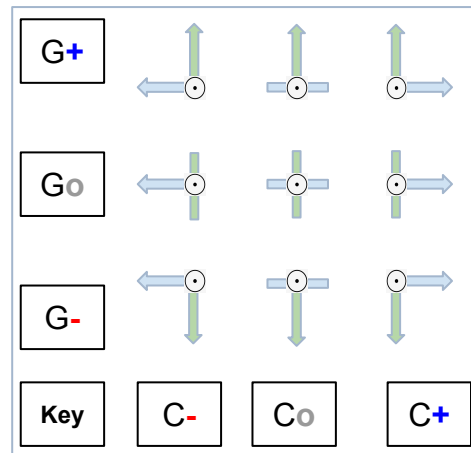**Explicit Exclusions (X)**: grade zones strictly prohibited

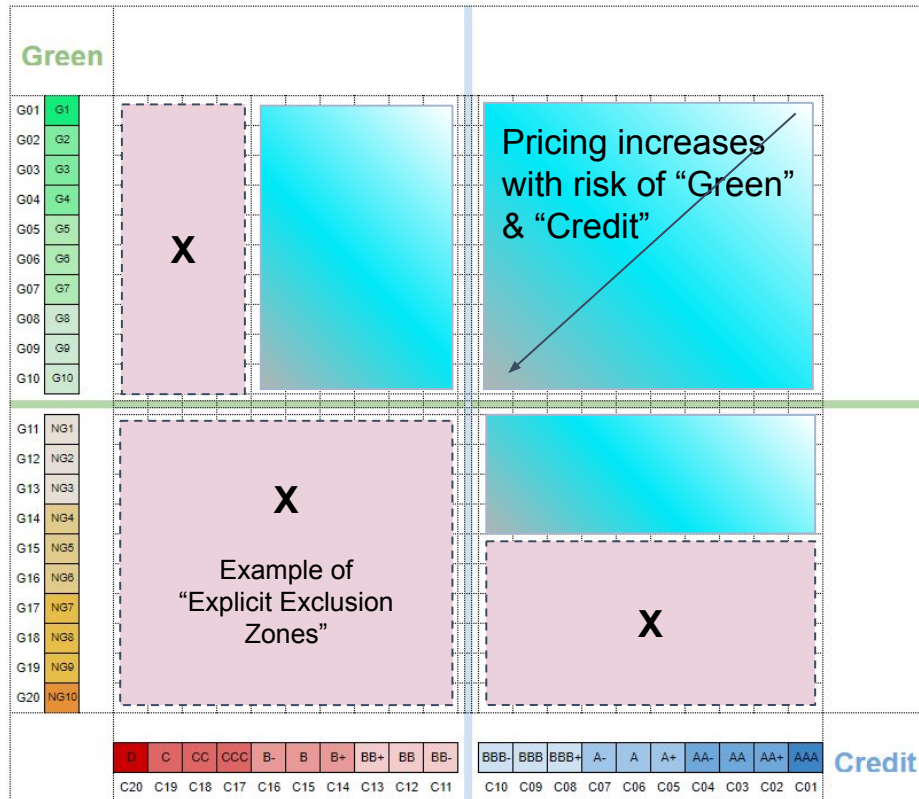**Limits**: apply limits framework to grades and/or grade zones

State of Asset "Modifiers"

3.2. **Re-pricing Risk**
Price Risk using Green Ratings & Credit Ratings

Illustrating Size of Data Sets

Credit Ratings: 20 grades
Credit Rating Migration 1 year forward: 20x20 = **400 outcomes**
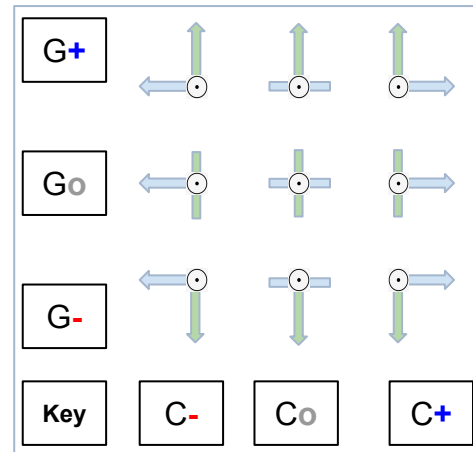
Combining Credit & Green Ratings:20x20 = 400 grades
Credit & Green Ratings Migration 1 year forward: 20x20x20 = **8,000 outcomes**

Adding State of an Asset (3 modified states for each rating: +ve, stable, -ve)
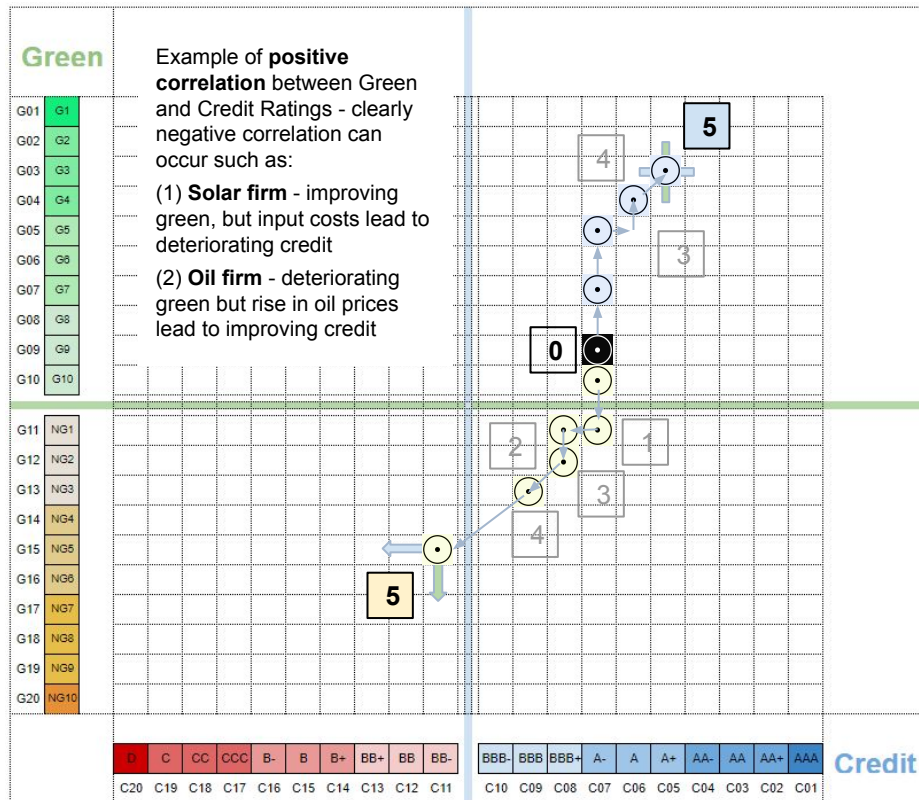Combining Credit & Green Ratings:60x60 = 3,600 grades
Credit & Green Ratings Migration 1 year forward: 60x60x60 = **216,000 outcomes**

**State of Asset "Modifiers"**

3.3. **Asset Rating Migration**

Examples of Improvement & Deterioration

Green

Example of **positive correlation** between Green and Credit Ratings - clearly negative correlation can occur such as:

(1) **Solar firm** - improving green, but input costs lead to deteriorating credit

(2) **Oil firm** - deteriorating green but rise in oil prices lead to improving credit

Monitoring Migration: e.g. 5x data-refresh cycles

5 *Improvement*: (C07,G09) =====> (C05,G03)
- Credit improves: 2 notches
- Green improves: 6 notches

5 *Deterioration*: (C07,G09) =====> (C11,G15)
- Credit deteriorates: 4 notches
- Green deteriorates: 6 notches
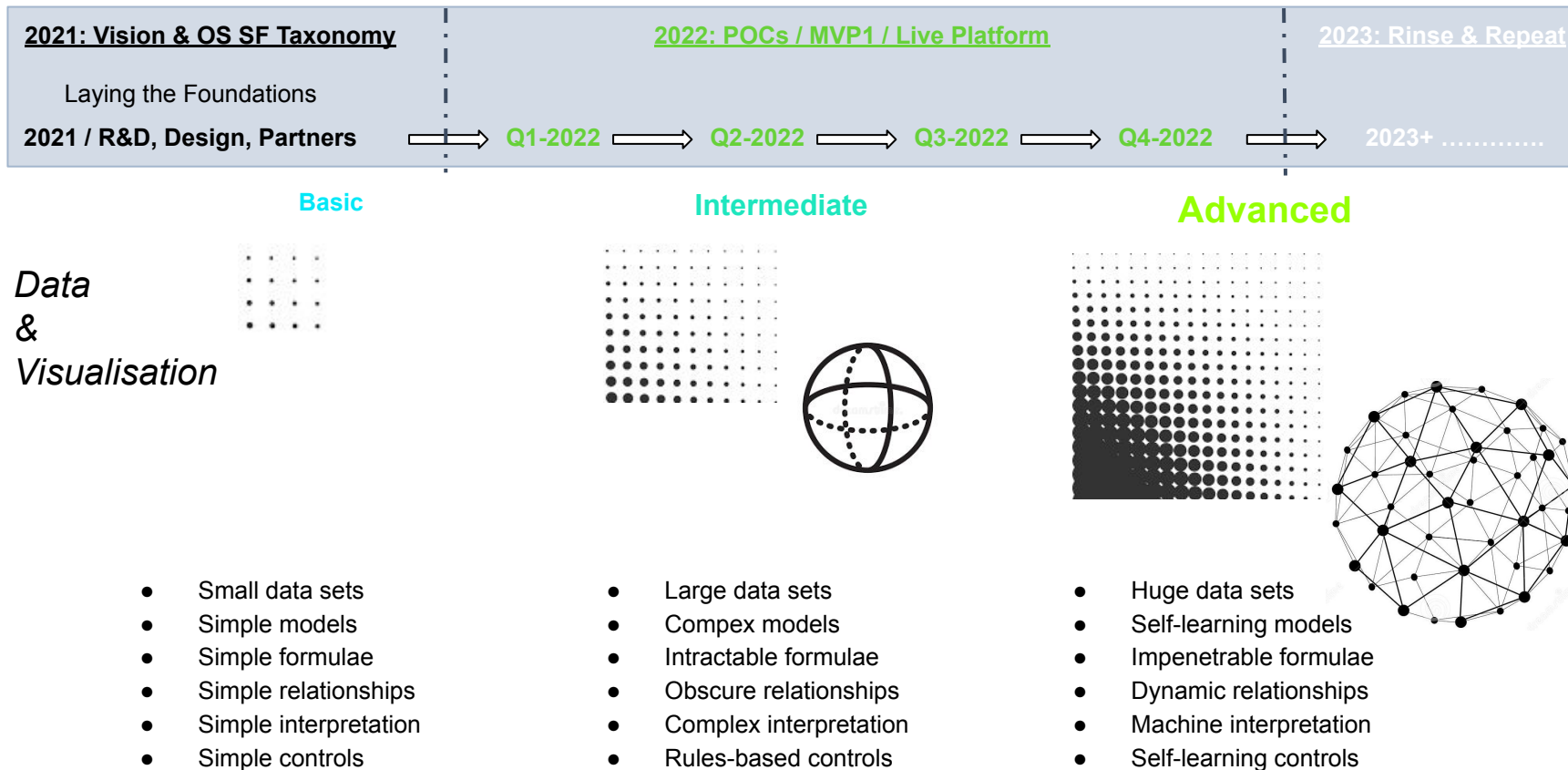
State of Asset "Modifiers"
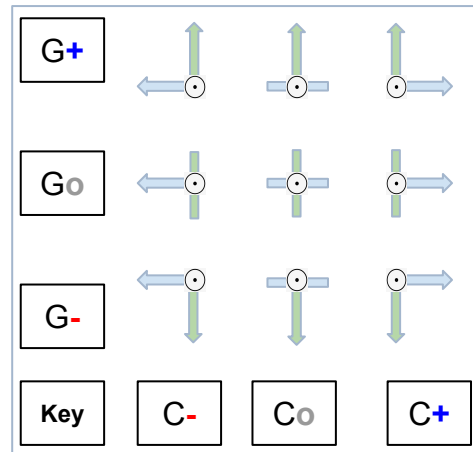
4. Impacts:
Data Complexity
Cloud Store & Compute
Service Componentry

4.1. **SF Impact on Data**

Data Demand will be Huge & Complex

2021: Vision & OS SF Taxonomy	2022: POCs / MVP1 / Live Platform	2023: Rinse & Repeat

Laying the Foundations

2021 / R&D, Design, Partners ⇒ Q1-2022 ⇒ Q2-2022 ⇒ Q3-2022 ⇒ Q4-2022 ⇒ 2023+ …………

Basic   **Intermediate**   **Advanced**

*Data
&
Visualisation*

- Small data sets
- Simple models
- Simple formulae
- Simple relationships
- Simple interpretation
- Simple controls

- Large data sets
- Compex models
- Intractable formulae
- Obscure relationships
- Complex interpretation
- Rules-based controls

- Huge data sets
- Self-learning models
- Impenetrable formulae
- Dynamic relationships
- Machine interpretation
- Self-learning controls

4.2. **SF Impact on Technology**
Cloud Services will Dominate

F/RST DER/VAT/VE

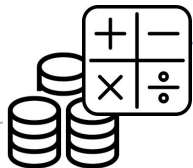| **Cloud for Data**	**Cloud for Analysis**	**Cloud for Process**
Store	Sourcing	Human+Machine
Compute	Assessing	Performance

Themes
- Prolific reporting
- Financial Risk data
- Climate Risk data
- ESG Risk data
- Cloud strategy
- Migration to cloud
- Hybrid-cloud
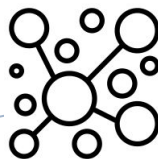- Multi-cloud
- Business continuity
- Disaster recovery

Themes
- Ingestion
- Sampling
- Model development
- Testing
- Human ideas
- Machine ideas
- Artificial intelligence
- Machine learning
- Neural networks

Themes
- Regulation
- Business transition
- Automation
- BIS/MIS/RegRep.
- Human performance
- Human to NLP
- Machine to NLG
- Human/Machine risk promotion/demotion
- Human performance
- Machine performance

4.3. **SF Impact on Service Models**

Modernisation will be Fast & Furious

Dismantle the mess	**Rebuild Orderly as**	**Change work practices by**
Think like Supply Chains	Micro-operations Services	Cloud Delivery with Built-in Continuity

Themes - Componentise
- Transaction lifecycle stages
- Data sources
- Operational processes
- Model development
- Model testing
- Model validation
- Model deployment
- Controls frameworks
- Limits frameworks
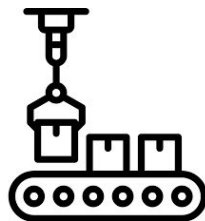- Escalation frameworks
- Applications maintenance

Themes - Managed/Hosted Services
- Data cost management
- Data permissioning
- Model lifecycle management
- Pre-transaction controls
- Transaction execution controls
- Post transaction controls
- Regulatory reporting
- New data & models (scenarios/climate)
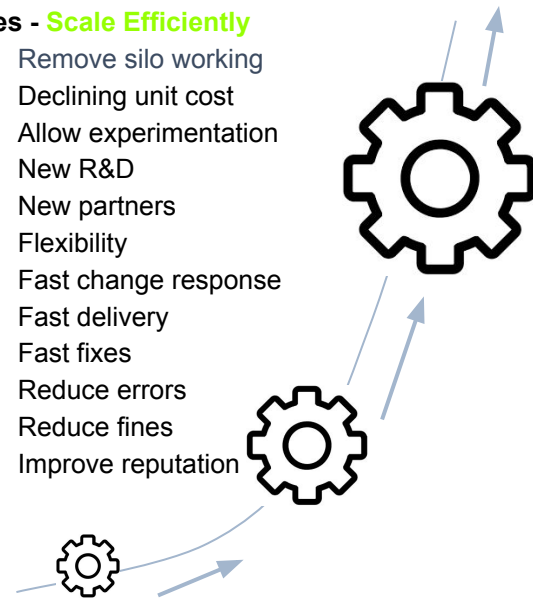- New business processes

Themes - Scale Efficiently
- Remove silo working
- Declining unit cost
- Allow experimentation
- New R&D
- New partners
- Flexibility
- Fast change response
- Fast delivery
- Fast fixes
- Reduce errors
- Reduce fines
- Improve reputation

Thank you

Johnny Mattimore

Johnny Mattimore